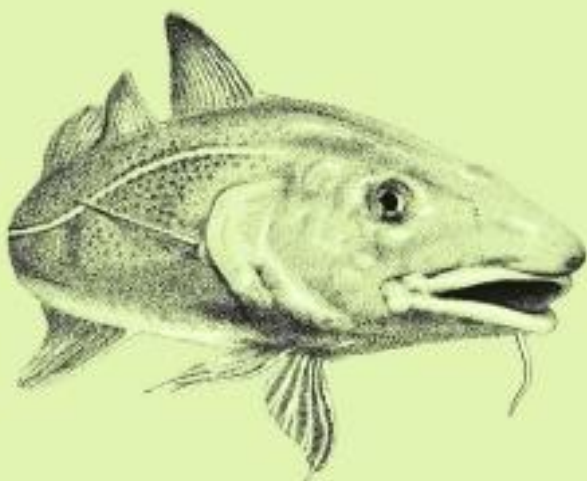


SAFMAMS

Review of Science & Stakeholder
Involvement in the Production of
Advice on Fisheries Management

A D Hawkins



SAFMAMS

Scientific Advice for Fisheries Management at Multiple Scales

Work Package 3

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A D Hawkins

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1. Summary

This study examines the involvement of fishers and scientists in the process of fisheries management. The fisheries of the European Union are going through a period of change, with the introduction of reforms aimed at achieving better governance and more sustainable fisheries. Those reforms will only be successful if differences between fishers and those managing and advising on fisheries can be reconciled.

Fisheries management is an important task. Man can put the very existence of fish at risk and many fisheries have already been harmed by over-fishing. There is an inexorable trend towards over-exploitation of resources as a result of improvements in fishing methods and technology. Sanctions are necessary to guard against excessive exploitation of fish stocks and social and legal arrangements have developed to provide the necessary regulation of fisheries.

Strong regulation of fisheries is now commonplace throughout the world. The modern era has seen the development of new systems of fisheries management based on the application of science. It is evident that expert advice, especially in the field of biology, is needed for the successful management of fisheries. However, there is increasing recognition that the development of successful and sustainable fisheries is not simply a biological or ecological problem. It is only by combining ecological, economic and social factors within an appropriate political or institutional structure that development can take place without exhausting natural resources. It is evident that successful management of fisheries requires the participation of fishers and fishing communities as well as scientists.

Diverse systems of ownership of fisheries have been put in place under different political systems. Some fisheries are privately owned, others are managed by local communities, but most are regulated by the state or by supra-national powers. Even when fisheries management is delegated to fishers or fishing communities, there are often several layers of management, with governments or international commissions playing a superior role. The development of fisheries policy, and the day to day management of fisheries, is generally carried out by fishery managers, employed as civil servants, aided by expert advisers. In many instances, management is top-down, with fishers playing only a minor role.

There are a number of difficulties in governments attempting to manage fisheries. Civil servants find it hard to understand the complexity of fisheries and cannot always anticipate the effects of the measures they impose. There are problems in regulating activities taking place at sea, especially when enforcement is under the jurisdiction of several states. Fish stocks themselves fluctuate in numbers and behave unpredictably. The management of fisheries therefore requires a long term approach. Yet within a democratic political system, elected representatives may not be prepared to adopt strong management options if benefits accrue only in the distant future.

Advice on fisheries management has concentrated on estimating the quantities of fish that can be caught without reducing stocks to a point where they can no longer sustain themselves. Mathematical models of the fisheries determine safe limits for harvesting the sea, and explore how close actual exploitation is to the limits which have been set. These analytical models have limitations. They are not easily understood or interpreted. They deal in the main with single stocks and do not take account of the complex relationships between different species within a changing

environment. They are data hungry, but often cannot be provided with the quality and quantity of data that they need. They often require further extension and development which must be accompanied by significant improvements in information from the fisheries, much of which can only come from fishers themselves.

International agreements have emphasised the need to maintain or restore fish stocks to levels that can produce the maximum sustainable yield. However, it is already evident that broader, less theoretical targets are required, with alternative management strategies being evaluated through the use of economic as well as biological models. Fisheries management is not only about conserving fish stocks. Management objectives include fairness in allocation of fishing opportunities; defining legitimate fishing methods, specifying appropriate fishing locations and seasons; promoting sound economic operation of fishing enterprises; avoiding conflict between fishers; ensuring stability of fish supplies; reducing the impact of fishing upon the environment; and enforcing fishing regulations. A wide range of advice is required in setting targets, not just advice from biological scientists.

Despite the heavy involvement of scientists, economists and other technical experts in fishery management there have been many instances of fish stock declines and collapses. Close examination of failed systems of management have pointed to the difficulties which arise when scientific advice is provided by organisations which are embedded too deeply within the management structure. Similar failures in the application of scientific advice to political problems are evident in other areas. There are major issues over the way expert advice is obtained and presented.

Scientific knowledge goes through various stages towards an increasingly detailed and refined understanding of nature – it is an evolutionary process. What is currently seen to be true may subsequently be seen to be false. Scientists, like everyone else, work within a culture which may steer their work in particular directions. Scientists tend to show allegiance to particular paradigms. They need to be exposed to alternative views. Yet much of the scientific advice on fisheries management comes from institutions which are owned and funded by government fisheries managers and which have a narrow perspective. There may be pressure to maintain a particular position or to produce advice which supports a political agenda. There may be temptation for politicians and administrators to claim falsely that there is scientific support for their actions. Moreover, control may be exerted by political authorities on the release of data and the expression of views by government scientists.

