Choose or Lose

A recovery plan for fish stocks and the UK fishing industry

A WWF Report

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Executive Summary

Few people understand why UK fisheries are in crisis. The symptoms of devastated fish stocks and overfishing are clear for all to see, but they are not the root of the problem. The reason why there is a crisis is that we have run down a natural resource – living off capital, not interest – at an accelerating pace over a century and more. Now, with stocks on the brink of collapse and no new fisheries to exploit, we have the following stark choice: whether to spend far more than current budgets allow to fund recovery programmes; or face the very real prospect of the loss of fish stocks, the fishing industry and the communities that depend on it.

If we invest in the industry now, there is good reason to expect stocks to recover, as will the fortunes of some of our most far-flung coastal communities. Indeed there is every prospect that, in the medium term of 5-10 years, such recovery programmes will become profitable. There is general agreement that a well managed fishery around the UK could generate vastly more income than now – a goal that should be at the core of these recovery programmes. Funding is not a subsidy: it is about investment, and the reduction and reform of subsidy. The stocks will be bigger and healthier; the economy and the environment will both win.

If we do not invest, fisheries will continue to lurch from one short-term crisis to the next. At best it will be a missed opportunity. More likely it will result in the decimation of stocks and disintegration of the communities. We will have helped cause the effective loss of species for which we have a unique responsibility in Europe, given the vast area of sea under the influence of this island nation.

Truly, it is a time to choose… or lose.

The problem is too severe to ignore any more. Now is the time to seize the initiative and invest in the future of our fisheries and our marine environment. Now is the time to face up to the choice and put in place all the elements needed for the recovery plans – economic, political, environmental and technological.

In a way there has never been a more opportune moment – it could mark the start of sustainable seas around the UK.

We believe that a full cost benefit analysis carried out on the recovery plans would show that it makes economic sense. However, we also have to be accountable socially, to remote regions in the UK with few alternatives for prosperity, and morally, to future generations who will inherit our environment.

The practicality and time-scale for successful action are good. If favourable measures are taken, it is reasonable to expect to see a turn-around in the health of fish stocks, and the fishing industry, within 5-10 years. That turn around could be very significant indeed. One study into the English Channel fishery showed that it could be over 1,500 per cent more profitable if fish stocks were

restored. By looking at the history of the fishing ports around the UK, an idea of the potential productivity of the seas can be gained.

The full worth of fish has been undervalued. Most stocks in the UK seas have been pushed far below the levels where they can be expected to produce a good economic return or be sustainable. Many fish, such as cod and herring, naturally live for 20 years or more. Ensuring that they can breed before, or more frequently before, being caught is not just a basic biological requirement but a necessity for long-term viability. By increasing predictability of fish stocks it allows forward planning and greater certainty in an industry that has been a by-word for crisis management.

Fishermen and those concerned about the environment share a common long-term vision of healthy seas and abundant fish stocks. Recovery strategies for both fisheries and the environment follow similar paths, and there should be little need for conflict or choice between protecting fish or human communities; the two go hand in hand.

We cannot predict exactly which stocks will recover fastest – some may never recover at all, which means that recovery programmes must be broadly drawn. On the basis of historical examples from the UK and abroad, and for stocks ranging from herring to cod, we can assert that such plans have every prospect of success. However, we must act before there are full-blown stock collapses.

We must get away from the annual round of crisis negotiations. Instead we need to establish *recovery programmes*, centred on medium- and long-term goals, and then work back to the specific measures that are required to deliver these. Here we identify four crucial elements of such recovery programmes: *recovery plans*, *delivery mechanisms, trust* and *money*.

Recovery plans are the specific technical and other measures intended to restore particular stocks, which may include regeneration areas, No-take Zones (also known as Fishing-Free Zones), bigger mesh sizes, lay-up schemes as well as effective enforcement and deterrent. From historical examples we can learn much about what measures worked and why others failed. Attempts are already being made at implementing such management tools around the UK (elements of the Irish Sea cod recovery programme) or are planned (elements of the North Sea cod recovery plan; pilot Fishing-Free Zones in the South Western Approaches).

Delivery mechanisms are the overarching elements for achieving policy goals. In the European Union (EU) the delivery mechanism is the Common Fisheries Policy (CFP). One of the failures of the CFP is the absence of devolved responsibility for managing fisheries at the most local possible scale, with greater empowerment of fishermen. This had led to the consequent loss of the incentive to fish sustainably.

Others claim to have done rather better using different delivery mechanisms. Iceland has gone down the route of individual private ownership of fishing rights, fully transferable. Others, such as Norway and the inshore waters of Japan (and also in the UK until recently), have placed a greater emphasis on community ownership and strict control of access to the resource, and

fishermen are central to the decision-making process. We need to look for lessons from the experiences of other countries when it comes to reforming delivery mechanisms in the EU.

The need to build *trust* is integral to any recovery plan. Distrust is an endemic and corrosive force. In the past fishermen, scientists, managers and environmentalists worked individually and there was a level of mistrust between the sectors. Now all sectors are recognising that they are working towards the same long-term vision. As a result they are coming together to work out the solutions to the problems with the UK fish stocks and fishing industry. However, one obstacle in their way is the systems failure of the CFP - a situation from which individuals or groups cannot extract themselves. Only a reform of the CFP can rectify this.

Money. The simple fact is that any recovery programme will fail unless there is the necessary funding. Whatever the rights and wrongs of the history of subsidies, fishermen simply cannot now absorb the scale of cuts required - so realistic funding must be a key component of a reformed CFP. We do not believe that the time scale for funding for current recovery programmes within the CFP (2–3 years), or the overall budget available to Fisheries Ministers, reflect the needs of a medium-term strategy or the investment necessary for success. The UK needs to take the initiative and win the case in Europe for action to avoid a fast looming and unprecedented environmental, economic and social crisis.

However, there is a problem – our past record. It is not generally appreciated that the UK governments have not even made full use of European money available for such recovery programmes, inadequate though this may be. In order to fully access these funds the UK governments must first put proposals before the Commission and put up match funding. But our past record for doing this compares very poorly with most other fishing nations in the EU. Between 1995 and 1998 the UK put forward just 25 million euros, releasing e124 million from the EU. During the same period Spain put up e389 million and Portugal e87 million, receiving e1,115 million and e213 million respectively.

The fate of both the coastal communities and the fish stocks are in the hands of the financial ministries, principally the Treasury. There is an opportunity now to re-evaluate the fishing industry: set aside preconceptions, to be prepared to invest in recovery programmes, and to ease the circumstances for others to invest. They need to take full account of the costs of failure to recover the stocks.

Indeed they have a positive role to play in ensuring that financial disciplines and safeguards are in place. On the one hand plans are not undercapitalised to the extent that there are no realistic prospects for recovery; but also public money must be invested in the most efficient manner.

WWF therefore recommends:

- a commitment to investment money from the UK Treasury so that decisions are not based on short-term survival but on medium-term recovery and long-term sustainability;

- UK governments should commit to the delivery of regionally-based recovery programmes that involve a package of regeneration measures such as closed areas, bigger mesh sizes, scrapping vessels and lay-up schemes, along with appropriate delivery mechanisms.

WWF's Oceans Recovery Campaign (ORCA) is also calling for:

- a stronger network of Marine Protected Areas around the UK and integrated marine legislation in the form of an Oceans Act;

- a network of regeneration areas to enhance and restore fish stocks, including pilot Fishing-Free Zones.

Part one

Planning for recovery

Planning for recovery

Given the state of stocks around the British Isles, it is hardly surprising that the general mood is one of pessimism and depression. But WWF strongly disagrees with this perspective; indeed we are upbeat about the potential for both fish and the fisheries, and regard the atmosphere of gloom as positively harmful. Of course we cannot be certain that all stocks will recover; some may not. The fate of the Newfoundland cod casts a long shadow. For centuries the most prolific cod fishery in the world, it collapsed in the early 1990s and shows few signs of recovery. Nevertheless it is also important to be aware of historical examples around the British Isles of stocks that have recovered. It is essential to remind ourselves of just how prolific the fisheries were, even in living memory. In principle there is no reason why much of this cannot be restored. Even past failures carry with them lessons for the future, for example in the design of recovery programmes focused on medium- and long-term goals. Similarly, there is much to learn from other countries which have faced similar problems, but have either maintained or restored their fisheries. The situation is not hopeless. But time is running out, and there is a great deal to do.

LEARNING FROM THE PAST

Currently we are struggling with a multitude of conflicts and dilemmas: between the interests of different parts of the fishing industry; between short-term and medium-term benefits; between maximising income for a few or for an entire community; and between the interests of human communities and other species. Yet these are age-old problems, and in planning for recovery it will be important to be aware of what has gone before. It will be important to learn from past mistakes, although there are also measures that worked, sometimes only to be undermined by other events. The difference is that in the past, when the stocks became depleted, the industry could always go further, deeper, or find new species to exploit. But now stocks are being depleted from the ends of the Earth, and from the depths of the oceans. There are no easy options left.

Even events dating back hundreds of years can be very revealing (See *From Wondrychoums to No-take Zones*). As early as 1376 there were concerns about the effects of trawling, of small mesh size, and of the use of fish for animal feed rather than for the table. By the 18th century there were attempts to control the loss of juvenile fish by minimum mesh sizes and landing sizes (and stiff penalties for those who contravened them). Fishermen themselves were using conservation measures, such as No-take Zones, sometimes to be undermined by outsiders unhindered by access restrictions. They were also frustrated by different regulatory regimes applied by different countries. All these are familiar issues today. Overall the lesson is that the persistent need for such measures indicates the strength of the underlying tensions, and of the historical failure to deal effectively with the root causes of over-fishing.

Over the last two centuries fisheries technology, management and science began to take on their current form. Nominally at least there is a basic division between two types of fishing, with different implications for fishing methods, management and science. First there are the fisheries for surface fish, the ‘pelagics’ such as herring, sprat, mackerel and tuna. Then there are the demersal ‘whitefish’ fisheries, which are directed at mid-water and seabed dwelling species

including cod fish ('gadoids' – cod, haddock, whiting, saithe and their relatives), flat fish such as plaice and sole, and many other species.

As the port accounts in this report illustrate, much of the early wealth of the fisheries was built up on the pelagics, and specifically the herring. *Pursuit of the Herring* draws together the lessons to emerge from these pelagic fisheries. One is that fisheries can produce fish far in excess of local demand; the modern day herring klondykers (east European boats taking herring and mackerel) have their historic equivalents, such as the Dutch herring 'busses'. The lessons are not so much about whether or not there should be outside access to local stocks, but of the importance of finding equitable terms for the relationship – financial and control – between 'locals' and 'outsiders'.

A second lesson is that pelagic stocks varied enormously at a time when it is unlikely that fishing had a significant impact, so we should be cautious about seeking to explain every current decline in terms of overfishing. But counter-balancing this is a third lesson, which is that although at first it seemed incredible that fishing could *ever* have an impact on the vast shoals, that view began to change in the 19th century as the diminishing returns from increasing fishing effort became apparent. The problem, which has still not been solved, is that of distinguishing the level of depletion from which stocks can recover, from that which they cannot. Herring off the English east coast did recover from near collapse in the 1970s, and also from severe depletion in the 1990s.

Yet the coastal shoals that were the source of Wick's prosperity in the 19th century never came back. The indigenous North Sea mackerel stocks that were depleted with the herring in the 1970s have been much slower to recover. One lesson here is that stocks can be resilient, but there is a certain point, and certain interactions with other factors, that can result in a point of no return, or at least a very long wait. But a more important lesson is not to let the stocks get in such a state. There is no rational reason why we should *need* to know how far a stock can be depleted before it crashes because, in both economic and environmental terms, one should never let a stock get anywhere near that level.

The whitefish fisheries reinforce some of these lessons and adds others. *Hunting the Cod* documents how the arrival of new, more powerful, technology – such as steam trawlers in the 19th century – can initially increase yields and reduce costs. But their capability to carry on fishing in adverse weather, and their ability to fish previously inaccessible areas, meant that they could seriously and rapidly deplete local stocks. Their mobility, in the absence of access controls or fishing rights, also meant that they rapidly fished out other fishermen's local grounds.

Trawling had other potential impacts of which, in the late 19th century, the destruction of fish spawn on the seabed was the most controversial. Accounts of trawling gear so smothered in fish spawn that hauling the gear became difficult caused consternation among other fishermen, and were the subject of parliamentary enquiries. Partly as a result of this, trawling in inshore waters was banned for a period in Scotland, and stocks recovered – a positive lesson. Similarly the incidental effect of two world wars was to restrict (but not completely stop) fishing for four and six years respectively. During this period stocks of whitefish showed some remarkable recoveries,

again an optimistic sign for future recovery plans, although one should caution that the levels of depletion were not as extensive as at present.

Finally *Hunting the Cod* looks at the lessons from the Common Fisheries Policy. One lesson is how technical mistakes can cast a long shadow. When the CFP was set up it was mistakenly assumed that the high level of 'recruitment' – the proportion of young fish appearing in the stock each year – for cod and its relatives in the 1960s and 1970s was typical. As a result it was assumed that the stocks could take greater fishing pressure than was actually the case. The assumed levels of catches for these species were then swapped and traded among the EU member states – along with catches for other species whose recruitment had not been overestimated.

This was the cause of complex negotiations, and was supposedly fixed for all time. The result was that when levels of cod-fish recruitment declined to normal levels, the fishing pressure was far too high, depleting the stocks. Then those countries that had particularly high quotas for cod-fish – such as the UK – could no longer catch their formal entitlement to these fish, but could not simply switch to other species because these now 'belonged' to other countries. One lesson here is clearly not to set up elaborate and inflexible arrangements, especially if they have no basis in biological reality. The second major lesson about the CFP is that when this was realised, in the early 1990s the European Commission attempted what was in effect a recovery programme. But with no extra money to cover the significant short-term reduction in profits that this required, the programme had no realistic prospect of gaining support, and it was abandoned. Rather than bringing about radical reform of the CFP, this situation was accepted. The end result was today's crisis, just 10 years later, but far worse.

The advent of steam trawling was just one particularly dramatic example of the role of technological advances. *Technology Creeps, Leaps and Bounds* briefly reviews the history of technological changes at one port, Newlyn in Cornwall, along with some of their social, economic and environmental consequences. Some technology allowed potentially sustainable increases in catches such as seine netting of pilchards from the 1500s. It opened new markets, for example when rail access to London markets converted mackerel from the 'poor man's fishery' to one that was highly profitable. But even here, there were social tensions where different fisheries adversely affected one another. Another beneficial technology concerns an increase in safety. But often the lesson has been one of 'selfish' technological improvements, which carry no overall economic or environmental advantage, simply allowing one group to gain a (temporary) advantage over others; a situation that flourishes where it is not possible to control access to a resource.

These lessons are reinforced, and others documented, in the detailed accounts of ports in Scotland, the east coast of England, Newlyn, Wales, Fleetwood, and Northern Ireland.

MOVING FORWARD

While the lessons of history are important, the world has changed and it is necessary to move on: many distant water grounds are no longer available to the UK fleet, for example, and the Dutch and Spanish have legitimately bought UK vessels with licences that entitle them to a share of the UK quota. But it is possible to respond to change. Fishing communities have already found ways to diversify (cf shellfish, recreational fishing and niche markets). But it is also important to be aware that the UK continues to have valuable historical rights to fish in European waters. It is vital to fully appreciate the benefits for the UK economy from rebuilding these stocks. Many of the port accounts give some qualitative impression of the potential benefits of such restoration. Yet astonishingly, very few attempts have been made to quantify this. However, as described in *Economics*, for the English Channel fishery alone the best estimates are that annual profitability could be increased from just £1.7 million per year to some £30 million.

Multiplied across the UK fishing industry, the potential economic benefits of recovery are very significant. Fish once had a reputation as a cheap and abundant source of protein of dubious quality. No more. The health benefits of low fat whitefish, and the health-beneficial oils of species such as herring and mackerel, are increasingly recognised. Fish is easy and quick to prepare with low wastage. It is a natural product. Appropriately managed, marine fish are an environmentally sound source of protein – the very opposite of intensively reared meat. Some methods of capture, such as fixed traps or long-lining, are energy-efficient ways of bringing food to the table. In short, fish are a fashionable luxury item, in short supply and commanding a high price. Even if fisheries elsewhere in the world were to recover, the UK would still have the advantage of geographic proximity to major markets.

Moreover, there are all the ancillary industries, from shipbuilding to processing and food preparation that fishing supports. In Scotland it has been calculated that four additional jobs are supported on land for every one at sea, with large amounts of money being retained in the local economy[1]. In areas such as the north of Scotland, or the south-west of England, fishing is prospectively a sound and credible route for some communities to advance from simply surviving to having a reasonable level of prosperity based on a natural geographic advantage. This is a rare reversal of the normal situation for such areas, and one that simply cannot be squandered.

So given all of the benefits, how do we actually get from here to there? What are the requirements that maximise the prospects for successful recovery programmes?

As an overall principle it is important to separate recovery programmes, both financially and conceptually, from the annual round of short-term crisis management that fisheries management has become. For the moment the latter is inevitable, but it should be kept as a distinct process. Recovery programmes need to wipe the slate clean: start with a clear-headed evaluation by interest groups and experts regarding realistic medium- and long-term goals for stock sizes and catches, investment requirements and profitability goals. Recovery programmes should then define the interim targets by which progress will be measured, along with agreed corrective steps should progress deviate from these targets.

At this stage it is important to avoid being prescriptive about the detail of recovery programmes. This has to emerge via a cooperative venture and the sharing of expertise by the different interested parties. However, we believe that there will be four essential aspects to such programmes: *recovery plans*, *delivery mechanisms*, *trust* and *money*. Elements of some of these, such as recovery plans, are already relatively clear; for others, however, new territory is being explored.

Recovery plans

When people discuss fisheries conservation measures in general, or specific recovery programmes, the element that tends to be most emphasised (to the exclusion of others) is the narrower, more immediate concept of recovery (or management) plans. These are the specific measures that are to be used to allow stock regeneration. There are a wide range of tools to choose from, of greater or lesser suitability, including mesh size, Total Allowable Catches, types of permitted fishing gear, licensing of fisheries, closed or restricted areas (or fisheries) of variable duration, minimum landing sizes, inspection and enforcement regimes, and so-on. A number of options have been described in the port accounts, and in the sections concerning historical lessons, and are not repeated here. At this stage it is simply noted that there is no shortage of options, or of collective experience in Europe and beyond, to provide a basis for agreeing what measures should be selected as part of the recovery plan for particular stocks.

Delivery mechanisms

A recovery programme that concentrates on specific measures alone, however, has little prospect of success. It also has to deal with delivery mechanisms. The Common Fisheries Policy is an example of such an overarching delivery mechanism; though nominally one which places a strong emphasis on command and control by governments and the European Commission. Interested parties are consulted, but ultimately it is governments that take and enforce (or rather attempt to take and enforce) the decisions regarding what will be fished, by whom, where and how.