Inquiries into the political application of scientific advice have shown that safeguards are necessary to ensure that scientific advice is objective and fit for purpose. The need for advice must be anticipated; expert advice must be drawn from a variety of diverse sources and not from a select group of specialists; and specific measures must be taken to ensure the quality, integrity, and objectivity of advice. Uncertainty and risk must be assessed, communicated and managed; there must be openness and transparency; and the impact and validity of the advice must subsequently be reviewed. Where public trust in science has failed it can only be restored by re-considering the way scientific advice is applied to complex modern day problems. There is a strong case for making scientists accountable to sceptical inquirers, who are free to question the foundation of their claims. The rationality of any scientific arguments presented in the field of public policy must be examined by members of the public as well as by experts.

It has been argued that the law derives its validity from the consent of the governed. There is a strong philosophical case for the involvement in government of all those who are being governed. Where control is exercised by unelected officials and a

democratic deficit exists, or where there has been a failure of management, there are practical advantages to be gained from more participative governance; a system of government where the state plays a less intrusive role and elements of decision-taking are devolved to stakeholders and other interests. The need for dialogue with interested parties is especially critical in dealing with risk to the environment and natural resources, where uncertainty is the norm. New ways of acquiring expert advice are required which draw upon knowledge from a wider range of sources. There are real benefits to be gained from public dialogue over issues which are complex. However, there is a lack of information on how to go about increasing public participation. Participation is an ill-defined concept and it is necessary to decide both the level of participation and the choice of participants.

In relation to fishing, the key stakeholders include those dependent upon fishing for a living; those whose lives may be affected by regulation of the fishery; those with political and environmental concerns about fishing; and those whose own activities may impact upon the fishery. On purely pragmatic grounds it is important to engage with all those stakeholders who are essential to the successful regulation of the fishery. However, concern for social justice also has to be met. There is a need for clarity on whether stakeholders have been selected to provide special expertise or whether they represent particular interests. Participation in governance can also take a variety of forms.

Fisheries management systems are complex. One example is the Common Fisheries Policy of the European Union. There, a system of management has evolved which brings together countries whose interests are very different and whose expectations differ. The policy is managed directly by the European Commission, a body of un-elected civil servants, although decisions are ultimately ratified by a Council of Ministers from Member States. The European Parliament does not yet exert significant control. Extraordinarily, fisheries management is one of only five areas of exclusive competence for the Commission within the Lisbon treaty.

Expert advice to aid management within the Common Fisheries Policy comes mainly from biological scientists employed by governments. Scientists gather the data required, country by country, and then bring it together for analysis and the preparation of advice through a body established by international convention – the International Council for the Exploration of the Sea. Stock assessment, the process of estimating the condition of the fish stocks, and the subsequent presentation of advice on management, is treated as the exclusive preserve of scientists.

The European Commission has acknowledged in a Green Paper that there are major problems with the Common Fisheries Policy. Politically, stakeholders do not feel sufficiently involved in management and many believe that there is no level-playing field in terms of compliance and enforcement. The Green Paper concluded that the Commission must change the way that advice on the fish stocks and management of the fisheries is provided. There must be wider participation in the process of assembling expert advice. Participation by outside experts, stakeholders and the public should not be considered as unnecessary or inconvenient but rather as a way of extending and enriching governance.

As part of the reforms to the policy a new institution has been established to promote stakeholder involvement in fisheries management – the Regional Advisory Council. The councils have been proposed for a number of regional seas and bring a wide range of interest groups together to provide management advice on fisheries. The first formal meeting of the North Sea Regional Advisory Council took place in November 2004. Since then, additional councils have been established for Pelagic

Fisheries; North Western Waters; the Baltic Sea; South Western Waters; and Long Distance Waters.

One of the important functions of the RACs is to provide sound, evidence-based advice on the management of fisheries. Integrating the views of scientists and stakeholders is critical to the functioning of the RACs. However, the RACs are new bodies, which need to develop novel ways of operating. Much experience in combining the advice from scientists and stakeholders has already been gained in the United States of America and Canada, where participation of stakeholders in fisheries management has existed for much longer.

The USA has several tiers of fisheries management, with state bodies, inter-state organisations, tribal bodies and federal agencies all playing a role. Strenuous attempts have been made to involve stakeholders at all these levels. A key feature at the Federal level is the appointment of stakeholders to Regional Fishery Management Councils, to which management of the fisheries is delegated. A number of initiatives have been taken to bring scientists and stakeholders together to improve the quality of stock assessments and gather wider relevant information to address fishery management issues. One of them, South East Data Assessment and Review (SEDAR) especially seeks constituent and stakeholder participation in development of the fish stock assessments, transparency in the assessment process, and rigorous and independent scientific review of completed stock assessments. It operates through three stages. First; a data workshop where data-sets are compiled, documented, analysed and reviewed; second, an assessment workshop where quantitative population analyses are developed and refined; and finally a review workshop where a panel of independent experts scrutinises the data and assessments and then makes appropriate recommendations. SEDAR provides a very successful model for integrating science and stakeholder inputs into fisheries management.

In Canada, the collapse of ground-fish fisheries in the early 1990s prompted major changes to the system for managing fisheries. The establishment of a new participative body, the Fisheries Resource Conservation Council, a body incorporating parties from outside government, was intended to provide the Minister of Fisheries and Oceans with independent advice, taking some of the responsibility for recommending conservation measures away from civil servants. In its initial form, Council members made public recommendations to the Minister on management measures for the Atlantic fishery.

The Council has now been assigned a more modest role in which it focuses on long-term conservation strategies. The task of providing immediate advice on fisheries management has been returned to the Department of Fisheries and Oceans, which obtains advice on management through a new Regional Advisory Process in which stakeholders participate. The process has evolved very quickly, but has diverged to address different interests and problems within individual regions. The essential purpose of the advisory process is to provide peer reviewed information on the status of the fisheries and fish resources, involving industry, other stakeholders, and outside scientific experts. The process is subject to very prescriptive guidelines but in practice is very diverse, depending on the region and the issue to be discussed. The three main elements are issue identification, assessment of the issue (the main review), and the production of a status report on any issue for the Minister. As with the American system, scientists, stakeholders and managers discuss positions before data assembly is complete and analysis begins. Stakeholders are present and can participate in the formulation of advice. The process is subject to strict

guidelines which place emphasis on the full exchange of data, transparency and peer review.

Within the European Union the Regional Advisory Councils are now the main bodies for promoting stakeholder participation within the Common Fisheries Policy. They are intended to provide sound evidence-based advice to the Commission and member states on fisheries issues. However, the budgets for the RACs are currently small, and do not include provision to pay for expert advice. In practice, very few scientists attend council meetings unless they are specifically asked to do so by the member states employing them. There is therefore a risk that the advice from these advisers may not be independent. In addition, the main source of expert advice continues to come from organisations which do not include stakeholders as participants. On the one hand there is advice from the regional councils. On the other hand there is advice from the experts. The two lines run in parallel.

Previous experience in Europe with partnerships between stakeholders and scientists (most notably the North Sea Commission Fisheries Partnership) has shown clear benefits. Informal consultation meetings between the Partnership and a stock assessment working group resulted in improvements in the knowledge of scientists and in the data available for analysis. The interactions also provided the transparency required by stakeholders. The RACs have called for regular dialogue with independent experts. They have sought assistance with questions on the fish stock assessments – including assurances that the assessments take account of all the available information. They have emphasised the need for validating proposals coming from the RACs and they have asked for expert advice on the social, economic & environmental consequences of management proposals.

Steps have been taken to improve the transparency of the scientific advice by allowing representatives of the regional advisory councils to attend the meetings at which scientific advice is formulated. This opening up of the process for preparing management advice has altered the relationship between stakeholders and scientific advisers. There is now recognition from both scientists and stakeholders that there is a need for better information from the fishing fleet if there are to be improvements in the management of the fisheries. However, it is not appropriate for stakeholders simply to provide that information and play no further part in the process. Stakeholders and scientists must join together in validating the assumptions being made about fisheries as well as improving the data being used. Stakeholders can bring a healthy dose of scepticism into the process of providing advice on the fisheries.

One of the stumbling blocks in the way of further engagement between scientists and stakeholders is the dominant role played by scientists within the Common Fisheries Policy. Considerable progress in integrating stakeholders into fisheries management has taken place in the USA and Canada. In northern Europe, fisheries managers are still dependent upon external institutional sources of scientific advice, with their own conservative ways of operating. The current system for obtaining scientific advice may have to change if further progress is to be made.

2. Introduction; the need to manage fisheries

This study examines the relationship between scientists and those who go to sea to catch fish. The involvement of scientists in the management of fisheries is just one example of how 'experts' play a dominant role in many aspects of modern life. It is interesting to ask why scientific advice has come to play such an important role, and whether that role is justified or needs to be reconsidered.

The fisheries of the European Union are going through a period of change, largely as a result of perceptions that fisheries management has failed. It is important to ensure that the process of reform results in an effective and equitable system of fisheries management, leading to sustainable fisheries. One aspect of this process of reform is to examine and improve the relationship between fishers and other parties involved in fisheries management, including scientists and other experts.

We shall begin by looking fishing itself and asking why fisheries need to be managed.

Fishing is the hunting and killing of wild, free-living fish. Fish are a renewable resource which can reproduce and multiply without any assistance from us. However, we can damage the ability of fish to renew themselves by catching and removing too many of them. Through fishing, we can put the very existence of fish populations at risk. Moreover, every fish that is taken from the sea is one fewer for others to catch. Every fisher is therefore vulnerable to the actions of others.

Fishing may also damage the habitat, both through physical damage from the fishing gear and through bottom fouling from discarded by-catches. Every fish taken is also a fish no longer available as prey for other predators.

Over-fishing is said to take place when fishing reduces fish stocks below levels where they are able to sustain themselves. Biological over-fishing occurs when the removal of fish has reached a level where the biomass, the total weight of fish in the population, is decreasing to a level from which it may not recover. Economic over-fishing occurs whenever there is a sustained decline in the commercial income from the resource, affecting fishers themselves.