The considerable experience that has built up with such a delivery mechanism shows that it does not work very well, for reasons that appear endemic. One is that they are rarely seen as legitimate by the fishing industry, who have little sense of ownership of the process. When fishermen are compelled to follow management steps which they regard as unfounded, and which turn out to be wrong; or when they are required to act on science whose basis is incomprehensible (and also turns out to be incorrect), it is hardly surprising that the process loses authority. There is a crucial difference between being consulted, and being inside the decision making process. This is not to say that fishers have a monopoly of wisdom, but the loss of authority *is* a likely consequence of mechanisms that exclude legitimate interests from direct engagement.

Therefore, as part of the success of recovery programmes, it will be fundamental to find delivery mechanisms acceptable to legitimate interests – stakeholders. Regionalisation, zonal management and the full engagement of the fishing industry in management, will form important elements of the new delivery mechanisms. While not exhaustive, *Alternative Delivery Mechanisms* illustrates the experience of three other countries – Iceland, Norway and Japan – with mechanisms very different from that associated with the CFP.

After the Second World War, **Iceland** faced the common problem of over-exploited stocks. It initially dealt with this by claiming exclusive fishing rights over an increasing area, and expelling foreign fishing fleets. This exclusive economic zone extended 200 miles offshore by the mid-1970s. This eased the pressure on the stocks, but still was not sufficient to prevent over-exploitation. After experimenting with a number of delivery mechanisms, Iceland chose to go down the private personal property route of individual transferable quotas (ITQs): rights to fish which can be bought, sold and accumulated. Since then there have been some problems with the stocks, but Icelanders would regard their management as relatively successful, although the recovery programme is not complete. Where there has been greater criticism within Iceland is the social consequences of the ITQ system, with fishing rights concentrated among relatively few people. Specifically the earlier part of the Icelandic experience does not apply to the UK, as there is no 'easy' option here of expelling a significant part of the fishing fleet.

Norway has also faced depleted stocks, as well as a heavily subsidised industry resulting from a social convention of subsidising remote coastal fisheries communities. Stock collapses in the 1980s, largely due to indigenous Norwegian fisheries, galvanised action. Management structures were drastically changed and previous practices, such as the discarding of fish at sea, banned. Subsidies were drastically reduced, funding being switched to social welfare payments as employment in the fishing industry contracted. Even with Norway's relatively generous social spending for remote areas – by comparison with the UK – this was a controversial measure. Compared with Iceland, there currently appears to be a greater emphasis on sustaining communities. Thus the system is primarily one not of ITQs but Individual Quotas (IQs) that cannot generally be accumulated.

Compared with the UK, the fishing industry, managers and scientists appear to work more harmoniously, and the Norwegian Fishermen's Association is more integrated in management decision making. The net result has been a turn-around in Norwegian fisheries. The stocks are in better shape, subsidies have been virtually eliminated, and the industry is profitable. One major issue continues to be that of a tension between maximising economic returns *per se*, or balancing this with social objectives such as maintenance of communities.

Norway is also an interesting example for fisheries where there is a substantial amount of community control, such as that for Lofoten cod. This was the historic model in many sites in the UK, from the east coast of Scotland through to Newlyn. The presumption against community control of resources is that it is an outmoded system, no longer applicable to the current situation. However some reassessment is under way in the light of examples such as Lofoten. In addition, the delivery mechanism of the inshore fisheries of **Japan** has attracted considerable attention. Local fisheries associations (LFAs) administer fishing in coastal waters. The Japanese LFAs are powerful, having an absolute right to block other coastal developments. Fishermen in these associations have rights to fish, which cannot be sold. There are elaborate community norms – informal but binding – that extend into the detail of fishing, and which deal with competing claims.

This system of community control is credited for the remarkable stability of the Japanese inshore catch over the 20th century, roughly equivalent to peak (but unsustainable) yields from the North Sea. Lest it is assumed that such a system is impossible in the West, it should be noted that it has

much in common with current thinking on stakeholder involvement and the exercise of rights and responsibilities. When it comes to discussing delivery mechanisms for recovery programmes, it will at least be important to see what lessons can be learnt from such a system.

Trust

The need to build trust is more poorly recognised than the need for delivery mechanisms. Yet it doesn't take much involvement to know that distrust in the fishing industry is an endemic and corrosive force. Within the CFP framework, politicians, scientists and the fishing industry typically distrust one another. So an important part of the groundwork for recovery programmes has to be the building of trust. For its part, WWF regards it as a priority, as part of its Oceans Recovery Campaign, to work with fishing organisations towards the common goal of healthy sustainable seas.

Deception and secrecy is an intrinsic part of fisheries. This ranges from practices that most in the industry would consider entirely normal – such as secrecy concerning good fishing locations – through to events that are deplored, and which are considered bad for the industry overall, but which are also considered to be an inevitable consequence of a broken system. Thus in the Scottish fisheries during the 1990s the 'black fish' (illegally landed 'over-quota' fish) supply became so large that it undermined both stock assessments and the price of fish on the legitimate market. In 2000, the International Council for the Exploration of the Seas (ICES), the body responsible for providing stock assessments to the EU, announced that the mis-reporting of catch locations remained a significant problem, for example for herring[2]. Trust clearly continues to be an issue. One producer organisation, approached during the research for this report, speculated that the economic value of fisheries was many times that recognised in the official accounts; with the ironic result that the value of fisheries to the local economy was not fully appreciated by policy makers.

One response to this might be that the fishing industry has created a rod for its own back, deserving no sympathy from regulators or the wider public. There is, however, something implausible about condemning whole groups as being implacably dishonest. It seems more realistic to assume that the fishing industry has been forced down the current path. Similarly, with politicians, fisheries managers and scientists, experience shows that there are very few who are not sincerely trying to find a resolution to the problem, within the limitations of the existing regime. The problem is one of a systems failure; a situation from which individuals or groups cannot extract themselves. Remedies for systems failures have to come from reform of the system, not by blaming individuals or groups. This in turn requires strong leadership.

Informal discussions we have had with UK fishermen and fishing organisations during the course of research for this report has reinforced this impression of a systems failure. There is a great deal of willingness and constructive thought among fishers about how to turn the situation round, and a great deal of frustration about how they are perceived, and of their lack of influence over events that profoundly affect them. Overall, there is no need for fishers and environmentalists to be in conflict. Recovery strategies for both fisheries and the environment follow similar paths, and the prospects for recovery will be enhanced if fishermen have far greater control of the resource and its management, while obviously working within an agreed framework that sets out certain criteria and goals (economic, social and environmental) that have to be met. Restoring stocks to

levels that can sustain far larger yields will represent a major improvement in the health of the environment in terms of species composition and abundance. Moreover, having reached that goal of high sustained yields, it is anticipated that any remaining conflicts will be eased, and crisis management and fears of a significant economic impact for the industry as a whole alleviated.

Money

Fundamental to the problem, overriding all considerations about recovery plans, delivery mechanisms and trust, is one simple truth: fishermen are not demanding enough money, and without it there is little prospect of recovery.

On the face of it, this may seem an astonishing statement. As already described in a 1999 WWF report[3], it is absolutely true that one of the major problems of fisheries, leading to the depletion of stocks, has been the over-capitalisation of the industry worldwide, and competing – ultimately self-defeating – government subsidies. However, much money has indeed been wasted and it is necessary to assess the situation as it is. Otherwise we risk far greater damage. The elaboration of this apparently paradoxical response is that fishermen are not demanding the right sort of money - investment in recovery programmes.

This conclusion is reached because there are essentially three possible options for resolving the crisis and rebuilding stocks so as to realise the potential economic benefits. First the fishing industry absorb the reduction in catches out of its profits; second government can attempt to deal with the problem by redirecting current subsidies; or, finally, investment in wide-scale recovery programmes.

Of these, there seems little prospect of the fishing industry being able to absorb the necessary cuts from their profits. Astonishingly, the quality of relevant economic information is poor. Nevertheless, the overall profitability of UK sea fisheries is low, and the effect of even a one per cent reduction in catches would be significant (See *Economics*). Similarly the current level of government expenditure overall on fisheries grants, far less on specific expenditure for recovery measures, falls far short of annual income from landings. Total landings by the UK fleet in 1997 were £622 million, while those from the troubled North Sea cod, haddock and whiting stocks were £111 million. By contrast, recent levels of funding were around £27 million for all fisheries grants for England and Wales.

On average, UK expenditure directly on removing fishing vessels from the UK fleet (decommissioning) in the mid-1990s was £10 million. Clearly this level of funding, compared with the shortfall in the value of catches, does not give much room for creative solutions. If these are the only options on the table, then the likely outcome would be a repeat of past experience. Either a ‘recovery’ programme will be derived that maintains the depletion of threatened stocks at a rate that brings stock collapses still closer; or major cuts will be demanded. However, financial desperation is likely to result in these being circumvented; and/or there will be wide-scale bankruptcies.

Thus, if spending is maintained at current levels, there is a very real risk of collapse, both of stocks and significant parts of the industry. Lest it be thought that this might be a cost effective means of bringing about a recovery – stocks collapse, industries collapse, stocks rebuild – it

cannot be guaranteed that stocks *will* rebuild, as demonstrated by the Newfoundland cod crash. If they did, it is questionable whether UK-based fishermen would be in any position to benefit from them. The experience of the impoverished Welsh fishing industry (See *Wales* port profile), unable to compete with, and displaced by, foreign bids for UK quota, and where such landings largely pass straight out of the country making little contribution to the UK economy, should serve as a very stark warning of the potential fate elsewhere.

The tragedy of the situation is that, were attention focused on the *potential* profitability of the industry resulting from better management and stock restoration, the prospects appear to be very different. For the landings along the Channel ports alone, there is good evidence that the level of profitability can be increased from under £2 million to over £30 million per year (See *Economics*). The rewards for the UK as a whole would be far higher. But, to the evident frustration of the experts involved, there has been very little concrete interest in redirecting policy towards what should be the central goal of fisheries management.

The country should be prepared to invest in such a recovery. First, there is a strong moral obligation to the environment and to coastal communities to do what is necessary to restore the stocks from decades of mismanagement. But second, there is also a straightforward economic argument. With profitability restored, it becomes a much more realistic prospect to remove subsidies, including indirect ones such as funding management, research and monitoring from the public purse.

Of course, it is important that public money is invested prudently. It is essential that legitimate interest groups are consulted and that all proposals for recovery programmes are subject to a rigorous assessment of the economic, social and environmental costs and benefits. One source of funding for such recovery programmes comes via the EU, in what is called the Financial Instrument for Fisheries Guidance (FIFG). Indeed the latest (2000–2006) FIFG programme specifically allows for payments in association with the implementation of recovery plans for resources that are threatened with exhaustion. Such payments can also be made to dependent industries, such as processing companies, affected by the introduction of a recovery plan – an important aspect that should not be overlooked. The Commission appears to favour such plans, but it has met resistance due to concerns over their short-term socio-economic effects[4] (suggesting that the funding is insufficient). However, the rules only allow for payments typically for a maximum of two years, with the possibility of extension for an additional year. This is likely that it is too short to restore stocks to levels from which their economic potential can be realised.

The situation requires UK fisheries ministers to actively and strongly make the case for this additional investment in the coming months within government. In addition they would need to make the case, in conjunction with fisheries ministers of other member states and the Fisheries Commissioner, within the European Union. The crisis is too severe to conform to pre-planned schedules or pre-programmed budgets. The ministers will need the support of all of those with an interest: the fishing industry, fisheries managers, scientists, environmentalists and members of the public. The public reaction across Europe to such an investment it is to be hoped will be very positive.

There is, however, an immediate UK problem. The FIFG funding already mentioned has a system. In order to access this funding, the UK authorities first have to develop a proposal, and commit match funding. The past record of UK match funding compares very poorly with many other countries, and FIFG money correspondingly low (see *Economics*). This, as UK Fisheries Minister Elliot Morley has conceded[5], is at least partly the result of the imposition of Treasury spending rules. As far as can be judged, the Treasury response does not appear to be specific resistance to expenditure on fisheries, but a simple blind-spot. It is remarkable that amid headlines of crashing fish stocks, a closure of the Irish and North Seas cod stocks and an end to 'cod and chips' from UK seas, the only mention of fishing in the UK Treasury White Paper (*Prudence for a Purpose*[6]), detailing the spending priorities for 2000–2004, is to finish paying for a new research boat. So, in terms of advancing the process, the single most important step that must now occur is for the Treasury and other financial departments to take a serious interest in investing in recovery programmes, both within the UK, and in promoting the case for wider action in Europe.

Of course, one essential question is 'what are the likely costs and benefits?' Partly due to the poor quality of economic data, and partly because – remarkably – this issue has never been systematically explored, it is impossible to give a detailed answer. One partial figure of the benefits for English Channel landings has been noted - from a current value of under £2m to in excess of £30 million. As for the costs, it is possible to put broad upper and lower limits. For example it is unlikely to be less than the £10 million per annum spent on decommissioning, on the other it can be expected to be substantially less than the ca. £270 million value of UK landings of whitefish and pelagics from the UK fleet (See *Economics*).

To place this in context, the total value of all UK landings in the UK and abroad in 1997 was £622 million, or one thousandth of the UK's total Gross Domestic Product. In the end, this is more a matter of values than costs. It is difficult not to be impressed by the actions of another government, that of Australia. The Australian Prime Minister spearheaded the Ocean Act, including detailed recovery programmes, which will be funded by a fraction of the revenue raised from the telecommunications industry[7].

The bottom line is that if, as a nation, we want to save the fish and the fisheries, and if we choose to save them, we can afford to do so. Such action would be a lasting legacy.

ECONOMICS: THE COST OF FAILURE, THE REWARDS OF SUCCESS

Reliable high-quality economic information is crucial to the successful management of fisheries; yet information collected in the UK is poor. This point has repeatedly been emphasised by important bodies since the 1980s. More recently, influential institutes have highlighted the huge economic costs associated with the failure to switch from crisis management to the type of medium term recovery programmes advocated in this report, and the consequent failure to realise fisheries' economic potential.

As long ago as 1988 the National Audit Office[8] highlighted the absence of economic information – such as profitability – vital for assessing performance and developing policy. Yet it was still

necessary to make the same criticism a decade later, in 1998, in the House of Commons Agriculture Select Committee's report on Sea Fishing[9]. Indeed a report commissioned by MAFF and available on its website[10] highlights the *"recurrent problem that insufficient economic data is readily available for the UK fleet"*.

That report, and more recently, another publication[11] from the same institute, the Centre for the Economics and Management of Aquatic Resources (CEMARE), based at the University of Portsmouth, have quantified part of the price of failure. They again emphasise the paucity of information available, but for one fishery at least, that in the English Channel, sufficient data exists to drive home some of the major points. In that fishery, in 1994 the value of UK landings was around £94–103 million, including high value shellfish such as lobsters and scallops. Yet the level of economic profit was *"estimated to be negligible, around £1.7m"*[12]. The problem comes, they state, from the failure to focus on how to achieve the *potential* profitability derived from better management. If recovery programmes were implemented, the fishery would be capable of producing far higher landings, resulting in a huge relative increase in profits, of the order of £30m. This maximum level, they suggest, would only be achieved with a significant reduction in employment. Nevertheless, if maintaining employment was also a goal, *"significant gains in economic profits could be achieved with relatively small decreases in fleet size"*[13]. A later study puts the potential profits even higher, at some £36 million[14].

The problem of current low profitability highlighted for the Channel is regarded as being typical of the UK, although there are substantial variations between fisheries, and between boats within fisheries[15]. Although equivalent detailed studies do not exist for other parts of the UK, something is known about the reduction in profits associated with any reduction in catches. For example, for Scottish trawlers (both under and over 24 m) CEMARE's modelling results indicate that a one per cent reduction in catch may result in a reduction of profits of some 4 per cent. Given the scale of action that is now necessary to restore stocks, it is implausible to expect that these can be absorbed from profits.

But if it is not to come from the industry; then what about government and EU funding? The problem is that current funding also falls far short of the scale of the problem. In 1998 the total value of whitefish catches landed by the UK fleet in UK ports was around £294 million, that for herring, mackerel and other pelagic species was some £29 million[16], and that for shellfish some £85 million. Landings by the UK fleet of cod, haddock and whiting alone amounted to £150 million, of which £111 million came from the North Sea. Clearly recovery measures are going to have a major short-term effect on income. Between 1993 and 1997 an average of £10 million was spent on decommissioning UK fishing vessels, a key part of the programme to reduce fishing effort in the UK. In England and Wales, according to Elliot Morley, fisheries grants of every form were some £27 million[17] annually. It seems unlikely that the current level of grants, even if totally redirected to recovery plans, would fill the gap.

This option, of making only marginal adjustments to current policy and funding, carries with it a very significant danger of collapsing stocks and significant parts of the industry, and does nothing to restore profitability. Moreover this is not a cost-free option, as it brings with it loss of tax revenue, social security payments, and the funding of regeneration schemes of dubious prospects.

This is why it is so urgent in the coming weeks and months to shift focus to recovery programmes with the medium-term goal of stock recovery and realising the potential economic returns, commensurate with social and environmental objectives. This will require short-term investment to realise medium-term gains.

However, there are problems, both generally within the CFP and specifically for the UK. The general problem is that the CFP Structural Funds budget available for dealing with such matters has already been agreed through to 2006, and at a level that now appears inadequate to deal with the crisis, which of course extends beyond the UK. Moreover, there are specific problems in the UK. The EU budget potentially available to the UK (the so-called Financial Instrument for Fisheries Guidance, FIFG – available for decommissioning boats, building new boats, developing small-scale coastal fishing, finance to assist restructuring, the protection of resources, compensation for recovery plans etc[18]) has not been fully taken up.

The initiative for specific proposals has to come from national governments, and they have to put up some degree of match funding. The UK administration has been reluctant to do this, unlike most of the other major EU fishing nations. The UK put forward e25m between 1995 and 1998, releasing e124 from the EU. Compared with this, Spain put up e389m, releasing e1,115m; Portugal put up e87m, releasing e213m; and Denmark put up e76m, releasing e140m. Germany put up e293m, although 'only' releasing e158m EU funding[19]. In 1999 Elliot Morley, in his evidence to the Agriculture Select Committee, accepted that this was partly the result of internal UK Treasury spending controls[20]. Similarly, with the EU 'PESCA' local community-based initiative, a report commissioned by MAFF[21] highlights the poor uptake of funds, again resulting from internal UK problems, that make it unlikely that we will be able to draw upon the full potential for EU money.

Of course, one vital question is – in addition to assessing the potential future benefits – 'how much is the investment going to cost in the short term?' Because the economic information is so poor, and because the options for the most effective way of achieving such a goal have never been explored in the UK, it is at present impossible to put a detailed figure on this. Nor would it be correct to attempt to pre-empt what needs to be the result of discussions between the various interested parties, and examination of the various options. WWF intends to be fully involved with fishermen's organisations, related industries, economists and government departments in the coming months to fill this gaping hole. On the one hand it is unlikely to be less than the £10 million annual sum made available for vessel decommissioning during the 1990s. At the upper level it can be anticipated that it will be well below than the £269m value of all UK vessel and UK-landed white- and pelagic fish in 1997, far less the total value of all UK fish and shellfish landings here and abroad in 1997 of £622m. One would also anticipate that the annual investment would diminish during the course of the 5-10 year recovery programme.