Just as fish populations may be damaged through over-fishing, so other resources may be over-exploited through what Garrett Hardin (1968) referred to the "*tragedy of the commons*". Hardin gave the example of a pasture open to all, where each herdsman would try to keep as many cattle as possible on the commons. "*The rational herdsman concludes that the only sensible course for him to pursue is to add another animal to his herd. And another; and another.... But this is the conclusion reached by each and every rational herdsman sharing a commons. Therein is the tragedy. Each man is locked into a system that compels him to increase his herd without limit - in a world that is limited*". Hardin pointed out that that "*the oceans of the world continue to suffer from the survival of the philosophy of the commons. Maritime nations still respond automatically to the shibboleth of the 'freedom of the seas.' Professing to believe in 'the inexhaustible resources of the oceans,' they bring species after species of fish and whales closer to extinction.*"

In reality, sanctions against excessive exploitation of the resource may develop within communities, or regulations may be imposed from outside to restrict fishing activities (McCay & Acheson, 1987). However, even where the number of fishers or fishing vessels remains stable, fisheries may deteriorate as a result of both 'technology creep' and changes in the behaviour of fishers. As the knowledge and

experience of fishers grows, and as the availability of technology increases, so individual fishers become more effective. Boats propelled by oars or by sail are superseded by powered vessels. Fishing nets become larger, more elaborate and more efficient. Fishers join together, forming crews to fish more effectively. Persistence by fishers results in new areas being exploited, including areas where fishing gears could not previously be fished effectively. The quantity of fish taken per fisher progressively increases even though the number of fishers may remain steady or decrease. Technology creep and the increasing experience of fishers may lead to over-exploitation of the resource and requires continual cut-backs in fishing capacity and expansion of the fishing grounds if fish stocks are to remain sustainable.

The impact of excessive fishing is not only experienced by the fish stocks and fishers themselves. There is an ecological dimension too. Fishing is often unselective and catches fishes other than those being exploited as well as a variety of invertebrates, birds, turtles and marine mammals. The act of dragging heavy fishing gears across the seabed may also harm marine habitats. Increasingly, criticism of fishers and their fishing activities is coming from environmental groups who view fishing as an activity which can inflict much wider damage.

A variety of mechanisms have been put in place or evolved to restrict access to fisheries and reduce the impact of fishing. Hardin himself addressed the potential solutions. He concluded that the problem cannot be resolved simply by the application of technical measures; it requires a fundamental extension in morality. That is, it requires social or legal arrangements that produce responsibility; that force fishers to behave well. These solutions may include allocation of the resource to private owners; licensing of the right to fish; regulation of the number of fishers, limits to the fish catch; limitations to the number of hours fishers may fish, restrictions to the kinds of fishing gear which may be used and confinement of fishing to particular locations. Hardin suggested that the commons might be sold off as private property, or kept as public property with the right to participate controlled by government.

Arrangements for regulating fisheries have developed across the World, and a diversity of institutions and laws have been put in place to undertake that regulation. Fundamental to all of them are provisions for allocating the right to fish, and the imposition of regulations to curb fishing activity. It is evident that these provisions have often developed independently within different cultures, and that they are by no means a modern phenomenon. However, the modern era has seen the development of more formal systems of fisheries management, based on scientific principles, which concentrate on the need to protect and conserve the biological resources on which fisheries depend.

In the modern era, fisheries management has been greatly influenced by theoretical studies of the effects of fishing upon fish populations utilising mathematical models. The idea of managing fisheries by setting an optimum level of exploitation has become prevalent. Understanding the dynamics of fish populations and their response to exploitation has been seen as the core problem of fisheries management and scientists have become key players in the process.

Nowadays, it is recognised that this purely biological approach is too simple. The management of natural resources is closely linked closely with the broader concept of sustainable development. The Report of the World Commission on Environment and Development (Brundtland, 1987) summarised the principle:

'Sustainable development seeks to meet the needs and aspirations of the present without compromising the ability to meet those of the future'

There has been increasing recognition that sustainable development is not just a biological or ecological problem. In addition to problems with the biological resources themselves there are economical, social and political difficulties standing in the way of managing the exploitation of natural resources effectively. The Brundtland Report, and subsequent discussions and agreements, have led to the idea that it is only by combining ecological, economic and social factors within an appropriate political or institutional structure that development can continue without exhausting natural resources. This has led to the notion that there are four components or pillars to sustainability (Figure 1). If fisheries are to be managed in a sustainable way, then all four aspects of sustainable development need to be addressed.

Not everyone has agreed with this new emphasis on wider aspects of sustainability. Pitcher & Pauly (1998), and others, have argued that sustainable development is a deceptive and elusive goal and have emphasised that strong ecological imperatives should be driving fisheries management. Rebuilding and restoring ecosystems should be the over-riding goal.

The United Nations Food and Agriculture Organisation's (FAO) Code of Conduct for Responsible Fisheries (1995) provides an evolving framework for more sustainable development of fishery resources. The Code lists the many different factors which must be taken into consideration. It places strong emphasis on the importance of sound and objective scientific advice in managing fisheries. However, there has been increasing emphasis from FAO and other development agencies, on listening to fishers, and evaluating the needs and aspirations of fishing communities rather than treating the management of fisheries as a purely scientific and technical problem. This enthusiasm to involve fishers has been opposed by others with strong environmental priorities. They see fishers as the root cause of the problem, and wish their own views to be given greater weight.

This study reviews the role of both expert advisers and stakeholders in the management of fisheries. It considers the evolution of fisheries management systems and their dependence upon scientific advice. In particular it considers the relations between stakeholders and their scientific advisers and examines arrangements which may ensure that fisheries management is more effective, more equitable and more broadly based in the future.