Finally, to place potential investment in context, the £622m value of total landings only made up 5 per cent of the total contribution of agriculture, forestry and fisheries to GDP, while in overall terms fishing was responsible for just 0.1% of GDP[22]. In 1999–00 GDP is predicted by the Treasury to reach £904,088 millions[23].

CONCLUSION

Clear solutions

The answer is clear. Wide-scale recovery plans for fish stocks and the fishing industry are needed. The time for successful action is now and if wide-scale measures are taken can be expected a turn-around in the reproduction and growth of fish stocks, and the viability of the fishing industry, within 5-10 years.

WWF therefore recommends:

- a commitment to investment money from the UK Treasury so that decisions are not based on short-term survival but on medium-term recovery and long-term sustainability;

- UK governments should commit to the delivery of regionally-based recovery programmes that involve a package of regeneration measures such as closed areas, bigger mesh sizes, scrapping vessels and lay-up schemes, along with appropriate delivery mechanisms.

WWF's Oceans Recovery Campaign (ORCA) is also calling for:

- a stronger network of Marine Protected Areas around the UK and integrated marine legislation in the form of an Oceans Act;

- a network of regeneration areas to enhance and restore fish stocks, including pilot Fishing-Free Zones.

Political indifference

There can be no doubt that for results in 5-10 years, a wide-scale reduction in the amount, and a change in the type, of fishing is required. This report illustrates reasons why, until now, this reduction has not been possible.

Ultimately, it is suggested that the problem is money. Within the UK, this lies, not so much the fisheries ministries, but rather as a result of Treasury spending restrictions. As far as can be ascertained there does not appear to be specific resistance to expenditure on fisheries, but a simple blind-spot. Amid headlines of crashing fish stocks, closure of the Irish and North Seas cod stocks and an end to traditional 'cod and chips' from UK seas, the only mention of fishing in the UK Treasury White Paper, detailing the spending priorities for 2000-2004, is to finish paying for a new research boat.

Given this, the lack of confidence by the fishing industry for investment from the Treasury to finance recovery programmes is unsurprising. This, together with the subsequent adaptation by the industry to short-term survival, has led to a belief that comprehensive action is a naïve dream. The onus is now on government to show, by deeds and actions, that this view is unfounded.

Recovery Programmes

The central conclusion of this report is the need for comprehensive, properly funded recovery programmes. It is important to be clear what is a legitimate part of a recovery programme is and what is not.

What the programme is not

Investment in recovery programmes does not mean long-term subsidy. If recovery programmes are comprehensively and successfully implemented now, we are confident that in 5-10 years time, it is likely that the UK fisheries will see a major increase in profitability. This is in direct contrast to current government spending and policy which is insufficient to halt stock declines, and carries with it a substantial risk of stock collapse and industrial bankruptcy. Should stocks subsequently recover, there is no guarantee that UK fleets will be in a position to respond and benefit.

What the programme is

There are two aspects to successful recovery: a shared vision and the means of achieving it. The goal is an industry that is sustainable, maximising long-term economic profitability, employment, social benefits and healthy fish stocks and healthy wildlife populations. Obviously, biology must be prioritised, as without abundant fish stocks and healthy ecosystems there will be no industry, no markets, no community benefits and no wildlife. The ways and means of achieving the goal has to be separated into *recovery plans* (the practical management tools) *delivery mechanisms*, *trust*, and *money*.

This report illustrates various options to improve the current system. *Recovery Plans* including regeneration areas and Fishing-Free Zones as highlighted by WWF's Oceans Recovery Campaign; bigger mesh sizes, scrapping vessels, lay-up schemes and other conservation measures. In some cases, elements of these are already in place (*eg* the Irish Sea cod recovery programme, the return of female lobsters to the sea) or under discussion (*eg* the North Sea cod recovery plan and the piloting of fishing-free zones in the South Western Approaches). Successful *delivery mechanisms* have to be built to deliver these recovery plans. Elements of such delivery mechanisms include an equitable decision making process, involving all legitimate interests; to create, implement and enforce plans; and regional and zonal management. During the development of delivery mechanisms advantage must be taken of best practice from other parts of the world. *Trust* between fishers, managers and scientists is also vital and needs to be re-established

However, decision making, and therefore the plans, will remain fatally flawed while there is no strategic financial investment available.

The price of failure

Fishing can be far more profitable. The industry can be self-financing and has a stable long-term future. The challenge is how to achieve this. The resource has been badly managed, and fishing effort has often been poorly matched both to the level that stocks can sustain, and to the needs of communities. This problem has built up over many years and the industry cannot now absorb the scale of cuts required for restoration. If the stocks collapse, this will not only affect fishermen, but also the many additional jobs in the chain of supporting industries, and the wider community.

The consequence of failure is to cause an avoidable biological catastrophe and pointless human misery. Fishing communities tend to be marginalised in every way - economically, politically and culturally. These factors make it difficult to develop viable economic alternatives. The choice is not whether or not the money is spent. It is whether it is spent on a recovery programme for an

infinitely renewable and sustainable resource, or face an indefinite period of paying for social security bills, unemployment benefit and job creation schemes.

It's time to choose or lose.

Part two

The History of fishing in the UK

Wales

As elsewhere in Britain, herring (in Welsh *penwaig*, *ysgadan*) once quite literally sustained many coastal communities in Wales, not only providing a source of inexpensive protein, but also an important (often the only) export. For centuries no creek or bay was without herring boats[24].

But by the start of the 20th century fishers had to go further afield in search of the herring, and landings were in decline, although in the 1920s and '30s Milford Haven had the largest landings in either Wales or England because other areas were suffering. The decline continued after 1945, and since 1972 herring has hardly figured in Milford landings (a speculative figure of 1 tonne, the smallest value possible, being recorded in the MAFF statistics for 1998[25]), and has been patchy and irregular elsewhere. Nevertheless, small landings of local fish do continue at the smaller Welsh sites, landed by part-time fishers using gill-nets drifted from boats, or set across harbours.

Historically, Tenby was the most important fishing port, the pier dating from 1328 when Edward III granted a charter to levy duties for its construction. In the early years herring and oysters dominated the catch and, until the end of the 19th century, fishing was limited to Carmarthen Bay and its vicinity, after which they went further afield, to the Bristol Channel approaches and the south and east coast of Ireland. Fishing methods included dredging for oysters (*wystrys, llymarch*), beam trawling for flatfish and long-lining for cod (*penfras*). In a trait that has repeated itself many times in Wales, for centuries a great deal of the fishing was in the hands of outsiders – in the 19th century it was Brixham fishers who visited annually and sometimes settled.

But Tenby went into steep decline, with fishing essentially extinct as a major commercial activity by the start of the First World War. Instead, it became a picturesque seaside town. It could not compete with Swansea and particularly Milford Haven, the emerging ports of the late 19th and 20th centuries. Today Milford Haven is the largest fishing port in Wales. Currently it is estimated that inshore, offshore and recreational sea fishing annually contribute £8.8, £11.8 and £28.7 million respectively to the Welsh economy, providing the equivalent of full-time employment for 598, 162 and 471 people[26]. Much of the activity is associated with rural communities. The contribution to the Welsh economy of offshore fishing is a shadow of earlier years, partly because of declining stocks, but also because a large proportion of the offshore fleet now comprises flagship vessels - owned outside the UK but registered in Wales. Of the 70 vessels greater than 10 metres (which can be assumed largely to represent offshore fishing) registered in Wales, 34 actually operate from Spain and one from the Netherlands[27]. While such vessels must land a certain minimum part of their catch in the UK, they generally contribute very little to the local economy, the catches mostly being exported from the quayside for sale abroad.

MILFORD HAVEN

As for Newlyn in Cornwall, the major change in the 19th century was the arrival of steam – on land in the shape of the railway, and at sea with steam trawlers – which allowed new fisheries and opened new markets. South Wales had the additional advantage of high-quality Welsh steam-coal that was abundant and cheap. The south coast fleet grew rapidly, with a ready market in the

populous industrialised valleys. Soon the boats were going as far as the southern European seas in search of fish. This offshore trend, and the involvement of outsiders already noted for Tenby, continued to typify development through the 20th century, climaxing in the flagship phenomenon just described.

Since Milford Haven's unplanned but profitable birth as a 'derided and despised'[28] secondary development for venture capitalists investing in a spectacularly unsuccessful ocean liner terminal, it has always played second fiddle to other industries. Even so, Milford soon became the fishing capital of Wales, a position it has maintained to the present day. The first steam trawler arrived in 1888, and before 1914 the Bristol Channel and Western Approaches attracted around 100 Brixham smacks every summer that worked from Milford. Its prominence in the herring trade has already been described, but in addition mackerel (*mecryll*), hake (*cegddu*), cod, ling (*honus* or *breninbysg*), whiting (*môr-wyniad*), pollack (*gwrachen y môr*), bream (*merfog)*, conger eels (*llysywen fôr*), skate (*cath fôr*), ray (*morgath*), sole (*lleden chwithig* or *tafod yr hydd*) and other varieties were all landed in significant quantities[29]. Overall in 1925 Milford ranked fourth in importance in England and Wales after Hull, Grimsby and Fleetwood. During the inter-war period, two important fisheries for haddock *(corbenfras)* and halibut (*lleden y môr*) were for species that have never been common off the Welsh coast – which illustrates the importance of deep-sea trawling.

Overfishing was taking its toll. By 1939 catches had fallen dramatically and Milford Haven was in serious trouble because of overfishing and competition from other ports. But the fishing grounds recovered during the war, with the result that 1946 saw all-time record landings of 59,000 tonnes. In 1953, 78 steam trawlers were based at Milford, but by the mid-1950s the signs of overfishing were once more all too clear.

A major part of Milford Haven's post-war fishing prosperity came from hake, caught off the south-east coast of Ireland. But the history of other stocks was repeated as the hake was over-exploited by fishers, who happened to be mainly Spanish and French. This ultimately led to the destruction of the stock and contributed to the decline of Milford Haven as one of the most important fishing ports of Europe. Ships specifically built for the hake fishery and acquired in the early 1960s had left the port by 1964.

The 1960s and '70s marked a period of decline: By 1974 there were just 14 Milford-based trawlers fishing the Irish Sea and Bristol Channel grounds. The most important fish landed during that period was the roker or thornback ray, In 1963 a total of 41,465 tonnes of roker was landed, along with 24,769 tonnes of cod, 19,846 tonnes of whiting and 15,390 tonnes of haddock. The roker, a particularly slow-breeding species, was unable to withstand the pressure and has virtually disappeared from the Irish Sea. In recent years attention has turned to sea bass (*draenogiad*), which has become a high-value and much sought after fish in all Welsh waters.

By the end of 1998 Milford had 12 vessels over 10 metres, and 99 including smaller vessels[i]. Inshore vessels are mainly potters landing crabs and lobsters. In 1998, according to MAFF statistics, demersal fish to the value of £3.1 million were landed. Over £1.5 million also came from shellfish landings – mainly crab (627 tonnes, £723,000) and lobster ('just' 68 tonnes, but worth £668,000). But if these figures are probed, another story emerges: many of these are 'flagship' (foreign boats on the UK register) landings of species, largely unrecognised by UK consumers, but highly prized by the Spanish and Dutch. They include £695,000 of angler fish (monk), £381,000 of hake and £242,000 of megrim soles. A small proportion of such fish are sold in the Milford Haven market, but most is transported for sale in Spain or the Netherlands. In other words they do not provide much export revenue.

SWANSEA

Both shellfish and finfish have been taken in Swansea Bay for many centuries. Oyster fisheries are recorded in the area at least from the reign of Elizabeth I. Indeed oysters have been found in deposits dated to the Mesolithic stone age. In early days, oysters were initially raised by dredging from small open rowing boats. During the 19th century the technology was gradually ramped up, with inevitable overfishing, the catches peaking at nine million oysters in 1873. They then fell, to 1.25 million in 1920, and just 10,000 in 1924, after the 'oyster disease' which hit the area in 1920–21[30].

Herring and other fish were caught, from the 1500s at least, by a line of fish wears, stake nets and traps along the foreshore between the Mumbles and Swansea. This was the principal fishing method, and source of fish, until 1887, when (as elsewhere in the UK) steam tugs started towing nets as an incidental but profitable activity while waiting for trade[31]. But within a decade, tugboat fishing was effectively banned, being displaced by dedicated trawlers. Their numbers were swollen in 1904 by one of the major steam trawling fleets – the Castle Fleet – transferring to Swansea from Milford Haven. These trawlers fished the western grounds off Ireland for hake. Others fished more locally for cod, whiting, hake, sole, plaice and other species in smaller amounts. Swansea had both a local market on its doorstep and good communications with London's Billingsgate Market and the Midlands. By 1924 the 'Consolidated Steam Fishing Company' (including the Castle Fleet) had 124 trawlers, reputedly the largest steam fleet in the world. Overfishing of the western grounds led to the decline and eventual closure of the hake fishery, while the local stocks of whitefish were also decimated. Some 15,000 tonnes of fish had been landed in 1928, and by the mid-1930s the annual catch was already in decline, approaching 10,000 tonnes[i], and the fishing fleet was down to 40 deep sea fishing steam trawlers[32]. By 1957 'Consolidated' had gone from Swansea.

The spiral in the decline of landings and locals employed in the fishing industry has since continued. Offshore fishing is no longer a significant industry in Swansea, but unlike Milford Haven, local fishing has proved tenacious as alternatives have been found and developed.

[i] Not to be confused with statistics for Milford Haven as a *Licensing District* – effectively the Welsh fleet – for which MAFF UK Sea Fishery Statistics 1998 records 115 in 1996, 89 vessels in 1998 and, according to the Nautilus Report, 70 in 2000.

Shellfish such as cockles, at sites such as the Burry Inlet, provide a significant resource for both hand-gatherers and the associated processing industry. A report published earlier this year, by Nautilus Consultants for the National Assembly of Wales[33] , sets out options of maximising the community benefits from Welsh shell fisheries. Drag netting, stake netting and trammel netting for fish is also continued by part-time fishers, suggesting that we have turned full circle. What is relatively new is the revenue provided by sport fishing. Even in the 1970s as many as 20,000 anglers were using the area each year and, as the overall figures for sea fishing in Wales illustrate (£28.7 million, see above), the economic importance of this is grossly underestimated. This is one of the principal findings of the Nautilus Report.

RECOVERY PROGRAMMES

The offshore fishery in South Wales is now largely lost from the hands of the Welsh, and that would be so even if stocks were to recover. This can best serve as a warning of the fate that awaits other parts of the UK unless positive proactive steps are taken. Instead the discussion now centres on the fate of the inshore industry.

Over the last 10 years inshore fishing has been encouraged and, according to the Nautilus Report, there has been an increase in the number of smaller vessels fishing inshore waters. Economic viability can be marginal, so there is an emphasis on acting efficiently and keeping overheads such as fuel to a minimum. So where possible, they use static gear (fixed nets, driftnets and pots – although power is needed for scallop dredgers offshore), and are diversifying so as to be able to target a range of species as available. At least in terms of energy consumption this is more environmentally friendly, although there can be conflicts, such as with the sport fishers who want big fish and a good level of sport in a day, rather than maximum yield. The range of species being landed by the inshore fishers around Swansea is diverse. Fish include cod, plaice, rays, turbot, sole, dab, flounder, whiting and dogfish, and bass is also important to the inshore fleet, in competition with off-shore fishers taking the same stock and recreational fishers in the bay. Crustaceans taken by inshore fishers include lobster, spider- brown- and velvet crabs, crawfish and prawns.

But the increase in vessels, and diversification, is putting pressure on sensitive inshore areas, including nursery grounds, which poses a dilemma for the Sea Fisheries Committees (SFCs), such as that for South Wales. They face a triple problem of lack of resources; an outdated and inflexible legal framework (some parts dating back to 1888); and an inadequate information and research base. Meanwhile new requirements, such as that to incorporate environmental considerations, are seen by some in the industry as an additional burden without additional funding, resulting in a dilution of effort.

As elsewhere, the SFCs see the crucial need for a more thorough fisheries strategy. They feel frustrated that the government does not recognise the true potential economic value, not just in terms of the fisheries, but also in wider benefits such as recreational fisheries, environmental improvements, reduction in welfare payments, wider infrastructure improvements that accrue from higher returns, and the knock-on effect of local processing of the catch. Ironically, part of the problem is that there are so many incentives to under-report catches and economic returns

(some have speculated that the true size of the industry's worth may be five times the 'official' value) that the true current and potential future benefits to the economy are underestimated in government economic forecasting. If this point were more widely understood, many on the SFCs believe that government would make a bigger commitment to the industry. In addition there is significant unlicensed fishing, supplying the 'grey' market, that may be large enough to be of concern to some recovery programmes.

More specifically they want government to place the emphasis on the medium and long term. It will also be important for the management of different fisheries to be integrated. SFCs, such as that for South Wales, believe that the returns from a well managed fishery are sustainable and significant, and that the industry could largely become self-regulatory, able to rein in the over-indulgence and excessive short-term profit -making of the few.

The SFCs believe that there are a number of tools of proven worth available to recovery programmes. This includes controlling the efficiency of fishing (*ie* don't take more than is sustainable; modern technology makes this very easy); the limitation of fishing effort (for example by creating private rights to encourage resource guardianship); preventing the catch of juveniles and ensuring that fish spawn before being caught; seasonal or area closures, the latter perhaps involving rotation between areas; the artificial enhancement of stocks (such as the release of juvenile bass, lobsters, cod and other species from hatcheries or the protection of brood stocks, for example by V-notching the tails of female lobsters to make them unmarketable), placing 'cultch' (stones, old shells or other hard material used in muddy areas to create a substrate where oysters can settle) and oyster seed, or transplanting cockles to impoverished areas. Unsurprisingly, they would also like to see the retention of a rule of UK vessels only within six miles, and for all vessels, regardless of nationality, to follow UK rules within 12 miles.

In the view of some of those within the SFCs, there also needs to be a mechanism to facilitate the setting up of fishermen's groups that can run and administer cooperatives, as currently there is no uniform voice and no means to act in a fully coordinated fashion – a point also brought out in the Nautilus Report. The economic potential for recreational fishing is often overlooked, especially with regard to tourism. Finally, the fact that such stocks are being managed sustainably should be part of a promotion campaign to consumers, emphasising the importance of fishing as part of the marine heritage, and an act that sustains communities currently under enormous pressure.

The benefits of community management for a recovery programme are well understood. But infrastructural investment is also needed to implement medium- and long-term plans; otherwise the fishing industry simply can't get from where they are now to where they need to be.. The frustration of wasted opportunities seems clear to many of those involved; the industry is looking for the government to grasp the nettle of placing long-term gains at the cost of short-term cost. There is room, they believe, for systematic research for the different stocks and to work out likely rate of payback for different levels of reduced fishing. In effect, it makes good long-term sense to pay people to fish inefficiently in the short term, but there are ways in which this can be done that do not result in excessive payment. The qualitative view of people closely involved in the SFCs is to anticipate a 20-year timeframe for full recovery, but that there would start to be a return on investment within five years.