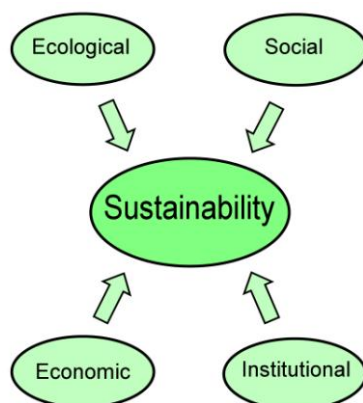


Figure1. The four pillars of sustainability

3. The regulation and management of fisheries

Wherever people live together they develop rules to regulate their own behaviour. Legislation, the making of laws, is a way of creating order by protecting the interests of individuals or institutions, controlling developments and in some cases protecting citizens from government. The function of the law is to impose obligations upon members of society in order to ease and clarify relations between them. In some instances the law may provide people and institutions with 'rights'. In others it may remove what people regard as their rights.

Roger Scruton (2006) points out that it is through laws that the state and the individual are accountable to one another. There is a web of reciprocal rights and duties upheld by a rule of law which stands higher than either party. Although the state upholds the law, it reinforces the law against itself as well as against the private citizen. Under the law contracts can be freely engaged in and collectively enforced. In a democracy the principle of accountability runs through all institutions.

Laws on fishing have existed since the earliest times. In some cases those laws have granted fishing rights to the state or to particular communities. However, in many instances the law has supported the idea that fish are a common resource. Under Roman law, which subsequently became the basis of law in much of Europe, the Institutes of Justinian Book II of the year 535 CE stated: "*Thus, the following things are by natural law common to all – the air, running water, the sea, and consequently the sea-shore*" (Moyle, 1913). In medieval England, the *Magna Carta* of 1215, signed by King John under pressure from his nobles, declared the rights of individuals against the power of the Crown. Provision 47 of *Magna Carta* instructed that: "*All forests that have been created in our reign shall at once be disafforested. River-banks that have been enclosed in our reign shall be treated similarly*". Since *Magna Carta*, the principle of open access to sea fisheries has passed into common law in much of the English-speaking world.

In addition to defining who has the right to fish, the law may also regulate fishing activity. In the reign of Edward III of England (1312-1377) the crown was asked to prohibit the use of a large dredge. The Parliamentary Rolls of 1376 reveal: "*Great complaints are made against the use of the net called 'wondyrchoun' which drags from the bottom of the sea all the bait that used to be the food of great fish. Through means of this instrument fishermen catch such great plenty of small fish that they do not know what to do with them, but fatten their pigs with them*". Fisheries laws have regulated the supply and sale of fish. Thus in 1357 the Statute of Herrings was passed to prohibit the people of Great Yarmouth from going out to sea to meet the herring fishers, thereby avoiding market duties (Galt, 1831).

Fishing 'rights'

An important issue in the regulation of fisheries is the ownership of the resource or of the right to fish. Within the territorial waters of individual states it is now comparatively rare for fisheries to be open to all; for there to be a total absence of any form of ownership. In some instances, fisheries are in private ownership, to be managed as the owners wish. In other instances, the fishery or the resource may be joint property, where the exploitation rights or the fish themselves belong to a clearly identified group of users who have the right to exclude others. In other instances it is the state which regulates access and exploitation within a fishery on behalf of the

nation as a whole. In the latter, the interests of fishers may be considered subordinate to those of the wider community.

There is currently strong interest over the role played by fishing rights in creating effective fisheries management systems. The European Commission has recently launched a year-long debate to improve understanding of how fishing rights have been established and used in the European Union.

Private ownership

Classical economic theory developed from the ideas of Adam Smith and others emphasises the importance of 'property rights'. It is maintained that ownership brings responsibility; while lack of ownership leads to loss of care. Property includes the assets or things acquired by individuals or organisations. Rights are the legal mechanisms convey those assets to the owners. Fishing rights, where the right to fish is held by an individual or company, stand in contrast to the 'commons' mentioned earlier, where fishing assets may owned by the community or a restricted group, and 'open access' where fishing is open to all.

Much has been written about the merits of rights-based fishery management; where some have the right to use the fishery resource; while others do not. There is a view that the conveyance of fishing rights to individuals will result in better management of the resource simply because owners will benefit from any improvements to the fishery. There are incentives for owners to behave well. There is also the expectation that a layer of management will be removed. Administration can concentrate on major issues like preventing illegal fishing, protecting the wider environment, and managing international aspects, leaving core aspects of day to day management to the owners of the fishing rights. It would be naïve, however, to accept these ideas unconditionally. Owners may decide to remove fish totally – to 'asset strip' or 'mine' fish – unless obstacles are placed in their way. There is also the issue of fairness in how rights are to be allocated. Nevertheless there is support for the idea that the allocation of fishing rights to individuals, companies or communities can be an effective way of removing the difficulties caused by open access, as Hardin (1968) and others have maintained.

An example of private ownership of fishing rights comes from Scotland. Under Scots law, salmon are wild animals and belong to no-one until caught. However, the right to fish in a river or along the coast belongs to the person who has the exclusive right to fish there. There is no public right of fishing for salmon (Anon, 1997). The right of salmon fishing is a separate heritable estate, which is owned independently of the land from which the fishery is undertaken. Fisheries may be bought and sold, leased and even time-shared. Responsibility for management largely rests with the owner. There is no licensing of fishing and no direct control of fishing effort. Stocks are conserved by prohibiting methods of fishing considered to be harmful and by fishery owners undertaking their own conservation work. A whole series of Acts dating from the 14th and 15th Centuries have been aimed at protecting smolts (juvenile salmon) migrating downstream to the sea or vulnerable adult salmon moving upstream to spawn in the river. Other Acts have protected the owners of fishing rights from excessive fishing by others or have guaranteed free movement of salmon to all parts of the river. The methods for catching fish are strictly proscribed but include netting and trap fisheries along the coast and in the rivers as well as angling (fishing with a hook at the end of a rod and line). Under current legislation, the owners or

proprietors of fishing may join together within a District Salmon Fishery Board to regulate the fishery.