In the words of Phil Coates, Director of the South Wales Sea Fish Committee: "*What society must begin to contemplate is the long-term potential value of well managed fisheries. Unlike the exploitation of other natural resources such as fossil fuels, if fishermen can be given the encouragement to become 'harvesters' rather than 'hunters', the benefits could truly be sustainable in every sense of the word. The reinstatement of fisheries to what they were like even 20 years ago is very feasible over a period of less than 20 years. If we do not act to stem the decline, what chance this, let alone rebuilding stocks to those seen in the early 1900s? If we fail to act, what fish will we see in 2010, 2020, 2050? Considering the rate of decline since the 1970s the future without action does not bear thinking about".*

Northern Ireland

In the mid to late 19th century there were two types of fishing in what was to become Northern Ireland: the herring fishing and long-lining for haddock, whiting and coley. As in Scotland, herring fishing was conducted at night (when the herring rise) with driftnets from open boats called skiffs – a very ancient form of netting. For long-lining, each crewman had a line with 450 hooks, and the women took on the work of opening and attaching the mussels used as bait. At that time, as described in the Scottish port account, there was a belief among some (at least) that the shoals were inexhaustible, and there were no conservation measures as such. However, by today's standards the catching ability was poor and this acted as a form of effort limitation.

By the turn of the last century, the pelagic fishers spent the summer chasing mackerel off Kinsale and turned to herring drifting in August. The beginning of the modern fishing fleet started with seine netting in the early 1920s. Scottish boats fishing off the Co Down coast attracted the interest of the Mourne locals who, seeing that a reasonable living could be made, purchased modern boats and equipment. After the Second Word War, loans and grants provided by the White Fish Authority and the Northern Ireland government led to a vast inflow of capital. There is trawling (including some pair trawling – two boats pulling a trawl). At this time trawling for prawns grew to become one of the largest employers at sea and on the landward side. Some fishermen dredge for queenies (small scallops, also known as clams), while others use mid-water nets, acting in teams of three high-powered boatsin pursuit of swimming herring.

By the end of 1999[34] there were 180 fishing vessels in the NI fleet over 10m in length and 163 vessels 10m and under in length. The estimated value of fish landed by NI vessels in NI and ports elsewhere in 1999 was £22.6m which is around 5 per cent of the total landings of the UK fleet. Around 2,250 people were employed, both full-time and part-time, in the industry: 930 in the catching sector, around 1,120 in processing and marketing, and almost 200 in other areas including harbour jobs, boat building and chandlery supply.

KILKEEL

In recent years the fate of the Northern Irish ports such as Kilkeel have been increasingly tied to that of the prawn. *Mary Joseph* was the first Kilkeel boat to trawl for prawns, back in 1954. Initially regarded with scepticism, the relatively high returns quickly convinced the doubters. Most of the boats at the time drift netted for herring in the summer and seine netted in the winter, but when the prawn fishing started, the drift net owners soon couldn't get a crew – the work was harder and earnings less. At that time boats out prawn fishing were netting £150 a week - good money in those days. There is a sense of pride in the area; Bill Quinn, a retired boat builder, speaks for many when he says "When one looks around the fishing ports in Ireland and sees the factories that are processing prawns, the way they are packed and presented in the shops, it makes one think of the people who have made a living on prawns over the past 40 years, on boats, on quaysides, in the markets, in the factories and in the shops. I am glad I was part of it"

According to ICES the stocks in the western Irish Sea appear to be relatively constant and catches relatively good, although there are concerns about the number of females caught in the summer fishery. In 1998 (the latest available set of figures) the total catch recommended by ICES scientists for the whole of the Irish Sea was 9,400 tonnes; the limit set by the politicians was 23,000, and that reported caught to be 9,400 tonnes[35].

RECOVERY PROGRAMMES

The biggest crisis to hit the Northern Ireland fleet concerns Irish Sea cod, which has been under severe pressure from overfishing since at least the 1980s. The cod fishery was traditionally carried out by otter trawling, targeting spawning cod in spring and juvenile cod in autumn and winter. But this decreased, to be substituted by large pelagic trawling for hake and cod during the 1980s, when the season was extended to include summer. Cod were also taken as a bycatch in the *Nephrops*, plaice and sole fisheries. As a result the stock fell in size until, by the late 1990s, 80 per cent of the stock consisted of fish 'recruited' over the past 12 months. 1997 and 1998 were very poor breeding years, and the International Council for the Exploration of the Seas, ICES, predicted, in its 1999 advice to the Commission and fisheries ministers, that the stock was set to reach record low levels. It also stated that any management objectives must include the rapid rebuilding of the stock, and that catches should be reduced to the lowest possible in 2000 – just that due to bycatches[36].

In December 1999 it was agreed to instigate an international recovery programme for Irish Sea cod, involving the UK and Republic of Ireland governments, and the Northern Ireland Assembly, working with the EU Commission and other member states, fisheries scientists and fishermen, to consider, among other things, the introduction of closed areas such as spawning grounds[37].

The Anglo-North Irish Fish Producer's Organisation, produced a series of what it considered to be detailed and constructive proposals as to how this recovery programme could be managed[38]. These included prohibitions of the use of trawl, seine or gill nets in certain areas between February and April 2000; targeted fishing not only for cod but also haddock and whiting to be prohibited in these spawning grounds over the same period (although fishing that could be demonstrated to be targeted at *Nephrops* would be allowed to continue); the possible closure of other areas aimed at protecting spawning stocks of cod off the Cumbrian coast, and protecting the stock itself as it migrated to its spawning grounds. It is very clear from the tenor of the proposal that, while the fishers are prepared to go along with, and see the underlying rational behind, closed areas, they are extremely concerned with past experience where closed areas, once established, have a life of their own, even when the fish intended for protection have moved on. So their proposal carries a repeated emphasis that closed areas should be temporary, focused on their purpose, and that they should be movable, to follow what are often highly mobile fish.

In addition to proposals related to closed areas, Anglo-North Irish suggested measures such as compensation for small vessels gill netting for cod that have a small proportion of the catch but for whom closure could be devastating; a series of measures to outlaw various stratagems for undermining technical measures, including the use of thicker twine to nullify mesh size increases (see *Newlyn* box), the type of mesh holes to be required; larger mesh in critical areas of the gear;

the prohibition of specified knotting and net constructions intended to undermine regulations; and of nets whose ends can be rapidly removed (to circumvent inspections); and changes to the mesh of *Nephrops* gear to reduce he relatively high bycatch of juvenile fish.

They also asked for the Commission to take up work initiated by Anglo-North Irish and the Sea Fish Industry Authority investigating ways of reducing bycatch from the developing haddock fishery; look for changes in the migratory patterns of cod; and evaluate whether rearing cod for release into the wild may accelerate stock recovery. In addition, they raised the potential (and problems) associated with a limited decommissioning or tie-up scheme, and a limited 'days at sea' scheme that could be easily monitored, such as a weekend ban. They recognised why issues such as satellite monitoring were being considered, but the cost of several thousand pounds per vessel was an issue. More generally, enforcement was a recognised requirement, but they argued that if the fishers felt they had ownership of the process, cooperation would be there. The industry *"must be given the responsibility to show that peer pressure can work, and that it is in everyone's interest that no one breaks the rules as agreed by the industry."* They also emphasised the age-old dilemma that if the measures were only applied to UK fishers, this would be completely unacceptable.

In the end, what the industry regarded as a draconian closure of the Irish Sea fishery was adopted, lasting from 14 February to 30 April 2000, and this formal proposal for a recovery plan was withdrawn. However, many of the technical gear changes were incorporated into a new EU Regulation for implementation by 1 January 2001. The recovery plan introduced by the Commission[39] prohibited the use of any demersal trawl, seine or similar towed net, any gill net, trammel or tangle net, or the use of hooks in the area where spawning cod were concentrated. Exceptions to this were the use of demersal otter trawls within certain sub-areas providing certain restrictions were followed, as was the use of beam trawling, again with certain restrictions.

Scotland

Fishing in Scotland goes back to the earliest hunter-gatherer site post-dating the Ice Age[40, 41]. Middens – refuse heaps – dating back some 5,500 years with remains of shellfish, fish and animals have been found on west coast the islands such as Oronsay, and on Orkney. The remains of species such as great auk remind us that the diversity of life that was then present. Indeed, we would have noticed significant differences from now as late as the 18th century. Thomas Pennant, in his *Tour of Scotland*[42] while at Loch Fyne, noted *"a shoal of herrings, close to the surface, perfectly piled on one another, with a flock of Gulls, busied with this offered booty"* He reported up to 300 horses being brought to the waterside each day to take away the catches, and up to 300 herring busses (fishing and transport ships) at Campbeltown. Even more remarkable was his account of the inshore tuna fishery; the images conjured more Mediterranean than Scottish to our occluded modern vision. *"Tunnies, called here Mackrel-Sture, are very frequently caught in the herring season, which they follow to prey upon. They are taken with a strong iron hook fastened to a rope and baited with a herring: as soon as hooked lose all spirit, and are drawn up without resistance: are very active when at liberty, and jump and frolick on the surface of the water"*.

By the 19th century Scottish fisheries, as elsewhere, were growing rapidly. Uncertainty about the consequences for the valuable herring fishery, and regarding the expansion of trawling (particularly steam trawling) for cod- and flat-fish, provoked a series of official enquiries between 1866 and 1893[43,44] as described in *Pursuing the Herring* and *Hunting the Cod*. Times were hard in the early part of the 20th century, with the collapse of the export market for herring to Germany and Russia, and onset of the Great Depression.

1930 TO THE PRESENT DAY

On the east coast in 1930 Peterhead and Fraserburgh were the major ports for herring, 20,850 tonnes[ii] being landed at Peterhead and 23,030 tonnes at Fraserburgh. Aberdeen was the principal port for demersal stocks, with 19,720 tonnes of cod, 26,601 tonnes of haddock, 6,740 tonnes whiting and 929 tonnes of plaice landed. Other major landings at Aberdeen were 4,825 tonnes of skate and rays, 2,191 tonnes of halibut and 2141 tonnes of lemon sole. Shetland was also principally a herring port in 1930, with 41,420 tonnes landed[iii]. Perhaps more surprising was the importance of lobsters from Orkney, from where 139,814 were dispatched in 1930.

On the west coast in 1930, herring were also the most important fishery: in Mallaig in 1930 a total of 8,053 tonnes were landed, along with 1,739 tonnes of haddock, 514 tonnes of cod, and smaller amounts of other species.

The marked wartime reduction of the fishing effort, and subsequent post-war boost in catches reported south of the border is not so apparent in the Scottish landings. Catches during the war

[ii] Converted from hundredweight

[iii] When considering these statistics it is important to remember that they are *landings*. They don't state *where* they came from, and a greater proportion may come from distant waters compared with the present day.

remained at about half pre-war levels (particularly on the west coast), with only a moderate increase in the immediate post-war years. One development that raised hopes at the time on the west coast was the re-appearance of herring in the Minch, with Ullapool taking landings not seen since the First World War[45]. This was however not to last. Similarly, on the east coast during the 1960s and 1970s the outburst of cod-fish (see Hunting the Cod) affected the Scottish fishery, with abnormally high landings of cod, haddock and whiting. More recently, in 1998 at Mallaig, just 1,081 tonnes of herring (and 1,929 tonnes of sprats) were landed. Demersal landings have fallen less; in 1998 1,040 tonnes of haddock, 884 tonnes of whiting, 437 of cod were landed, along with 347 tonnes of megrims, 307 of hake, 266 of skates and rays and 189 tonnes of witches. One big change is the 2,701 tonnes of *Nephrops* and 1,449 tonnes of scallops – according to an information panel in Mallaig Aquarium, three out of every five scampi eaten in Europe are caught by Scottish vessels. At Ullapool during the 1990s klondykers became very important. Today, around 20 smaller vessels based at Ullapool provide jobs for some 60 fishers who mainly concentrate on mussels, as well as crabs and lobsters caught in creels, and prawns (*Nephrops*) caught by trawling.

On the east coast Peterhead has, since the 1930s, displaced Aberdeen as the fishing capital of Scotland. According to the official statistics, 83,000 tonnes of demersal fish such as cod and haddock were landed in 1998 at a value of £71 million, and 26,400 tonnes of pelagics at a value of £5.8 million. In more detail, in the north-east 17,056 tonnes of herring were landed at Peterhead in 1998, and 4,026 tonnes landed at Fraserburgh, along with 8,932 and 7,108 tonnes of mackerel respectively. Only 653 tonnes of pelagics were landed at Aberdeen. Of the demersals, 34,779, 6,423 and 14,722 tonnes of haddock were landed at Peterhead (value £23 million), Fraserburgh and Aberdeen respectively; 19,585 (£21 m), 2,254 and 7,278 tonnes of cod, 9,024, 2,197 and 2,650 tonnes of whiting. Although the lobster catch was a fraction of that in the 1930s, *Nephrops* now contributed 3,758 tonnes landed in Fraserburgh (the highest value of any catch at Fraserburgh, at £8.5 million, followed by haddock, monks and mackerel, all worth some £3.5m each), along with 1,794 tonnes of *Nephrops* landed at Peterhead.

LESSONS FOR RECOVERY PROGRAMMES

The poor management of Scotland's marine environment is of concern to all coastal communities in Scotland. Fishing and its dependent industries are vital employers in remote regions. Some 2,500 vessels, each a business in its own right, employs over 8,000 people. It has been calculated that another four jobs on land are dependent on every job at sea. The Scottish fleet and its support services are almost all locally owned and controlled, and contrast with the fate of other Scottish industries ranging from whisky to marine aquaculture. This has led to the retention of management and development functions at a local level and as a result the local communities are the major beneficiaries of the fishing industry. In recent years it has become increasingly apparent that it is necessary to have a radical re-think about fishing policy, concentrating on medium-term strategies and organisational structures.

A WWF and SFF joint position on sustainable fishing

In a unique partnership, and as a potent sign of changing times and alliances, WWF Scotland and the Scottish Fishermen's Federation have developed and published a joint position on sustainable

fisheries. This calls for effective management of all activities that affect Scotland's marine environment. It calls not only for reform of the CFP to provide for a healthy fishing industry by ensuring abundant fish stocks in healthy seas, but also for more effective action on other concerns, such as pollution, that affect fishers and the environment alike. For fisheries, SFF and WWF Scotland believe that the deficiencies of the CFP can be repaired by:

- integrating all the legitimate interests operating in a discrete zone;
- decentralising where appropriate the geographical scope of the Common Fisheries Policy;
- re-designing the political structure governing European fisheries.

Both organisations believe that the basic building block for successful European fisheries management is the *Regional Management Advisory Committee*. The committee will utilise the expertise of professional fishermen as well as knowledge of other legitimate interest groups to take a sustainable approach to fisheries management. The four main interests which must be accommodated in an effective fisheries management plan are *professional fishermen, fisheries managers, scientists* and *economists*. At present their involvement in the CFP is haphazard and their interaction disjointed. In future they need to be fully integrated on an equal footing. Taking an ecosystem-based perspective on fisheries management will make it necessary to integrate the management of all legitimate interests operating in a discrete zone.

At present, *fishermen* and their representatives are consulted on European policy through the Advisory Committee on Fisheries and on the national implementation of such policies via a variety of bodies. But this consultation invariably takes place late in the process and it is only very rarely that anything of substance is changed. There is no formal mechanism by which fishermen may take the initiative in the development of a policy which bears directly on their operational efficiency as well as their social and economic wellbeing. Fishermen have a great deal of knowledge and expertise to contribute to the formulation of policy in areas such as stock assessment, technical measures and fisheries management. Their involvement is vital when designing technical conservation measures and the protection of spawning and nursery areas to minimise discards.

The remit of the committee would include advising on a medium-term strategy for conserving and harvesting fish stocks in a discrete zone and proposing appropriate conservation measures.

As *scientists* are aware, most scientific advice is inexact and fisheries science also proceeds by a series of approximations. Because of the way in which fisheries management is currently organised, scientific proposals are not discussed with fishermen until they have reached the (inflexible) status of official advisers. Even then ministers and officials do not make a sufficient distinction between scientific advice and scientific evidence. The official 'wall' between fishermen and scientists is unhelpful and must be removed. Under new arrangements proposed by SFF and WWF Scotland, scientists and fishermen would meet quarterly to exchange information on a continuous stock assessment against the background of a medium-term strategy for a group of species.

Economics are a vital part of the fisheries debate. Both fishermen and scientists need to be fully informed of current and projected market conditions for the main commercial species. It is

important that when deep cuts are necessary for conservation reasons, the economic interests of the affected fishing vessels are taken into consideration. Such a socio-economic assessment could drive short-term diversification programmes and, if necessary, subsidised lay-up schemes so that economic pressures do not undermine conservation objectives.

A medium-term stock management strategy, involving effort limitation, must be accompanied by a market impact assessment. Below a certain level of supply processing capacity becomes unviable and may never return. Equally there is little point in increasing catch limits if the resultant market glut is lower economic returns for greater effort. At a more positive level there needs to be a long-term strategy to ensure that fish and fish products achieve and sustain prices appropriate to a market which increasingly values healthy food.

The *Regional Management Advisory Committees,* covering each of Europe's main fishing zones and including fishermen, managers, scientists and economists, should meet at least quarterly. Each would assess stocks and update the medium-term strategy for conserving and harvesting fish stocks in the zone. Although Total Allowable Catches would continue to be determined by the European Fisheries Council, the advice on which the decision was based would be a consensus reached over the course of the year. The Regional Committee would also propose specific conservation measures appropriate to the zone. Examples of such conservation measures might include 'real time' area closures (*ie* an ability to respond immediately to high discard levels) and other potential stock enhancement measures such as Fishing-Free Zones.

Such arrangements would be primarily directed at offshore fisheries, and would only apply to inshore fisheries when issues affecting spawning grounds or migration routes were relevant. Otherwise waters within six and 12 mile limits would continue to be managed by the adjacent nation state, although that country's representative on the committee would ensure appropriate coordination. The model proposed is unlikely to be applicable to highly migratory species such as mackerel and tuna, where it would seem appropriate for such fisheries to have their own committees.

The purpose of these integration proposals by SFF and WWF Scotland is to enhance the quality of information underlying management decisions. The objective of a decentralised structure is to ensure that policy properly recognises the distinctive features of each fishing zone. Thus the central aim of the committees will be to ensure that the stocks in each fishery are managed to the optimum level for conservation and harvesting. The FAO Code of Conduct for Responsible Fishing might form a basic rolling agenda to ensure accurate stock assessments, appropriate fishing methods and other adequate controls.

The Magnuson-Stevens Act, which governs regional fisheries in the United States, is also a useful source of reference for establishing a rolling agenda for the committees. In any event, they would advise on catch limits, minimum landing sizes, discard policy, technical conservation measures, area and seasonal closures and economic factors and other ecosystem effects of fishing. Although the main thrust of the proposal is aimed at stock management, the committees' work could not be done in isolation from the capacity controls set out in the Multi Annual Guidance Programme on structures. Indeed it is likely that the establishment of a zonal management system would imply revision of structural policy. In particular the current lack of any clear relationship between

capacity controls and fishing entitlement would have to be addressed. In a sense structure policy is a form of technical conservation which would, of course, be a matter for the committees.

The proposals assume that the current system of relative stability in catching entitlements between national fleets would continue. It may be, however, that a zonal system of inter-country leasing arrangements could be made annually between individual vessels, to balance any mis-match between entitlement and catching patterns. Such a system would be more flexible than the current swap system and, if it could be set up electronically, it could mitigate discarding due to inadvertent over-quota fishing.

In areas where non-EU member states share stocks with the EU, it would seem sensible to invite the third country concerned to join the committee. Indeed, there is a committee for the Baltic that is similar in structure to that proposed by SFF and WWF, and which includes non-EU fishing nations. In the case of Norway, and shared North Sea stocks, a continuous dialogue of the kind anticipated would greatly simplify annual bilateral negotiations.

WICK

Travel to Wick, and you can see something of a precursor of the fate that awaits other ports if we fail to restore the fishing. From Glenlivet, already far in the remote Highlands to most people, it is another three hours and 150 miles of twisting coastal road to Wick. From the Black Isle, first the wheat disappears from the landscape, then the barley, then the trees, leaving a windswept barren of poor grass, bog and rushes. Truly, there is little alternative to the fishing. And as the fishing has declined, so has the town to an extent not seen even in towns such as Grimsby, hard hit by the decline in fishig but where alternative employment does exist and which is located, to Wick people's eyes, in the heart of metropolitan England.

Yet 100 years ago Wick was prosperous, the largest herring port in Europe. The fish were plentiful, but as Pennant noted in the 18th century, there were few safe havens. One solution, adopted a few miles down the coast from Wick, was to build a staircase down the face of a cliff, the women of Wallagoe repeatedly struggling up the 400 exposed steps with baskets (crans) of herring balanced on their heads. At Wick the best British engineer of the day, Thomas Telford, drew attention to the potential of the Bay for development as a safe haven to the British Fisheries Society. This had the remit, established by Act of Parliament, to enrich the region and reduce emigration by extending 'the Fisheries, and improve the Sea Coasts of the Kingdom by building free towns, villages, harbours, quays, piers and fishing stations in the Highlands and Islands of North Britain'. The funding activities of the society, along with the relaxation of the law to allow men of no capital to set up in the fishing industry, had resulted in a chain of fishing ports being created around the north and west coasts. The society's final act was to die in the act of creating Wick Harbour at Pultneytown, its exposed breakwaters requiring repeated re-engineering which bankrupted the society in the process. Telford's harbour was beaten by the waves, and later another famous engineering family, the Stevensons, struggled only with partial success to secure the harbour. Nevertheless the investment proved spectacularly successful. For a time, Wick became the biggest herring port in Europe. But by the early 20th century, the herring immediately off the north coast of the Moray Firth had declined, ships were better able to berth further south

and receive the attention of specialist engineers and workshops that they increasingly needed… then the market for herring collapsed. Wick went into decline.

Now the two basins of the harbour are virtually empty. The landings of the inshore fleet are depressingly low. If the stocks recovered, one could expect this to be reflected in the prosperity of this inshore fleet, although there may be structural reasons why the offshore fleet would not return – more remote than, say, Peterhead, and without the vast marine hinterland of Shetland. Each settlement is different in its problems and opportunities. Wick's opportunities are now perhaps more limited than most, and its fate serves as a reminder of the problems that await other fishing communities if we cannot seize the positive opportunities for recovery.

England

EAST COAST

As elsewhere in the UK, some of the earliest records of fishing along the east coast of England refer to herring. Michael Wigan[46] found records of herring fishing going back probably to Saxon Yarmouth in 495 AD. Certainly by 670 the fishermen of both Lowestoft and Yarmouth were paying tax on their herring fishery to the Abbey of Barking. The herring fishery was mentioned in the Doomsday book as yielding 60,000 herring to the King of England from the settlement of Dunwich in East Anglia. 'Then we were unable to affect their vast shoals; rather we were at the mercy of their proliferation (a glut caused a collapse of the market) and failure.' By the middle of the 12th century herring had become a major commodity, with action being taken to prevent unscrupulous traders cornering the herring market in Yarmouth.

Distant water fishing

Meanwhile, just up the coast, whitefish, particularly cod, were the primary target. Cod was certainly present in the North Sea, but by the early 1400s Icelanders were reporting English boats fishing for cod off their coast. Soon they were also fishing the Newfoundland Grand Banks. It is a reasonable bet that fishers from Grimsby were among those early pioneers, but the real era of expansion started in Grimsby in 1796 when the Great Grimsby Haven Company was formed by Act of Parliament to develop the port[47]. From that point the landings and the population of Grimsby increased in virtual synchronisation, 1,000 people for every ton: 27,000 tons of fish and a population of 26,500 in 1871. The first steam trawlers arrived in 1881, allowing greater access and greater duration, and by 1890 total landings were 70,000 tons and the population was over 60,000. The first British steam trawler to fish Icelandic waters, in 1891, was from Grimsby, bringing back a catch of haddock and plaice[48]. By the early years of the 20th century, 651 trawlers were travelling as far afield as Newfoundland, the Barents Sea, Greenland and the White Sea. Despite the disruptions of wars and depressions, in the 1950s there were still many vessels based at Grimsby, employing 3,771 fishers.

All that changed in the 1970s, when the deep sea fleets lost their access to Icelandic waters upon which the fortunes of Grimsby and Hull were then based (see *Alternative Delivery Mechanisms*). Looked at dispassionately, Iceland's action might be commended. But from the perspective of Hull and Grimsby it was a disaster. By 1985 there were just 585 fishermen. This loss was all the greater because the loss of fishermen's jobs are the visible part of an iceberg of unemployment in dependant or part-dependant jobs.

As if that were not enough, in the 1970s herring and mackerel collapsed, widely perceived to be the result of (Norwegian and Danish) purse seining for fish meal and oil. The herring recovered, by which time the processing industries in places such as Lowestoft and Yarmouth had disappeared, and British fishers were no longer in a position to take much benefit.

Moving forward

Nevertheless, although very much reduced in size, a significant amount of fishing still takes place. The Fish Producer Organisations have adapted to reduced circumstances and diversified where possible. Grimsby Producer Organisation's membership includes 51 fishing boats, actually based (and indicating how producer organisations are evolving) from Whitby to Lowestoft. These may fish anywhere from the coasts of Scotland and England in the North Sea, through the English Channel and into Irish waters. In 2000 the most important species (over 100 tonnes) landed by GPO members in order were cod, plaice, haddock, whiting, scallops, whelks and lemon sole, although there were also significant landings (over 10 tonnes) of crab, dogfish, ling, lobsters, *Nephrops* (scampi), red mullet, saithe, skate and rays, witches, and bream.

Recovery programmes

Given their location, and with such large landings of cod, haddock and whiting, it is not surprising that the GPO is concerned about the crisis in the North Sea. As components of a recovery plan[49], and in common with other east coast producer organisations, it favours a requirement for a minimum mesh size of at least 100mm to be brought in, and the abandonment of 'derogations' which allow certain types of fisheries, such as those for sole, whiting and *Nephrops* to use nets with a mesh size less than the standard which results in unnecessary bycatch. They argue that GPO members are fishing profitably for *Nephrops* and whiting with 100mm (or greater) mesh nets, while the landing of undersized sole is actually suppressing the market price for larger fish. They also object to the continuation of the industrial fishery for sandeels. They were opposed to the removal of minimum landing size restrictions on species such as lemon sole, turbot and brill, and are opposed to a similar move to abandon minimum landing size for plaice. As described in*Alternative Delivery Mechanisms*, in Norway there is a requirement to land and count everything against quota, to encourage better selectivity. But the GPO sees the other side of the coin: the landing of large numbers of juvenile fish being bad for stocks and bad for market prices.

FLEETWOOD

Fleetwood, like Newlyn and South Wales, saw a period of rapid expansion during the 19th century, with the combination of increased technological capabilities at sea (steam trawling) and access by rail to the growing urban populations of Britain. Fleetwood was close to the burgeoning industrial towns of north-west England. The railway and associated wharf was opened as long ago as 1840, and the first dock in 1877. Although initially fishing was a fairly minor activity, by 1890 there were some 35 inshore fishing smacks, and 60 deep-sea smacks. These sailing vessels worked as far as the coasts of Wales, the Isle of Man and Scotland.

The first steam trawler arrived at Fleetwood in 1891, marking a period of transition. By 1910 steam trawlers were staying at sea for two or three weeks, travelling to the same grounds as the east coast deep-sea fleet. Activity reached its peak in the 1920s and '30s, with 178 trawlers operated by 60 companies working from the port. At that time Fleetwood was the third largest fishing port in Britain. Fishing statistics show (after a massive catch immediately after the First World War) an increasing trend in total landings, peaking in excess of 75,000 tonnes in 1937. A

similar catch was achieved in 1947-48, after which there was a steady decline to a consistent level of around 45,000 tonnes between 1960-67.

Fleetwood's demise as a deep sea port came with the loss of access to grounds such as Iceland, and increasing fuel costs. Deep water fishing from Fleetwood ceased in 1982. Since then it has primarily been a port for inshore fishers. According to MAFF, in 1998 there were 54 vessels over 10 metres registered at Fleetwood, of 1,815 tonnes in all, representing a fall from 70 and 2,550 tonnes in 1996[50]. However, membership of the Fleetwood FPO increased from 24 vessels in 1998 to 55 in 1999. No pelagic fish are landed at Fleetwood, but in 1998 a total of 2,399 tonnes of whitefish were landed, including 622 tonnes of haddock (worth £614,000), 429 tonnes of skate and rays (£422,000), 362 tonnes of cod (£492,000), 260 tonnes of plaice (£244,000) and 121 tonnes of whiting (£40,000). A total of 261 tonnes of shellfish were also landed, including 148 tonnes of scallops, worth £373,000.

One current major concern of Fleetwood fishers is that of 'super beamers' – high-powered large beam trawling for sole, principally by Belgian and Dutch boats[51]. Representatives of the fishing industry, such as Tom Whatson, want the minimum mesh size for larger vessels (responsible for most of the catch) to be increased to 100mm diamond mesh with 90mm square mesh panels. This is in order to assist the recovery of cod and to sustain haddock, which are still found in Morecambe Bay as juveniles. Fleetwood landings from the beamers have a bycatch of between 8 and 14 per cent cod, by weight. According to Whatson, this represents a significant loss of juvenile fish at a time when the Irish cod stock is in severe trouble.

NEWLYN

Newlyn, in Mount's Bay, Cornwall, has been the South-west's premier fishing port for more than 100 years. It is the largest port in England, Wales and Northern Ireland by value of landings[52], averaging £20 million per year over the last 10 years[53]. The long spear of land which extends Cornwall into the Celtic Sea has meant that Newlyn and the other fisheries of Mount's Bay are ideally situated to exploit the natural resources of the Channel, the Irish Sea and the South-western approaches. Its sheltered location and the nearby natural anchorage of Gwavas Lake suggest fishing activity would have been present, as an important part of the local economy, as long as people have inhabited the peninsula. The changing markets and technologies have meant that the exploitation patterns have swung between demersal and pelagic species, and static and active gears across the centuries.

Pre-20th century

Newlyn's first documented involvement in fisheries is recorded in 1202 when King John granted merchants from Bayonne the right to purchase, cure and fish whales, conger and hake along the coast from St. Michael's Mount to Dartmouth[54]. While the local fishers would always have taken large flats and groundfish in the bay (along with opportunistic kills of seals or whales), pelagic species were the first economically important catches. With no means of preserving fish other than by salting, pressing or smoking, pilchards were an important and early export. Their oily nature meant that as well as acting as a highly nutritious and cheap food, pilchards were also a source of energy for lighting. Seine netting, introduced by the 16th century (See *Technology*

Creeps, Leaps and Bounds), had a season which lasted from July to December, although the maximum catch that could be processed could be taken in a few days. There was a healthy European market for the Cornish pilchard (known as *fumadoes* in Italy) well into the 20th century.

Other fishers dispensed most of their catch locally, the species they caught never reaching the economic importance of the pilchard until the end of the 19th century. Their age-old method of 'share-fishing' (which has parallels with inshore Japanese practices – See *Alternative Delivery Mechanisms*) ensured a much more equitable payout of the profits from the catches, and the fact that they operated all year (as near as possible) was of greater benefit to the community.

The arrival of the railway in the mid-19th century made it profitable to build and operate large trawlers from Newlyn to exploit these species in the South-western approaches, and the industry began to approach something of its modern form. After the completion of the railway line, the government decided to improve the facilities of the country's ports, targeting Newlyn in particular (1884-94) due to its increasing importance as an international exporter of fish. Prior to this, much of the money for the one-third of a mile-long Northern Pier was raised locally, by subscription. Paradoxically this may have hastened the decline of the traditional local fisheries, with the increased capacity of the port being utilised by trawlers from elsewhere.

The 20th century

Historically the big money spinner was the pilchard fishery, but this was a separate enterprise from other fishing methods, and the profits had not reinvested into the alternatives by the time this fishery declined. Historically this had meant that in comparison with other regions of the UK, Cornish vessels were small, owned by the skipper and late to motorise. So while the rest of the nation's fleets turned to the distant water fisheries[55], Newlyn remained a comparative backwater.

Post-war there was a significant concentration of ownership. By 1966, 16 of the largest trawlers (greater than 20 metres) were owned by Stevensons & Son and were landing 60 per cent of all the port's fish[56]. This pattern has persisted to the present day, resulting in a large privately owned fleet of 30 vessels, alongside an equally dynamic skipper-owner fleet. The boats range from the Irish Sea around Man to the edge of the continental shelf, and land occasional catches in Ireland and France as well as at the home port. The fate of the mackerel fishery (see *Pursuing the Herring*), tossed about by outside forces and big-scale fish politics outside local fishers' control, illustrates one of the problems that Newlyn faces. The presence of hake on the markets (along with the large amounts of megrim and monk caught by the beam trawlers) attracted the attention of Spanish buyers and eventually generated a level of exports not seen since the days of the *fumadoes* trade. Hake became one of the biggest earners in Newlyn, for both boats and crews, from the mid 1980s until the mid '90s.

The fleet today

Although high prices have ameliorated the effect of stock and quota reductions, it is clear to the remaining fleet that change in the way the stocks are exploited and managed is badly needed. The diversification that has typified Newlyn, at both fleet and vessel level, from its earliest days perhaps enables the owners and crews to more readily embrace new ideas and techniques.

Recovery programmes

Cornish fishermen are committed to stock recovery programmes and consider that they have taken a proactive role to engage both the UK government and other EU fishermen in talks about the future of the South-west's fisheries. There is a sense of frustration regarding what is seen as government indifference to the necessary reshaping of the management of regional fisheries. Their argument is that only those *operating* in these waters should have a say in their management, thus excluding the horse trading element that bedevils EU level fisheries discourse, and countering problems such as those encountered by the mackerel fishers (See *Pursuing the Herring*). A reduction of effort is needed, spread among all those who fish the waters in the south-west, and specific measures need to be targeted at this. At the same time local fishermen are fighting to keep quota in the Cornish region and see this as an essential part of the sustainable future for Newlyn and Cornwall. They would like to see quota held in perpetuity for the regions current and future fishermen.

Technical measures

Among the technical measures that many Cornish fishermen wish to see introduced is the minimum mesh size of *all* vessels operating in the areas they fish to increase from a current minimum of 80 mm to 90-100mm within three years. Minimum landing sizes must be increased in line with this, taking into account the fact that any increase in twine size (often left out of the regulations) can easily prevent any gains from mesh-size increases. They also want square mesh panels of 120–140mm to be fitted to *all* trawl and seine gear, again the size to be increased over time towards the upper range. The rationale behind the use of square mesh is that alternatives such as diamond mesh nets close up under strain, circumventing nominally large mesh sizes.

Some consider that there may also need to be technical measures introduced regarding fixed gear. The development of the so-called 'parlour pot' has tripled the catching power of UK crabbers, as the shellfish cannot escape from the pots. This means that they can be left longer, while working other gear, safe in the knowledge that the catch cannot escape the gear. The traditional 'inkwell' pot is not so secure and must be hauled with greater frequency. In France, at least, the use of parlour pots has been banned. Finally there is a pressing need for gill netters to be limited to a maximum length of gear.

Beyond these specifics there is a procedural point, that of prolonged and open-ended debates about alternative measures that some believe are at least in part a ruse, to prevent implementation. It has been suggested by some fishermen that any alternative proposals for gear changes to selection methods should now be assessed alongside the implementation of the proposals documented above, preventing further delays. Another suggestion is that the successful implementation of all such measures depends on a fair, transparent and international EU enforcement agency as patchy or non-existent enforcement will rapidly undermine any stock conservation attempts.

Conservation Initiative Support funding

One aspect not usually discussed is that, while money has been made available in the past towards the purchase of capital equipment, there is none for the loss of earnings associated with experimental gear or fishery development. Examples that could qualify for Conservation Initiative Support (CIS), making up any short-term gap between the experimental use of gear and

usual earnings, might include semi-pelagic trawl gears (operated just above the sea bed, rather than on it, greatly reducing sea bed disturbance); pole and line fishing for tuna; small-scale pilchard ring netting; and electric beam fishing (electricity tickles or 'disco lights' that stimulate the fish into motion, rather than depending on physical disturbance of the sea bed). Similarly, regarding no-take zones, some in the Cornish industry have suggested that CIS might also be paid for vessels excluded from normal grounds or affected by displaced effort; again on a temporary and cost-effective basis.

As part of this process it is regarded as important to have a formal assessment of which measures are successful, and which are not. The Centre for Environment, Fisheries and Aquaculture Science (CEFAS, the UK government agency) should model the effect of such experimental fisheries, including negatives such as the short-term loss of earnings as well as the positives, such as the reduced fuel and gear costs associated with larger meshes and gear alternatives. CIS might, for example, be paid to affected vessels for the use of larger mesh gear, for a short term (3–5 years), on a clear and continuing quantifiable basis. As the average size of individual fish increases, the catch with such gear will improve, and the CIS funding can then be progressively withdrawn. Overall it should be noted that many fishermen consider that they trying to find solutions that involve limited investments rather than open-ended subsidies, responding to circumstances that have often not been under their control, and tend to react with irritation to anysuggestion that they are looking for subsidies.

Satellite surveillance

The potential of such equipment eventually fitted on all vessels is huge, ensuring the integrity of NTZs, reducing enforcement costs and increasing vessel safety. There is a sensitivityamong the local fishing industry about who will pay the cost of such equipment, when all vessels of 24 metres or more will have to carry such equipment. It is already considered common knowledge among the fishing industry that 'black' electronics have been developed, for example in the Netherlands, which can throw a 'ghost' of a vessel fishing illegally to any position the operator desires. They are concerned that regulators appear unaware or unwilling to accept that this much-vaunted technology has already been undermined Some fishermen have suggested that if the invaluable data that can be collected by such equipment is to be of any future use, possession of such 'black' technology must mean the instant and permanent loss of all fishing rights of the skipper and vessel.