Even under this system ultimate power rests of course with the state. Thus, the District Salmon Fishery Boards can only introduce management measures with the permission of the state, and it is open to the government to change the legislation at any time. In particular, since the salmon is a migratory fish which may be captured by fishers from other countries in their own coastal waters, the state becomes involved in negotiating with other states over the management of salmon fisheries. Indeed, International aspects of the management of salmon fisheries are the responsibility of the North Atlantic Salmon Conservation Organisation (NASCO).



Figure 2. Vignette of a salmon fisher (school of Thomas Bewick)

Within this system the provision of expert advice on management operates at several levels. The District Salmon Fisheries Boards may employ their own experienced staff to provide advice on the state of stocks and apply and enforce measures to regulate the fishery. In recent years independent fishery trusts have been established to provide scientific advice within individual catchments. A Scottish Fisheries Coordination Centre, funded mainly by government, collects, and establishes protocols for data collection by the trusts. A government agency (Fisheries Research Services) advises Ministers on the management of salmon stocks and on regulation of the fisheries. NASCO itself is able to initiate research programmes on salmon, and may seek advice from the International Council for Exploration of the Sea (ICES), an international scientific organisation.

Such a system of private ownership of fishing rights does not have universal approval. Ownership of salmon fishing rights tends to end up in the hands of wealthy individuals or even investment companies, who may let the fishing at especially high prices. Absentee owners may be seen as withholding fishing opportunities from local people who are unable to afford to rent or buy fishing.

A special case of private ownership of fishing rights is the system of individual transferable quotas (ITQs) or individual transferable effort (ITEs) which has been put in place in some countries where state ownership prevails. With such systems either the catches or the fishing effort are bought and sold. Many fisheries economists have claimed major benefits for ITQs, claiming that if such a market-based system is put in place, then a more effective management regime is obtained. The argument again is that conveying fishing rights to individuals will ensure proper stewardship of the resource. The sustainability of the resource will be protected and management made more efficient through the exercise of self-interest.

Hersoug (2002), after a detailed examination of the New Zealand ITQ management system, has confirmed the suitability of ITQs in the New Zealand setting, given the

specific goals of economic efficiency and biological sustainability. He concludes that in other countries the free transferability of fishing rights might lead to extensive relocation of employment and settlement. He also points out that a system which was initially seen as simple, with the market playing a central role, has since turned out to be very complex and has required continual adjustment. Quota aggregation has taken place with more than 70% of the quotas in the hands of 10 companies. Some out-sourcing of management costs has taken place but overall the management costs have increased. Environmental interests claim that management is not sufficiently precautionary and point to the spectacular crash of the highly valued orange roughy stocks. In other countries where ITQs have been introduced there has been great concern over the fairness and equity of the system. Small communities dependent upon fishing have failed to compete in the market for quotas. Issues of social justice may arise, as discussed in Section 6.

Private ownership does not rule out the implementation of strong conservation measures. Indeed, it may facilitate their application. Salmon fishers in northern Atlantic waters have eliminated the exploitation of salmon in waters off the Faeroe Islands and Greenland by the simple expedient of purchasing the fishing quotas and closing the fishery. Fishing rights for salmon along the coast of Scotland have increasingly been purchased by angling interests and netting stations subsequently closed to conserve stocks. In principle, fishing rights can be purchased by environmental interests and then not exercised.

Private ownership of fishing rights may provide an effective way of sustaining the resource. It may also reduce the costs of management to the state or public. However, it does not always result in an equitable distribution of fishing rights. Those who cannot afford to buy fishing rights, or compete in an open market for fishing opportunities, may feel aggrieved and unfairly treated.

Community ownership

Fisheries may be owned and managed by local communities. In Japan, small-scale fishermen have legally-guaranteed access to and ownership of the living aquatic resources in coastal waters. No conceptual distinctions exist between land holdings and sea holdings. A full description of the system of fishing rights is provided by Ruddle (1987).

Community ownership had its origins in both customary law and in formal legislation from the Japanese feudal era, which stretched from the 12th through to the 19th century. Fishers worked as members of a fishing guild, with membership limited to persons born in a particular village. All members had to follow the regulations of the guild, which established fishing zones, set seasonal limits and imposed restrictions on gear and methods.

The feudal system was subsequently dissolved, but in 1901 a new Fisheries Law was introduced by central government which reflected both traditional rights stemming from the feudal era and newly granted rights. The old guilds were designated Fisheries Associations, charged with carrying out fisheries management. They were granted fisheries rights within the sea territory of the village or a group of villages. Since then, sea territories established during the feudal era have been mapped, codified and registered. In some cases adjacent fishing areas have been rationalised or amalgamated. Conflict between areas has often been intense.

The current fishing rights system in Japan continues these historical practices, intended to protect coastal fisheries and fishers against the encroachments of others. Communities are granted fishing rights which are legally protected in full against third parties. These rights cannot be loaned, rented or transferred to others, nor can they be mortgaged. Such rights are regarded as the exclusive property of the fishing community to which they are granted. Local fisheries are essentially managed by the individual Fisheries Associations.