Regional management

The CFPO believes it is essential to discuss problems directly with other stakeholders, and to develop a collaborative ethos when it comes to delivery mechanisms. On its own initiative, it has instigated three meetings aimed at building common ground with others fishing the area and with NGOs. The first meeting was in June 1999 and representatives attended from Spain, France, Ireland and the South-west. The talks are designed to lead to the foundation of a management body in which fishers have a central role, and which monitors the shared stocks of the Western Waters for the mutual benefit of all. However, without support or much interest from government about developing stakeholder management, funding the meetings has been a problem. Yet their success depends on increasing their frequency and the amount of delegates from each region, ensuring proper representation of the fishers' interests.

Moreover the problems to be overcome are formidable. For example, when dealing with as complex a body as the Spanish industry, there are strong regional and commercial differences, bought into focus by the re-flagging issue (*foreign owned boats* on the UK register and using UK quota). Some believe that the Spanish-based Spanishfleet would like to have access to the sea area known as the 'Irish box', and can see the *potential* benefits of a system of no-take zones (NTZs – something that the CFPO advocates in suitable circumstances) and, all things being equal, would like to make a trade. The Spanish flagships on the UK quota, however, are vehemently opposed to the opening of the Irish Box or other technical measures. They are also regarded as having considerable influence, through their Iberian parent companies, on the Spanish government's attitude regarding NTZs and increased mesh sizes.

The CFPO sees the way forward in the medium term, as setting up a working group for all legitimate interests, preferably involving only those regions (but if unavoidable, countries), fishing in the Western Waters. These groups would pool catch discard and effort information with each other and work together with ICES fisheries scientists to discuss, establish and monitor stock levels and technical conservation methods. Advice from this working group would then be presented as recommendations to the EU Council of Ministers. The intention is to step outside the horse-trading by non-stakeholders in much of the EU fisheries discourse – something to which South-western fishing industry is particularly sensitive, certain that it has usually come off worst in the past.

From *wondrychoum* to no-take zones

Lessons from the Middle Ages to the 18th century

Perhaps the most remarkable of early references to conservation measures comes via the knowledgeable Edgar March, writing in 1953[57]. This panel draws from his research into the early days of fisheries regulation. One of the earliest is a complaint about a form of trawling dating from the 14th century:

"*That such a contrivance was destructive to fish life was realised in the reign of Edward III, when in 1376-77 a petition was presented to Parliament calling for the prohibition of a 'subtlety contrived instrument called the wondyrchoum'. This consisted of a net 18 ft. long and l0 ft. wide '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 . . . by means of which instrument 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 in like places, for which they pray remedy'. Responsia. 'Let Commission be made by qualified persons to inquire and certify on the truth of this allegation, and thereon let right be done in the Court of Chancery*"'.

Thus, already back in the middle ages, the basic arguments surrounding three of the most sensitive current issues - the use of (beam) trawling, the use of small mesh size, and of industrial fishing for animal feed - were already fully formed.

By way of illustration that there is little that is new under the sun, is the following statute from the reign of George I, in 1716:

"From and after the twenty-fifth day of September one thousand seven hundred and sixteen, if any person or persons shall use at sea upon the coast of that part of Great Britain called England, any traul-net, drag-net or set-net whatsoever for the catching of any kind of fish (except herrings, pilchards, sprats or lavidnian [sand eel] *which hath any mesh or moke of less size than three inches and half at least from knot to knot, or which hath any false bottom or double bottom, cod or pouch, or shall put any net or nets, though of legal size and mesh, upon or behind the others, in order to catch and destroy the small fish which would have passed through any single net of three inches and half mesh, all and every such person and persons so offending shall forfeit all and singular such net or nets so used contrary to the true intent and meaning thereof, and also for every such offence the sum of twenty pounds of lawful money of Great Britain, to be recovered and levied in such a manner and form as the penalty above inflicted upon the master of any vessel, wherein fish shall be imported contrary to this Act, is above directed to be recovered and levied, and in default of payment of the said twenty pounds, or of sufficient distress, the offender to be imprisoned in like manner, during the space of twelve months."*

A later article specified the minimum size of fish for sale or exchange: *"turbut 16 in., brill or pearl 14 in., sole 8 in., plaice or dab 8 in., whiting 6 in."* and that any offender was to pay a fine

of twenty shillings or, failing that, *"to be severely whipped, and kept in hard labour for a space of six days and not longer than fourteen days"*.

Similarly through the ages come tales of strife between local fishers trying to conserve stocks, only to be undermined by outsiders, whether from the other side of the bay or from another country. March wrote that by the 1830s fishing in the English Channel was considered to be in a bad way, and an official enquiry blamed the French, who came within a stone's throw of the shore, and were able to sell their catch duty free. What made the fishers particularly furious was that they were restricted from fishing in the same way off the coast of France and the Low Countries. If they attempted, the French navy would impound them. One skipper, protesting that the French did the same all the time in Rye Bay received the mocking reply *"Ah! I know that, but the laws in France are not the laws in England"*. So the feeling among fishers that their plight is peculiarly of little interest to British politicians also has a long track record.

As in Scotland (See *Pursuing the Herring*), trawling was the cause of strife with other fishers, and there were a series of Royal Commissions to 'enquire into the truth therein'. Many trawlermen had similar concerns, despite the assurances of scientists. According to March, smacksmen in 1883 became so concerned about the catching of immature fish that a *"resolution was moved by John Helyer of Yarmouth, admiral of a fishing fleet for 10 years, and carried unanimously"* with the result that for two years many of the trawling fleet voluntarily agreed to restrain from working on certain grounds at specified seasons. But with no wider enforcement mechanism, the scheme broke down when outsiders defied the ban. According to March, writing in the early 1950s, no further conservation measures were attempted in the area until discussions just before the outbreak of war in 1939. March concluded that *"the question first arose in 1376 and Royal Commissions have been sitting on and off ever since. It is a problem to tax the skill of the wisest statesmen as many other nationalities are concerned, and it is useless to make laws restricting fishing to one lot of men, when all of the rest go scot free and can do as they please."*

Pursuing the herring

PAST LESSONS FROM PELAGIC FISHERIES

The pelagic stocks – 'upper water' fish such as herring, pilchard and mackerel – have always been fickle. Herring went through cycles of increase and depletion – sometimes recorded over periods of hundreds of years (cf the Baltic Hanseatic ports), when it seems at least questionable whether fisheries could have had a major impact. One therefore has to be careful not to interpret every decline in terms of overfishing, or to assume that stocks will immediately recover when fishing ceases. Nevertheless there are clear examples, such as North Sea herring in the 1970s, where modern fishing power is so great that it can deplete stocks; and yet those stocks did recover when fishing pressure was reduced. So another lesson is to avoid jumping to conclusions.

HERRING

It gradually became apparent, sooner to some than others, that we were becoming capable of depleting stocks even of such astonishing fecundity as the herring. In 1865 the prescient James Bertram[58, 59] documented inshore Scottish catches between 1818 and 1863, when the area of driftnets carried per boat grew from 4,500 to 16,800 square yards, yet the catch fell from 125 to 82 crans (baskets). Such figures spoke too plainly to him to *"expend further argument"*. He wrote: "*I have always been slow to believe in the inexhaustibility of the shoals, and can easily imagine that overfishing, which some people pooh-pooh so glibly, could easily be possible … As it is, I fear the great Wick fishery must come some day to an end. When* [it] *first began the fisherman could carry in a creel on his back the nets he required; now he requires a cart and a good strong horse".*

Bertram's words proved prophetic. By the 1890s the German Heincke had established, contrary to earlier belief, that herring existed as isolated races; too late for the innermost shoals of Wick and the Moray Firth which were gone. Nevertheless Thomas Huxley, President of the Royal Society and Inspector of Fisheries, could still state, for British herring in general, that there was *"nothing to show, so far as I am aware, that, taking an average of years, they were ever either more or less numerous than they are at present"*[60] In 1893 a parliamentary committee also saw *"no indication of any falling off in the numbers of herrings to be found off our coast"*. Presumably landings were equated with stock size, without allowing for increasing effort, area covered and length of season. During the first half of the 20th century overall North Sea herring landings fluctuated without trend. However, it seems that this was not so much to do with the state of the stocks, but the turmoil in traditional German and Russian markets that restrained the technological potential of the new motorised drifters.

It was a similar story on the west coast. In the 19th century the unpredictability of the inshore shoals of herring upon which Ullapool depended meant that it gradually lost out to Stornoway in the Hebrides as a major fishing port. In the First World War many of the crofter fishermen joined the Highland regiments, the boats were commandeered for patrol work, and the fishing generally declined. In post-Second World War Ullapool it staged a short-lived recovery. By the 1950s

herring were being dispatched to a Norwegian factory ship and complaints were being made about the poor price received in a buyers' market[61]. No doubt this echoed complaints made centuries earlier about the Dutch herring 'busses', the *"klondykers of the day"* and subsequent complaints made of present day klondykers from eastern Europe. Ominously, that article also referred to *"the fishing which used to last only six weeks has been extended to nearly four months now, aided by the echo sounders"*, and that *"the fleet this winter… is not quite so large as in previous years… only 60 boats are engaged in west-coast fishing, whereas, during the winter of 1953/4, about 160 boats operated"*.

It has been argued that herring may disappear due to other fisheries or activities. When the Newlyn herring fishery off Padstow and Hayle Bar disappeared in the 19th century, the herring fishers blamed this on the arrival of French trawlers on the associated spawning grounds of the Smalls, off South Wales. The steady increase in trawling (sailing beam trawlers) was noted by John Maddern of Newlyn. He recorded seven or eight trawlers fishing around the Wolf Rock in 1845 rising to 'above a hundred'[62] in 1878. The impact of trawling, particularly steam trawling, on fish eggs was also a big issue in Scotland – and was the subject of Royal Commission inquiries – in the mid-to late 19th century, At the time it was assumed that most species' eggs lay on the seabed. When it was shown that only herring, of the commercially important species, did this, the entire argument about the effect of trawling on fish eggs was dropped. Yet given the reports of trawls in the 19th century being coated in spawn to the extent that the gear became difficult to handle, one can at least question to what extent current trawling activities help prevent a herring recovery.

More certain is the effect of technology. Post-war, mid-water trawling and purse seining for herring became heavily capitalised and involved all available technical assistance such as echo sounding, which made it possible to locate the shoals without doubt before shooting the nets. In the words of one fisher from Northern Ireland, *"when we were drifting we waited for the fish to commit suicide by swimming into our nets, but today fishermen find the shoals and murder the fish"*. The purse seine is a huge net, covering an area the size of several football pitches and costing up to £100,000. Such big investments need big returns.

When a new, vast market for fish meal and oil developed in the second half of the 20th century, the new technology, the necessary safety margins and early warnings were either underestimated or ignored, resulting in a stock collapse. Oily fish such as herring are particularly sought by industrial fisheries. The spawning stock of North Sea herring was around two million tonnes in the early 1960s, but fell rapidly as 60 per cent or more of the stock was removed over the course of each year[63]. In 1977 the stock stood at only 60,000 tonnes and a drastic recovery plan was imposed – a complete ban on industrial fishing for North Sea herring. As there were insufficient adult herring to make a fishery for human consumption viable, in effect this was a total ban on all fishing for North Sea herring[64]. The herring stock did recover, allowing fishing to start again in 1983. However the scientists' recommended catch that year of 98,000 tonnes was increased to 145,000 tonnes by the politicians, and the actual catch was 308,000 tonnes. Landings climbed through the 1980s to peak at around 900,000 tonnes before starting to decline again. Overfishing resulted in emergency regulations during the mid 1990s. They were subsequently lifted as the spawning stock showed some recovery[65].

It has been said that one of the consequences of the ban was the disappearance of processors geared up to deal with herring for human consumption when the fishery re-opened. Hence, when fish could once more be landed, there was no market. It might be argued that this was simply the final blow to an industry on which consumers were turning their backs, but nevertheless it provides a warning of the potential for knock-on effects when vigorous recovery programmes are implemented. It will be necessary to consider the impact down the marketing chain, and more widely in communities that strongly depend on fishing.

PILCHARD

The pilchard's fate in south-west England has parallels to the herring. By 1900, the decline of the pilchard fishery was well under way while the emergence of trawling (mainly by boats from outside the region) and the exploitation of the whitefish (cod-fish, flat-fish and other mid water and seabed species) stocks were becoming increasingly important. By the 1920s, the drift-net fleet had become motorised and this may have increased their ability to break up the large summer shoals further offshore, denying them to the inshore seines. Another potential candidate was the increasing use of the trawl, disturbing the inshore feeding grounds of the pilchard and filtering the immature fish of the Mounts Bay through mesh sizes that would be illegal today.

Again we have to be careful in interpretation. One further lesson is that the reasons for the eventual decline of the pilchard fishery may be an extremely complex one. For example, it could involve shifting boundaries between warm and colder waters that meet off the south-west coast, harbouring either pilchard or herring. Perhaps then, rather than looking for single-factor explanations for the decline of a stock, we are wiser to look at a wide range of factors, each of which may play its part in a chain of events predisposing or leading to certain outcomes. If so, it follows that recovery programmes will also have to be broadly based. Moreover, in the case of pilchards, as with Scottish herring in the1920s, it may be that it was the pilchard *fishery* that disappeared rather than the pilchard *per se*, and that the underlying reasons were primarily economic rather than biological. The biggest market for Newlyn's pilchards was Italy, and that country's increasingly poor economy and exchange rate after 1910 led to the first contraction in demand. Despite rallying in the late 1920s, the worsening political situation in 1930s Europe finished the trade in *fumadoes*.

MACKEREL

North Sea mackerel collapsed along with North Sea herring in the 1960s and '70s, for the same reasons. But it fared worse, the indigenous North Sea stock never recovering. The lessons here are much the same as for the herring. But while such 'big picture' considerations are very important, mackerel also illustrate how the detail of such 'big' decisions can take on major yet disregarded significance at individual community level. For example, in Newlyn hand-lining with feathers for mackerel had been occasionally practised in the bay since the end of the Second World War, although the large shoals being worked were said to be broken up by mid-water trawlers[66]. By 1966-67 the fish had returned and many fishermen consider that the introduction of the six and 12-mile limits helped the shoals of mackerel to stay undisturbed. This allowed their growth into the huge shoals of the late 1970s (although again climatic and/or oceanographic

changes are alternative explanations).The Newlyn handline fishery is something of a classic inshore fisher's tale of initiative, initial success, followed by failure generated by uncontrollable outside forces. By 1968 the introduction of the 'gurdy' (a simple reel for the mackerel handlines) had greatly increased the catching power of the small-boat man and decreased the skill necessary to enter the fishery. By 1969 landings had exceeded the (modest) capacity of the market to handle them, requiring catch limits per crew member to be introduced. This was clearly unsatisfactory: new markets were needed, and the Cornish ports successfully joined together to find a market for the high-quality hook-caught mackerel. The fleet and its catches subsequently continued to grow throughout the 70s to the benefit of the local economy. This diversification thus enabled the development of overseas markets, reduced transport/distribution costs, and allowed prices to stabilise.

But the over-capitalisation and specialisation of the rest of the industry was to impinge on this south-west revival. With the final loss of access to the Icelandic grounds in 1975-6 and the collapse and closure of the North Sea herring fishery in 1977, the surplus pelagic capacity was looking for new targets. The mid-water vessels and purse-seiners who arrived off Mounts Bay in the late 1970s early '80s caught enormous amounts of mackerel and swiftly exceeded the quotas. 'Klondykers' (foreign-owned processing vessels) bought much of the over-quota mackerel by transhipping which led to the introduction of the 'western mackerel box' – an area where mackerel fishing was severely restricted. According to Holden[67] this area was a conservation measure proposed by the European Commission in the early 1980s that should have benefited the handliners, making a huge area of the western Channel, Celtic and Irish Seas inaccessible to all fishing gear except handlines and gillnets, the declared purpose being to protect juvenile mackerel. The Commission believed that it would not work unless there were an absolute ban on other methods. But because other pelagic trawl and purse seine fisheries existed (for sprat, horse mackerel and pilchard) the member states instead set a limit of 15 per cent mackerel in any catch. The net result was the opposite to what was intended: instead of protecting the mackerel it meant that as many mackerel as ever continued to be caught along with other fish, but when the proportion went over 15 per cent, the extra mackerel were dumped at sea. Holden regarded this as being *"a typical example of how proposals to ban fishing in certain areas and certain seasons have foundered on the rock of self interest of the member states* [who argue] *that such bans should not affect the fisheries for species which do not require protection, even if the objective cannot be achieved, as it invariably cannot, if the necessary derogations are made"*. Moreover the unfortunate handliners were trampled in this argument between elephants that had wandered into their area. A conservation measure that should have benefited them ended up crippling them, because their catch was actually considered to be part of the overall quota and often suffered as a result of the excesses of the incomers. So yet another message for future recovery plans is 'consult widely and think through the consequences and implications of the plans'.

Hunting the cod

Lessons from the whitefish fisheries

STEAM TRAWLING

One of the biggest events to affect whitefish fisheries was the arrival of steam trawling in the late 19th century. This allowed access to grounds too dangerous or inaccessible for sail or oar, and increased the available power to drag and haul nets. Trawling for cod- and flat-fish divided scientists and fishers alike. The principal complaints (see *Pursuing the Herring*), were that trawling destroyed spawn on the seabed, caught immature fish, resulted in wastage through damaged fish, interfered with other fishers, and that trawlermen – mobile outsiders – depleted the traditional grounds of others[68].

In 1865 Bertram noted these accusations against trawling, citing a parliamentary inquiry. He considered trawling was destructive, but he also thought it indispensable and, in its proper place, the best tool[69]. By 1883 another parliamentary inquiry had commissioned research which concluded that the immature catch was insignificant (less, it suggested, than by traditional long-lines), that most fish were undamaged and, of the commercial species, only herring spawn lay on the seabed, and even here it was questionable whether injury would occur.

On the effects of trawling within inshore waters, Professor McIntosh, the research's author, stated that these *"could very easily be trawled out"* and that the suspension of trawling *"would be a very valuable experiment. It would set at rest all sorts of notions, and it is upon safe lines, and does no harm to anyone"*. This was supported by Scottish fisheries officers, other scientists, some trawlermen, and evidence from neighbouring countries and the US. However the inquiry concluded that, whereas fishers tended to blame each other for any decline, natural fluctuations *"largely influence the supply of fish"*. They could not justify prohibition unless experimental evidence *"decisively settled"* the issue.

This conclusion was controversial. In Scotland alone, despite the inquiry's conclusions, a political decision was made by the Secretary of State for Scotland, who took a close personal interest in the future of fisheries, to ban trawling in inshore waters, including the Moray and other firths. So one more lesson for a recovery plan is the importance of political involvement and real commitment at the highest level. This continued until the 1920s when seiners (the sons and grandsons of those originally protected by the measure), under pressure from the failing herring market, started dragging seine nets behind their boats, effectively using them as a trawl[68]. The initially large landings suggested that the policy had been successful; the consequent decline confirmed the wisdom of the original judgement.

WARTIME RECOVERIES

Two World Wars, both of which severely restricted fishing effort, and which in effect resulted in temporarily closed areas, resulted in dramatic stock recoveries. One example, the rebound of North Sea plaice, is well documented[70]. Prior to the 1914-18 war the catch had been about 2.5

(arbitrary) units per day's work; after the war it was almost five. Catches then fell back to pre-war levels by 1924. Similarly, prior to 1939 the catch was about two (arbitrary and slightly different) units, but initially resumed at 7 units when fishing restarted after the Second World War. Again it rapidly declined. Much the same was true of other whitefish such as cod and haddock[71]. The important lesson here is that they demonstrate that demersal stocks can recover, and also illustrate something of the timescale of that recovery.

COD, HADDOCK AND THE CFP

The history of the management of cod and haddock within the Common Fisheries Policy starts with a massive technical mistake[72]. This was associated with what is technically called the 'Gadoid outburst' (Cod and haddock are members of the gadoid family). Between the early 1960s and the mid-1980s the numbers of cod and haddock 'recruited' to the stocks (*ie* the number of new fish entering the stocks each year) were extraordinarily high, which was subsequently reflected in the level of catches.

Previously, between 1920–38, and 1947–63, the maximum recorded landing of cod was 129,000 tonnes in 1920 and the minimum 52,470 in 1936. Haddock had fluctuated between 210,019 tonnes in 1920 and 52,419 tonnes in 1962. But recruitment increased enormously in the early 1960s and from 1964 this was reflected in landings. In the early 1960s North Sea cod landings were around 100,000 tonnes, and by the early 1970s this was between 200,000 and 300,000 tonnes. Haddock landings in the early 1960s were around 66,000 tonnes; these peaked in 1970 at some 650,000 tonnes. The level of landings for haddock that had previously become the maximum became the average; while the average for cod was almost double what it had been before.

Subsequent to 1985 recruitment fell back to more 'typical' levels. The technical mistake was in assuming that the levels of recruitment during the gadoid outburst were in fact typical, even though a full analysis of earlier data (as done subsequently) would have shown this to be false.

One might automatically point the finger at increasing fishing power, overfishing and subsequent decline. It is certainly true that yields of cod and haddock were greater immediately after the Second World War, so we know that fishing does have an effect on the population size of adult fish. But it has been argued by Holden that, for once, this does not seem to hold up – it appears that the level of recruitment during this time remained independent of the size of the adult stock, and it was the level of recruitment that increased and remained high for many years. All sorts of environmental reasons, from climatic conditions to reduced predation from the declining herring stock, have been advanced for this increase in recruitment, but none convincingly.

It might even be that recruitment is affected by factors that we scarcely consider, such as disease affecting eggs or larvae, or even that recruitment is fundamentally chaotic, unrelated to any biological or environmental parameter (or, less rigidly, that such parameters only set extreme upper and lower limits). The lesson here is that there is no reason to assume that we can find out the controlling factors in time to be of assistance to policy makers. Good public policy is not necessarily based – indeed often is unlikely to be based – on waiting for ultimate proof before

action: rather, the pros and cons of various options have to be weighed up and decisions taken in the face of uncertainty.

Subsequently, recruitment - particularly of cod, but also of haddock - fell back, which touches on another dilemma. Here, as elsewhere, we know that across a wide range of population levels, the number of new fish arriving in a stock can bear little relation to the numbers of fish already there. On the other hand we know that below a certain level, cod are apparently unable to recover. One can assume from this that there must be a dramatic flip between these two positions, from total loss to total recovery, but we don't know where this boundary lies, or how it may be influenced by other conditions. The net effect is that cod and haddock contribute to their own downfall. Fishers and scientists alike are aware that there have been high sustainable catches in the past from stock sizes that are not dramatically greater than before; coupled with unsettling unease that at some low but unknown point the risk of complete collapse must dramatically increase. Faced with this, the politicians can hardly be blamed for looking on the bright side.

TECHNICAL MEASURES

Despite all this, conservation measures for cod and haddock were in place. As for mackerel, closed areas were sometimes used. For example the 'Norway Pout box' was argued about and finally established in the 1970s and 1980s. This box, in the north-west North Sea, stretches from the Firth of Forth to Shetland. Here, according to Holden, industrial fisheries are not permitted to use nets with a mesh size less than the standard for the area. This was intended to reduce the level of haddock and whiting bycatches in the Norway Pout fish meal fishery.

More typically, attempts to conserve cod and haddock have been via Total Allowable Catches (TACs) and minimum mesh sizes. When, from the mid-1980s, it became apparent that the bonanza years for North Sea cod and haddock were over, this resulted in a major political crisis. This happened because, prior to this, in the negotiations setting up the CFP, countries had parcelled out the rights for minimum national catch levels for different stocks, trading an increase in one for a reduction in another. It was a highly politically sensitive deal that took much anguish to negotiate, and was regarded as a delicate balance that should in future be left untouched.

The compromises reached were partly misguided as a result of events such as the gadoid outburst, and they included a considerable dash of biological naivety regarding the level of fluctuations that could occur. The net effect all became horribly apparent in the late 1980s as the scientific recommendations for maximum TACs fell way below what are called the 'Hague Preferences' for the minimum 'guaranteed' UK catches for cod and haddock. For a number of years in the late 1980s, the UK was left isolated. For example in 1988 the UK argued that, as part of the original bargain, it should get its 60,000 tonnes of fish, in the shape of cod, even though this only left 500 tonnes for everyone else, once the nominal 2,000 tonnes of bycatch in the industrial (fish meal and oil) fisheries had been taken into account. The Hague Preferences were set aside, initially as a temporary measure, but as the shape of the stocks got worse in the late '80s and early '90s this abandonment increasingly became the norm for North Sea and west of Scotland giddies.

The net result in the UK was that what had originally seemed an acceptable bargain began to appear something of a disaster for the industry. All strategy and planning went out of the window to be replaced by crisis management and a desperate plea that 'we must have more', which has continued to the present day. The lesson to be drawn for recovery plans is that biological reality must be put before political deals and compromises, otherwise the policymakers will loose authority.

MINIMUM MESH SIZES

Most would agree that it is not a good idea to catch juvenile fish. This means that emphasis must be placed on technical measures such as gear design to try and reduce such catches. Often there will be a minimum landing size, which means that these undersize fish have to be discarded. (See *From Wondrychoum to No-take zones*). The related problem of bycatch has caused particularly difficult problems. Cod, haddock and whiting tend to swim together. Whiting are smaller than cod and haddock; a fishery directed at whiting can end up catching a large number of juvenile cod and haddock. In addition it may be that a boat has a quota for one of these species, but not for others.

Were it the case that stocks had not been fished down, this might not be a particularly big problem: large mesh nets could be used and all fish caught brought back to port and sold. However, now that the stocks are depleted, remarkable – sometimes rather desperate – ingenuity has been exercised in designing fishing gear. The aim is to try and segregate the wanted from unwanted fish before hauling them up to the surface, which kills all the fish. These efforts ranges from the type of knotting of the nets – which affects whether the mesh stays open (square mesh) or closes (diamond mesh) when pulled through the water – through to complex attempts to exploit small differences in behaviour between species when caught in the net.

The commonest approach to technical measures is to increase mesh size. One should note in passing that there are indications that the survival rate of fish passing through a wide range of mesh sizes is poor: this is unwelcome news, and it does not find a particularly receptive audience. Setting that to one side, the typical increases in mesh size are of small scale – typically 5-10 mm – and some would question whether such changes will have any great effect. However, on one occasion there was an attempt to introduce a major increase in mesh sizes. This was the European Commission proposal of 1990, also documented by Holden. Alarmed by the status of North Sea and west of Scotland cod and haddock, the Commission proposed to:

- increase the standard minimum mesh size to 120mm from the existing 90mm, except for whiting;
- require that the cod-end of the net should be made entirely of square mesh rather than diamond mesh net, along with other modifications;
- abolish the minimum landing size for whiting; and
- prohibit the carrying of nets of more than one minimum mesh size – the 'one-net rule'.

The main aim was to reduce the number of discards (which were making up to 30 per cent, by numbers, of the catch for North Sea haddock and whiting). This was considered the most

effective way of halting the rapid decline in stocks of cod and haddock reported by the scientists for the North Sea and west of Scotland. In addition it was believed that whiting was a major predator of the more economically valuable cod and haddock. The deliberate depletion of whiting implied by the removal of its minimum landing size was intended to assist the recovery of the other two species.

The proposals had major implications for Scottish fishers, and had serious consequences for British fishermen in general. Until that point even a proposal to increase mesh size by 10mm had been regarded by the industry as economically disastrous, according to Holden, and increases in mesh size, if accepted at all, were typically in steps of 5mm. The Commission's proposal, effectively of an increase in mesh size of 40mm (because of the substitution of square mesh for diamond mesh) was regarded as little short of an insanity that would result in immediate bankruptcy. The Scottish Fishermen's Federation undertook a two-week trial with 120mm mesh netting, during which time it caught just eight haddock and no whiting of legal landing size. However the dilemma was underlined in the parallel trial of 90mm diamond mesh netting, which resulted in a catch composed of 35 per cent of haddock below minimum landing size and 38 per cent undersized whiting. The English National Federation of Fishermen's Organisations, was prepared to accept 100mm mesh, with a 90mm panel in the cod-end, and a derogation for fishing whiting in winter with 90mm meshes. Other countries were more sanguine, principally because they were less directly affected: German and Dutch fishers who targeted mainly cod, saithe and plaice were said to be prepared to accept the new regulations, while those fishing for sole were not required to use such large meshing. Denmark and France, however, were not in favour.

The then Vice President of the Commission defended these proposals vigorously, arguing that they were 'an extreme solution to an emergency situation'[73]. But in the end, it was agreed to implement a far more modest set of proposals: an increase in the minimum mesh size to 100mm, with the option of a 90mm square-mesh panel; and a derogation of a 90mm mesh for whiting, providing whiting made up 70 per cent of the catch; and a reduction in the minimum landing size of whiting from 27 to 23 centimetres. The Commission never again made such radical measures for a recovery programme.

Technology creeps, leaps and bounds

The historical impact of change in Newlyn

Modern fisheries are generally over-capitalised; in other words so much has been invested in fishing technology that it is capable of catching vastly more fish than is sustainable. This is partly to do with government subsidy, and partly because modern technology is a fast and more specific technology; you catch the fish before anyone else can, or you can access refuges that no-one else can – or, more likely, you don't lose out in the race to catch fish.

Much effort is supposedly directed at countering this over-capacity. But it tends to be targeted very crudely, for example by reducing the tonnage or total engine power of the fleet. Boats of similar tonnage or engine power tend to increase their catching power from year to year in a process known as technological creep. It is a current problem of fisheries management that the increased efficiency of gear, or greater daily fishing effort, more than offsets attempts to reduce fishing capacity by reducing fleet size. Yet while sometimes perceived as a modern phenomenon, technological creep – and technological leaps and bounds – have been with us for as long as fishing.

If one looks at the history of a port, such as Newlyn, technological changes have had a variety of environmental, economic and social impacts. Some may be good, opening up new fisheries or increasing safety. Others have no overall benefit but allow some to gain a (temporary) advantage over others; a situation that flourishes where it is not possible to control access to a resource.

Seine netting of pilchards, for example, began off Newlyn in the late 1500s. The seine net was only capable of catching pilchards inshore, but also needed a large amount of labour and several vessels to operate it[74]. The net was expensive to manufacture and maintain (£1,000 in 1798[75]) and was generally owned by a wealthy individual who employed labour as and when it was needed. The season lasted from July to December although the maximum catch that could be processed could be taken in a few days. Despite this, the development of the seines led to conflict with fishers who employed a wide array of gears needed to exploit the regions of other fisheries, changing these and areas by seasons. In particular the seine owners claimed that fishers using driftnets[76] for mackerel and herring were preventing the pilchard shoals from reaching the shallow inshore seining grounds[77].

The next major technological leap, in the south-west as elsewhere, was steam power, first in the form of the railways, and then as steam trawling. The railway effectively reached Newlyn in 1859. Fresh 'round' and flat fish could now reach the market in reasonable condition, making it profitable to build and operate large trawlers to exploit these species in the South Western Approaches. Similarly, the drifters - previously the 'poor man's fishery' - now became extremely profitable, as the difficult to preserve and consequently valuable mackerel could be swiftly shipped to London buyers. These technological advances resulted in social tensions, climaxing in riots between locals who refused to fish on Sundays and the east coast fishermen who had no such scruples[78]. The inevitable result was the loss of an age-old and involuntary effort limitation, and a harbinger of future problems.

Already, prior to the Second World War, the rise of trawling in the region drove the traditional longline fishery up to 100 miles offshore, and was badly hit by the lack of pilchard for bait and the low prices gained for the target species (ling, rays and conger). Motorised trawlers and their demersal catches steadily increased in importance and numbers up to the Second World War. This trend accelerated with post-war government grants allowing the purchase of decommissioned motor fishing vessels and second hand boats from France and Belgium. Another major post-war technological development was the arrival of mono filament gear, which generated a new gillnet fishery almost overnight. The old twine nets, occasionally used by longliners, and in small lengths by small inshore vessels, were heavy, weak and highly visible (a factor in shallow inshore waters) and were mainly used for entangling crawfish, crab and rays.

New technology has continued to drive the ability to catch fish at an accelerating pace; the electronic contents of a netter's wheelhouse can now sometimes approach the value of the boat. At the same time as the netting fleet was expanding, the electronics industry began to sell cheaper and more accurate position finding equipment and radar. By 1990 most larger vessels - and many smaller vessels - had satellite navigation systems. The increasing accuracy of this equipment had significant impacts on the stocks, while also improving the safety of fishing vessels.

Medium-sized vessels could now spread their tiers of nets over much greater areas without the risk of being unable to locate the gear. They could also be more easily guarded, reducing the cost of replacing 'towed' gears. 'Fishy' areas and wrecks could now be found and worked with pinpoint accuracy. Trawler 'tows' plotted on charts - which told the trawler safe routes through wrecks, hitches and reefs - were revolutionised. The safe distance from seabed obstructions was reduced at a stroke from (in some cases) several hundred yards to tens of feet. This greatly reduced the extent of these natural refuges.

The gillnetters, mainly second-hand trawlers or ex-longliners and crabbers, began by targeting 'wreckfish' (ling, pollack and cod), which gathered on wrecks to spawn and feed, particularly in the winter months. The rapid evolution of winches swiftly increased the depth at which the gear could be worked and the speed at which it could be boarded. A spurdog fishery in the Mounts Bay was effectively wiped out in a few seasons by the fleet (83-84) and attention consequently turned to hake. This was a much more robust target stock as the hake tends not to shoal at any point in its life cycle, at least when targeted by the netters. 'Over-ending' machines, the last human limit on netting effort, outside of the physical capacity of a vessel to carry gear, is now also a part of the 21st century netter's equipment.

Despite awareness of technological creep and the variation in catching ability of boats of nominally similar capacity, much effort supposedly to reduce fleet capacity has been misdirected. In the case of Newlyn, the introduction of decommissioning money was an attempt to match effort/capacity to stocks, and resulted in around 50 vessels leaving the port. Unfortunately for the scheme, only the *least* efficient left. When it comes to establishing recovery plans, more effective means of ensuring that technological developments do not compromise the maximisation of sustainable economic and environmental goals will have to be found.

Alternative delivery mechanisms

Experiences outside the European Union

ICELAND

Iceland, by contrast to the European Union, is a state that has managed to implement successful recovery programmes and is now reaping the economic benefits. Mention Iceland and fishing and, for most Britons, it will be the 'cod war' of the 1970s that is remembered. From a British perspective, Iceland's success was bought at the expense of UK ports such as Grimsby, Hull and Fleetwood. But the dispute went on far longer, and involved far more than cod. In fact, as long ago as the 1920s, the Icelanders were certain that stocks of all fish were far from inexhaustible.

They tried to negotiate voluntary protective fishing limits with the British, Germans and others who vastly outnumbered the Icelandic fishers – but failed. They turned to enforcing the then three mile territorial limit, where important plaice and haddock grounds lay, but this provided only very partial protection, even when the boundaries were respected. Following the Second World War all the Icelandic stocks came under intense fishing pressure. But as international law evolved, the rights of maritime states increased. In 1952 the territorial limit was pushed out to four miles, then 12 miles in 1958, to 50 miles in 1972 and to 200 miles in 1975. According to Michael Wigan[79] the positive effects of the recovery programme first became apparent with plaice, a typical inshore species, favouring shallow waters and spawning over sandy beds. Trawls and seine nets were thought to cause particular damage to young stocks and were banned within the 12 mile limit. Even Icelandic boats were only allowed at certain times and sites outside the nursery areas. The wisdom of the measures became apparent as the plaice stocks recovered.

For cod, living and spawning in water further offshore than plaice, it was a different story. A familiar script began to play, with greater and greater effort being required to catch the same amount of fish, and the age of the fish getting younger and younger. After the war on average each cod was estimated to spawn 2.5 times before being caught, but by 1967 they spawned on average just 1.3 times. In the early 1970s, 70 per cent of the stock was being caught each year, compared with just over a third in the immediate post-war years. The 12-mile limit sparked off the first 'cod war' between Iceland and Britain in the late 1950s, now forgotten. Outside the 12-mile limit cod were soon depleted, to be followed by herring. When in the 1970s the Icelanders extended their limit first to 50 and then to 200 miles, this sparked off the 1970s 'cod wars'. After a successful outcome for Iceland, initially the fishery was open access to Icelandic fishers, with a limit on the number of days at sea. When this failed, an ITQ (individual transferable quota) system was introduced for the Icelandic fishers. This is generally regarded as having contributed to the recovery of the stocks, although it has also concentrated wealth, which has created some social tensions. According to the editor of Iceland's main daily newspaper, talking to Wigan, it has created a system that *"is medieval . . . Here are the mighty sealords of the ocean, two per cent of the population. The rest are serfs"*.

Icelandic management has not been without some problems. According to ICES assessments in May 2000[80] stocks of cod were over-estimated in the late 1990s, and catches *"have exceeded*

national advice and national TACs considerably for the past decade", but ICES also states that catches are now closer to the agreed TAC. In recent years the aim has been to remove no more than 25 per cent of the available biomass of cod, although recent catch levels have been higher, nearer one third. Nevertheless, while the stock remains below that which existed in the 1950s and 1960s, it is rebuilding - and recent recruitment has reached record levels.

For reasons that are uncertain, according to the Icelandic Marine Research Institute, many of the other stocks have fallen in abundance and TACs have been sharply cut[81]: while cod stocks during the late 1990s are now thought to be close to the long term average, the fishable stock of haddock in 2000 is at its lowest for 20 years; the saithe spawning stock is at the lowest level ever observed (since the 1940s) and considered to be outside safe biological limits; the status of Greenland halibut is uncertain; that for halibut is severely depleted, with a scientific recommendation to ban direct fishing of this species; the plaice stock has declined 50 per cent between 1991 and 1999 and recruitment low; and the fishing effort on dab is not sustainable. Stocks of long rough dab, witch, lemon sole, mergrim, wolffish, lumpsucker, and *Nephrops* are all significantly below (often 33–50 per cent of) historic levels, and TACs have been significantly reduced in recent years.