As with the Scottish example of individual ownership, regulation of the fisheries in Japan has many layers. There is a national vessel licensing scheme and regulations for the construction, registration and inspection of fishing boats. A prefectural licence is required for fishing vessels operating in regional waters, offshore of the area for rights-based fisheries. The Law Regarding Conservation and Management of Marine Living Resources imposes total allowable catches (TACs), as in many other countries. A total allowable effort (TAE) system sets an upper limit on the number of fishing days and the number of vessels operating in a specific area.

Thus, in Japan regulation through a traditional rights-based management sits alongside a vessel licensing system, a vessel registration system and TAC and TAE management systems. Scientific advice is provided by a series of national fisheries research institutes working in different sea areas and with different fisheries. In addition, in those prefectures where fishing is especially important there are regional fisheries institutes providing advice on management of the coastal fisheries.



Figure 3. Japanese 'manga', drawing of an octopus

Community based systems have also been in operation in other parts of the world in the past. In New Zealand, before the arrival of Europeans, Maori communities had developed detailed regulations governing the use of resources from the sea, based on a system of marine tenure (Hersoug, 2002).

Within Europe, organisations have existed in the past to manage fishery resources within a common pool. Guilds were established by fishers to apportion resources, control the sale of fish and manage the fisheries in the best interests of fishers. Examples of guilds which were traditionally involved in fisheries management at the local level include the *cofradías* of Spain and the *prud'homies* of France. Astorkiza *et al.* (1998) have described the history and development of the *cofradías* of the Basque country, while Franquesa (2004) has described their wider development within Spain. *Cofradías* began in the eleventh and twelfth centuries, but became consolidated in the fifteenth and sixteenth centuries. Fishing grounds were managed as the property of the brotherhood. The power of the *cofradías* was almost total. They regulated catches, determined the species to be fished at each season of the year, the type of gear to be used and the measures to be taken to prevent the extinction of species. They also looked after the welfare of fishers and had strong religious affiliations.

During the 20th century, the *cofradías* became part of the trade union movement. They represented working fishers from the inshore and pelagic sectors of the industry and enjoyed representation in the Spanish Parliament. Following the death of General Franco, workers and employers in the fishing sector were able to join other unions and the *cofradías* lost their monopoly in the representation of corporate interests.



Figure 4. Symbols of present day Cofradías

Community or pool arrangements for managing fisheries may be effective from the standpoint of sustaining the resource, but they do not always resolve all conflict. In particular, those outside the system, who do not own fishing rights or have fishing privileges conveyed to them, may see the allocation of fishing rights to others as arbitrary and unfair.

Ownership and regulation by the state

The ultimate power to regulate fisheries in inland and coastal waters is usually held by the nation or state. In many countries the state is responsible for regulating all fisheries in the absence of alternative arrangements. Different systems have developed in different countries, reflecting differences in their culture and legal structure.

With ownership by the state, the government effectively acts as a 'trustee' for the public for the management of fisheries. It is by no means certain that management of fisheries by the state ensures their sustainability. It has been argued by Scruton (2006) and others that state ownership tends to favour urgent and non-negotiable purpose over long-term continuity and equilibrium. Thus, in totalitarian economies, rivers have been dammed and diverted and seas deprived of their freshwater inputs. Fisheries have been prosecuted with larger nets and more powerful vessels, without regard for conservation of the resource. The state often has higher priorities than the conservation of fish stocks. It is often a primary concern of governments to promote economic growth with disregard for the environmental costs. Fisheries may be considered unimportant and be traded away in return for other concessions. Freshwater fisheries may be subordinated to the need for roads, homes, factories which use rivers for waste disposal and hydro power schemes. Oil platforms, offshore wind farms and dredging for aggregate may be considered more important than the sea fisheries. In contrast, private or community ownership may set limits to the damage which can be done to fishery resources.

It is the regulation of fisheries by governments and even larger supra-national bodies which will subsequently be focused upon in this report, but it must be remembered that both private and community ownership offer some advantages for the management of fisheries.

International aspects of fisheries management

A particular problem with marine fisheries is that the fish may migrate over large distances, passing through regional seas which are used by a number of nations. Juvenile fish may live in one part of the sea, and adults in another. The resource is essentially shared between different states.

There have been a number of 'laws of the sea', which have sought to regulate maritime activities and allocate rights to users of the sea. In Italy, the city of Amalfi had its own code which applied in the Mediterranean at the time of the Crusades. The laws of the island of Oleron, on the west coast of France, were applied in the regional seas close by. In the Baltic and North Seas the code of the Hanseatic League held sway.

Countries have often laid extravagant claim to the seas and fisheries immediately off their coasts; England in the North Sea; Sweden and Denmark in the Baltic Sea. In the sixteenth century Spain and Portugal attempted to divide ownership of newly explored seas between them, although their attempts were subsequently frustrated by the fleets of England, Holland, and France.