Nevertheless, it is understandable that Icelanders regard their management as a success, its problems minor compared with those of the CFP, and that it responds rapidly when problems are identified. In 1996, for example, Iceland banned discarding[82], putting an end to the threat of highgrading (throwing back the smaller fish to maximise the economic value of a boat's quota). Even with perfect management and responsible sustainable fisheries, it is inevitable that stocks will go through dramatic fluctuations due to biology and environmental change. Thus another lesson is that once a recovery plan has been successfully completed, constant vigilance and appropriate responses will still be required to keep stocks at desired levels.

NORWAY

According to official publications and other accounts, Norway has taken a slightly different route from Iceland[83, 84, 85, 86]. In the mid-1980s the industry was typical of Europe – heavily subsidised, with unsustainable catches. Then the Barents Sea cod stock became severely depleted, a combination of overfishing the capelin (important food for cod); overfishing the cod itself, and perhaps other factors. This galvanised the Norwegians. Subsidies were phased out. A comprehensive nationwide recovery programme was instituted. Management was toughened up. A very simple but strict rule on discarding was introduced – none is allowed, all fish must be landed. This, coupled with strict enforcement, has encouraged the development of methods and gear that minimise unwanted catches and, according to the fisheries management models, has had a major impact on stock size. There are also other very clear management priorities: for example fisheries for human consumption get preference over industrial fisheries for fishmeal and oil. The capelin fishery, for instance, has been drastically scaled back in years when there is concern about the food supply of cod. Some would argue that Norway has tended to place greater emphasis on maintaining remote communities compared with Iceland. So, although property rights belonging to individual boats were introduced,, they were generally not transferable – Individual Quotas (IQs), rather than ITQs. However, since the mid-1990s Norway has been experimenting in some

fisheries, with a limited and specific relaxation of this rule; allowing a 'two to one' scheme – the merger of two boat quotas provided one boat is scrapped, as part of an overall goal of halving fishing capacity.

The end result has been a turn around. Stocks have recovered and catches have gradually increased through the 1990s. According to the Norwegian government, subsidies have now been virtually eliminated, and the industry returns a significant net profit to the country, making up 8.7 per cent of Norway's exports in 1999 - the largest contributor after oil and natural gas. The export value was 29 billion Norwegian Kroner (around £3 billion), three or more times the value of exports by UK, Spain, Denmark or the Netherlands[85]. A current debate is about the appropriate balance regarding further movement towards maximisation of profit in narrow terms, against a wider assessment that includes the economic and social costs of the reduced employment that this might bring. Peter Gullestad, head of the Norwegian Fisheries Directorate, recently caused a stir by suggesting that there was 50 per cent over-capacity in the Norwegian fleet[87]. It is interesting to see that, even in 2000, the virtues of small-scale enterprises in both the fishing and processing industries (for instance in terms of flexibility of response), at least as one dimension of policy is still being emphasised in speeches by the Norwegian Fisheries Minister[83]. As in Iceland, Norwegians do not claim that the system is perfect. At present there is considerable concern and debate about the scale of illegal activities, including various scams for slipping over-quota landings through the system, and the mis-declaration of the species when quota limits are reached[88]. Gullestad puts these at anywhere between zero and 20 per cent of all landings[87]. But Norwegians, like the Icelanders, would rather have their system than the CFP.

The relationship between government and the industry is notably different in Norway from in the UK. An illustration of this is the annual publication on the state of the industry, a joint production of the Fisheries Ministry and the Norwegian Fishermen's Association[85]. Norwegian negotiation teams comprise both government and industry representatives; and, in contrast to the situation often prevailing under the CFP, fishers and scientists have a good cooperative relationship. Finally, Norway has attracted attention for another reason - that of the successful and continuing community involvement in the large Norwegian cod fishery of Lofoten island[89]. However, when it comes to community control, it is the inshore Japanese fisheries that have attracted perhaps the greatest interest.

JAPAN

The community control of inshore Japanese fisheries is particularly interesting, and its development can be traced back over many centuries[86,90]. Local fisheries associations arose in the early 20th century out of fishing guilds of recognised fishing villages, and now administer fishing in coastal waters. A fisherman's property rights cannot be loaned or transferred to another. Individual fishing operations are generally small-scale and highly flexible, changing target species and fishing methods over the year. If fish are in short supply in one area and abundant in another, guest rights can be arranged. The local fisheries associations are very powerful, having, according to Michael Wigan, an absolute right to block coastal developments. There are elaborate community norms extending into the detail of fishing, so the prospect of competition and conflict

that might be expected in similar conditions in the West simply do not happen. The system is informal but binding.

This may appear complex, but it has its rewards. Compared with the wild swings and stock closures seen in the seas around the British Isles and in most other parts of the world during the 20th century, the inshore Japanese catch has remained remarkably stable. It has been some 2.5-3 million tonnes since 1925, according to Wigan, roughly equivalent to peak (but unsustainable) yields from the North Sea over this period. Lest one thinks that this is all very well, but only possible in within Japanese cultural institutions, one should note that, with appropriate adjustments to the jargon, it may have much in common with current thinking in the West on the stakeholder's exercise of rights and responsibilities. When it comes to discussing delivery mechanisms for recovery programmes, it will at least be important to evaluate what lessons might be learnt from the Japanese experience.

References

[1] WWF Scotland/Scottish Fishermen's Federation (2000). Towards a sustainable fishing industry in Scotland. WFF Scotland/SFF, Aberfeldy/Aberdeen.
[2] Advisory Committee on Fisheries Management (2000). Report of the May Working Group. 3.10.3 Herring in Divisions VIa (South) and VIIb,c. http://www.ices.dk/committe/acfm/comwork/report/2000/contents.html [Accessed 20th November 2000].
[3] Coffey, C and Baldock, D (1998), European funding for fisheries development and environmental appraisal, IEEP
[4] Coffey, C. and D Baldock (2000). Reforming EU Fisheries Subsidies: The Financial Instrument for Fisheries Guidance. Institute for European Environmental Policy, London.
[5] House of Commons. Sea Fishing. Eighth Report of the Agricultural Committee, Session 1998–99. Question 1088. http://www.parliament.the-stationery-office.co.uk/pa/cm199899/cmselect/cmagric/141/9062213.htm Accessed 31 November 2000.
[6] HM Treasury (2000). Spending Review 2000: New Public Spending Plans 2001–2004: Prudence for a Purpose: Building Opportunity and Security for All. Stationery Office, London. http://www.hm-treasury.gov.uk/sr2000/index.html [Accessed 2 December 2000]
[7] MacGarvin, M. (2000). A Marine Act for the UK? modus vivendi, Glenlivet / WWF-UK Godalming.
[8] National Audit Office (1988). Financial Support for the Fishing Industry in Great Britain. HC 88, HMSO London.
[9] House of Commons. Sea Fishing. Eighth Report of the Agricultural Committee, Session 1998–99. http://www.parliament.the-stationery-office.co.uk/pa/cm199899/cmselect/cmagric/141/14102.htm [Accessed 29 November 2000].
[10] Hatcher, A. & S. Pascoe (1998). Charging the UK Fishing Industry: A Report to the Ministry of Agriculture, Fisheries and Food. Centre for the Economics and Management of Aquatic Resources (CEMARE), University of Portsmouth. Available on the MAFF website at http://www.maff.gov.uk/fish/charging/short.htm. [Accessed 31 November 2000].
[11] Whitmarsh, D., C. James, H. Pickering and A. Neiland (2000). The profitability of marine commercial fisheries: a review of economic information needs with particular reference to the UK. Marine Policy 24, 257–263.
[12] Hatcher, A. & S. Pascoe (1998). Para. 198.
[13] Hatcher, A. & S. Pascoe (1998). Para. 199.
[14] Pascoe, S., M. Tamiz and D. Jones (1999). Optimal fleet size in the English Channel: a multi-objective programming approach. Resource Modelling Association Annual Conference, Halifax, Canada, 23–25 June 1999.
[15] Whitmarsh, D., C. James, H. Pickering and A. Neiland (2000)
[16] MAFF (2000). Derived from Table 3.4 (all UK landings) and 3.6 (UK landings by foreign fleets) in UK Sea Fishery Statistics 1998. The Stationery Office, London
[17] House of Commons. Sea Fishing. Eighth Report of the Agricultural Committee, Session 1998–99. Question 1000. http://www.parliament.the-stationery-office.co.uk/pa/cm199899/cmselect/cmagric/141/9062209.htm Accessed 31 November 2000.
[18] Coffey, C. and D Baldock (2000). Reforming EU Fisheries Subsidies: The Financial Instrument for Fisheries Guidance. Institute for European Environmental Policy, London.
[19] Anon (1999). Seventh Survey on State Aid in the European Union in the Manufacturing and certain other Sectors. 30.03.1999., COM (1999) 148.
[20] House of Commons. Sea Fishing. Eighth Report of the Agricultural Committee, Session 1998–99. Question 1088. http://www.parliament.the-stationery-office.co.uk/pa/cm199899/cmselect/cmagric/141/9062213.htm Accessed 31 November 2000.
[21] Anon. (1998). Interim Evaluation of the UK PESCA Community Initiative. Nautilus Consultants/ Ekos Ltd. Edinburgh. http://www.maff.gov.uk/fish/pesca/pesca.htm Accessed 31 November 2000.
[22] MAFF (2000). Table 1.1. UK Sea Fishery Statistics 1988 (ed. David Lee). Stationery Office, London

[23] HM Treasury. GDP and GDP Deflators at Market Prices. http://www.hm-treasury.gov.uk/deflators/figures.html Accessed 31 November 2000.
[24] Jenkins, J.G., 1991, The Inshore Fishermen of Wales. University of Wales Press, Cardiff.
[25] MAFF (2000). Table 3.4. UK Sea Fishery Statistics 1988 (ed. David Lee). Stationery Office, London.
[26] Anon. (2000). Table 7.1, p. 86 in Study into Inland and Sea Fisheries in Wales. Nautilus Consultants/EKOS Economic Consultants for the National Assembly of Wales.
[27] Anon. (2000). pp. 9–14 in Study into Inland and Sea Fisheries in Wales. Nautilus Consultants/EKOS Economic Consultants for the National Assembly of Wales.
[28] Wood, T, (1890), Speech of Thomas Wood (Chairman of the Milford Dock Company in the half-yearly company meeting, July 1890. Cited in Jenkins, J.G. (1991). The Inshore Fishermen of Wales. University of Wales Press, Cardiff.
[29] Jenkins, J.G., 1991, The Inshore Fishermen of Wales. University of Wales Press, Cardiff.
[30] Shackley, S.E., P.E. King & J. Rhydderch (1980). Fish and Fisheries in Greater Swansea Bay. pp. 555-563 in Industrialised Embayments and their Environmental Problems: A Case Study of Swansea Bay (ed. M.B. Collins). Pergamon Press, Oxford.
[31] Jenkins, J.G., 1991, pp. 136-137 in The Inshore Fishermen of Wales. University of Wales Press, Cardiff.
[32] Davis C., 1990, SWANSEA – AN ILLUSTRATED HISTORY.
[33] Anon. (2000). Study into Inland and Sea Fisheries in Wales. Nautilus Consultants/EKOS Economic Consultants for the National Assembly of Wales.
[34] DARDNI (2000). Northern Ireland Fisheries Division Corporate Plan 2000-2003. Department of Agriculture and Rural Development Northern Ireland.
[35]. Advisory Committee on Fisheries Management(1999). Annual Report. *Nephrops* in Division VIIa, North of 53° N (Management Area J). http://www.ices.dk/committe/acfm/comwork/report/1999/nep-7a.pdf. Accessed 6th November 2000.
[36] http://www.ices.dk/committe/acfm/comwork/report/1999/cod-iris.pdf. Accessed 6 November 2000.
[37] MAFF New Release 453/99 (17 December 1999). Regional Management to Revive Cod Stocks. http://www.maff.gov.uk/inf/newsrel/1999/991217a.htm. Accessed 6 November 2000.
[38] Anon (2000). Irish Sea Cod recovery plan proposal. Anglo-North Irish Fish Producers Organisation, Kilkeel.
[39] Official Journal of the European Communities. (2000). Commission Regulation (EC) No. 304/2000 of 9 February 2000 establishing measures for the recovery of the stock of cod in the Irish Sea (ICES division VIIa). 10.2.2000. Brussels
[40] Wickham-Jones, C. R. (1994) Scotland's First Settlers. Batsford/Historic Scotland. London.
[41] Ashmore, P. J. (1996). Neolithic and Bronze Age Scotland. Batsford/Historic Scotland. London.
[42] Pennant, T. (1774). A Tour in Scoland; MDCCLXIX. Third Edition. P. 221. Reprinted 1979 by Melven Press, Perth. ISBN 0 9505884 9 0.
[43] *Anon.* (1866). *Report of the Commissioners appointed to Inquire into the Sea Fisheries of the United Kingdom.* Presented to both Houses of Parliament. London.
[44] *Anon.* (1885). *Report of the Commissioners appointed to Inquire and Report upon the Complaints that have been made by Line and Drift Net Fishermen of Injuries sustained by them in their Calling owing to the use of the Trawl Net and Beam Trawl in the Territorial Waters of the United Kingdom.* Presented to both Houses of Parliament. London
[45] The Weekly Scotsman, 4 August 1949, 'Herring Fleet is Busy in the Minch'. Front page spread, Articles and photographs. Edinburgh.
[46] Wigan, M. (1998). p. 24 in The Last of the Hunter Gatherers: Fisheries Crisis at Sea. Swan Hill Press, Shrewsbury.
[47] Charles Clover, *pers comm.*
[48] Wigan, M. (1998). The Last of the Hunter Gatherers: Fisheries Crisis at Sea. Swan Hill Press, Shrewsbury.
[49] Anon. (2000). The Case for the Elimination of Derogations to Fish with Small Mesh Nets. Grimsby Fish Producers' Organisation Limited, 29 June 2000. Grimsby, UK. 13 pages.
[50] MAFF (2000). Table 2.3 in UK Sea Fishery Statistics 1998. The Stationery Office, London.
[51] Fishing News, p. 2 "Sacrificed for the sole fishery" 20 October 2000.
[52]Sea Fish Industry Authority *United Kingdom Fish Industry annual statistics 1998* 1999
[53] Landing values obtained courtesy Newlyn Harbour
[54] Pearse, R. *The Ports and Harbours of Cornwall* 1905

[55] Cornish fishermen were among the first to the cod grounds off Newfoundland, perhaps as early as the late 1400s
[56] Kirtlley, J PhD. Thesis 1965
[57] March, E. J. (1953). *Sailing Trawlers: The Story of Deep-Sea Fishing with Long Line and Trawl.* Percival Marshal and Company, p. 33. Reprinted by Charles & David, 1970, Newton Abbot.
[58] Bertram, J. G. (1865). *The Harvest of the Sea.* John Murray, London. pp. 277–282.
[59] Sutherland, I. (undated). *From Herring to Seine Net Fishing on the East Coast of Scotland.* 231 pages. Camps Bookshop, Wick. ISBN 0 9508697 2 4.
[60] Huxley, T. H. (1881). *The Herring.* Nature 23, 607–613. Cited in Sinclair, M. (1988). Marine Populations: An Essay on Population Regulation and Speciation. Books in Recruitment Fishery Oceanography. Washington Sea Grant Program. University of Washington Press, Seattle.
[61] Nicol, A. (1950s - unknown date). Article 'Toilers of the Deep'. Superintendent, Seamen's Mission, Ullapool.
[62] Clark, R. *The Longshoremen* 1974
[63] MacGarvin, M (1990). Greenpeace The Seas of Europe: The North Sea. Collins & Brown, London. Page 73.
[64] Holden, M. (1994). The Common Fisheries Policy: Origin, Evaluation and Future. Fishing News Books, Oxford, p. 58
[65] ACFM (2000). 3.5.8 Herring in Sub-area IV, Division VIId and Division IIIa (autumn spawners) ACFM May Working Group Report. International Council for the Exploration of the Seas, Copenhagen.
[66] Pengelly, A. J. *Oh For a Fisherman's Life* 1979
[67] Holden, M. (1994). The Common Fisheries Policy: Origin, Evaluation and Future. Fishing News Books, Oxford
[68] Sutherland, I. (undated). *From Herring to Seine Net Fishing on the East Coast of Scotland.* 231 pages. Camps Bookshop, Wick. ISBN 0 9508697 2 4.
[69] Bertram op. cit. p. 308.
[70] Cushing, D.H (1975). Figure 37, p. 134 in Marine Ecology and Fisheries. Cambridge University Press. Cambridge.
[71] Holden (1994), pp. 151–156.
[72] Holden (1994), pp. 151–156.
[73] Holden (1994), p. 80
[74] See Wilkie Collins historical description of a seine netting in *Rambles Beyond Railways* 1851
[75] Kirtlley, J Phd. Thesis 1965
[76] Introduced in the 17th century by a Breton according to Nance, M in *A glossary of Cornish Sea Words* 1936.
[77] Corin, J. (1990). *Fishermen's Conflict*
[78] Corin, J. (1990). *Fishermen's Conflict*
[79] Wigan, M. (1998). pp. 76-91. The Last of the Hunter Gatherers: Fisheries Crisis at Sea. Swan Hill Press, Shrewsbury.
[80] ACFM (2000). 3.2.2.b Icelandic cod (Division Va). ACFM May Working Group Report. International Council for the Exploration of the Seas, Copenhagen.
[81] MRI (2000). State of marine stocks in Icelandic waters 1999/2000. Fisheries prospects 2000/2001. 4. English summary. http://www.hafro.is/hafro/Radgjof/2000/summary.html. [Accessed 12 November 2000].
[82] Finnsson, A. (1997). Icelandic Fisheries Management: Towards Sustainability. WWF Arctic Bulletin 17, 16–17.
[83] Otto Gregussen, Minister of Fisheries. Opening speech at Nor-Fishing 2000. http://www.dep.no/fid/engelsk/p10001957/p10001958/008001-090006/index-dok000-b-n-a.html. [Accessed 19 November, 2000].
[84] Myrstad, B (1998) The Norwegian Fishing Industry. Utenriksdepartementet (Ministry of Foreign Affairs). http://www.dep.no/fid/engelsk/032001-990086/index-dok000-b-n-a.html. Accessed 19 November, 2000
[85] Anon (2000). Facts about the Norwegian Fishing Industry. Fifteenth edition. Ministry of Fisheries/ Norwegian Association of Fishermen. Oslo. Accessible via http://www.dep.no/fid/engelsk/p10001872/p10001953/index-b-n-a.html. [Accessed 18 November 2000].

[86] Wigan, M. (1998). The Last of the Hunter Gatherers: Fisheries Crisis at Sea. Swan Hill Press, Shrewsbury. pp 92–97.
[87] Moy, R. (2000) 50 prosent overkapasitet i den norske fiskeflåten. Article in Aftenposten. 27 November 2000 (in Norwegian). http://www.aftenposten.no/nyheter/okonomi/d176876.htm. Accessed 2 December 2000.
[88] Henning Røed, WWF Norway, pers. Comm.
[89] Wigan, M. (1998). The Last of the Hunter Gatherers: Fisheries Crisis at Sea. Swan Hill Press, Shrewsbury
[90] Wigan, M. (1998). The Last of the Hunter Gatherers: Fisheries Crisis at Sea. Swan Hill Press, Shrewsbury