Hugo Grotius. In his *Mare Liberum*, or, 'Free Seas', published in 1608, sought to reinforce the right of the Dutch to participate in the East-India trade and to fish off the coasts of England. His pamphlet denied the right of other countries to divide the high seas between them. Grotius followed the Laws of Justinian in claiming common ownership of the seas for all people. Recognition of the principle of freedom of the seas has since resulted in limitations being placed on the abilities of sovereign nations to claim extensive maritime areas for themselves. In part, this limitation has been brought about by an insistence by the more powerful maritime nations on freedom of access to all seas for their own vessels. Nevertheless there has been some agreement that waters close to shore should belong to the immediately adjacent state. In the eighteenth century, the limit of sovereign authority of a maritime state was held to be the distance it could defend by force of arms. By agreement this was the distance which could be travelled by a cannonball; a distance of about three miles from the shore. Subsequently, as artillery improved, this distance was enlarged. By 1736, England was proclaiming a 12-mile marine customs zone.

In 1930, the Assembly of League of Nations called a conference to consider the problems of international maritime law. Problems relating to the width and sovereignty of territorial waters, the necessity for regulating exploitation of natural resources and defining coastal zones were examined. However, agreement could not be reached.

In the nineteen seventies, a number of states, beginning with Peru with its large pelagic fisheries, began to assert their right to fish out to two hundred miles from shore (instead of the traditional three, six, nine or twelve miles). Initially, these extensions to territorial rights were disputed. The so-called 'cod wars' between Iceland and the United Kingdom in the 1950s and 1970s involved a series of confrontations regarding fishing rights in the North Atlantic around Iceland. Iceland unilaterally declared an Exclusive Economic Zone extending beyond its territorial waters, before announcing plans to reduce over-fishing. It policed its quota system with the coast guard, leading to a series of net-cutting incidents with British trawlers

that previously fished the areas. British Royal Naval warships and tug-boats acted to deter harassment of British fishing vessels by the Icelandic coast guard. Such disputes also took place elsewhere. There was a continued reluctance on the part of the larger maritime states to accede to the wishes of others to claim extensive areas of the sea for themselves. The UN Law of the Sea Convention (UNCLOS) in 1982 allowed Exclusive Economic Zones (EEZs) extending up to 200 nautical miles from the coastline, allocating sovereign rights and responsibilities for resource management to individual countries. In the case of highly migratory species and fish stocks straddling boundaries, this sovereign responsibility has to be exercised in collaboration with neighbouring coastal states, usually through intergovernmental regional organisations set up for the purpose. There is no doubt that the assumption of rights by individual countries has greatly simplified management of the fisheries, in some cases with enormous benefits in terms of conservation and profitability.

UNCLOS does not prescribe precisely how fisheries that occur solely in international waters should be managed, and there are fisheries in some areas that are not yet subject to international agreement. Such issues were discussed within the United Nations in 2004 and the UN General Assembly issued a resolution on Fisheries which set the scene for further development of international fisheries management law. In 2002 the Johannesburg Declaration on Sustainable Development had proposed actions which must be pursued to achieve sustainable fisheries. Many governments are now committed to resolving the problems of over-fishing, both as part of their domestic policy and also to meet international obligations. They have agreed to observe relevant international conventions and treaties, although they have not always implemented these agreements through their own national legislation.

Those who undertake the regulation of fisheries

In most countries the management of fisheries is delegated to a specific management organisation or ministry established for the purpose. Fishing is managed on behalf of the state by civil servants, employed to develop fisheries policy, introduce management measures, and impose regulations. It is their task to examine the biological and economic state of the fisheries, make judgements on their success or failure, and where necessary introduce regulations to conserve fish stocks, make fisheries economically successful, or resolve conflicts.

Alongside the regulators, and often part of the same organisation, are enforcers, who ensure that the observance of fisheries regulations takes place and that penalties are imposed upon those who do not comply. In some cases the enforcers may be part of the police, the coast guard or even the armed forces. It is commonplace for breaches of fisheries regulations to be treated as criminal offences, and for those who breach fisheries regulations to appear before the courts, and to be subject to an array of penalties imposed by the judicial system.

Within a conventional, top-down system of fisheries management it is common for the regulators themselves to seek advice on the state of the fisheries from others, and to delegate monitoring and evaluation of the fishery to experts. Thus, analysis of the performance of the fishery and the state of the fish stocks is often undertaken by specialists working in scientific and economic institutes. The regulators and their enforcers may be involved in the collection of some statistics – especially those relating to fish landings – where there may be incentives for fishers to provide false information, and where the collection of data is itself problematical or vulnerable to outside influence. However, responsibility for the analysis of the data and the

subsequent preparation of advice has usually been seen as a specialist activity, to be undertaken by experts who stand above the political fray.

In such a hierarchical system of management fishers themselves are essentially those whose activities are being regulated. Remarkably, fishers themselves have not usually been regarded as experts, whose advice has value. Fishers may not be involved at all in deciding on fishery management measures or regulations, although they may be consulted on them in advance and their views taken into account by regulators.

Such a management system, with those being regulated playing a minor role, is not necessarily regarded as anachronistic or inappropriate by fishers. At a recent workshop on inshore fisheries a number of fishers declared their preference for a system where they themselves were not directly involved in the regulation of their fellows and where decisions on regulations were the responsibility of others who could take a more objective view. These fishers simply wished to be consulted on any regulations in advance and to have their views taken into account.

There can be little doubt that regulation of commercial activities is difficult. A great variety of institutional structures and legislative provisions has developed to provide for the regulation of fisheries. Fundamental to all of them are provisions for allocating the right to fish and the imposition of regulations to curb the activities of fishers, both to resolve conflicts between them and to conserve fishery resources. Other regulations may control the markets for fish. It is evident that these provisions have often developed independently within different cultures, and that they are by no means a modern phenomenon. However, in the modern era we have seen the development of more formal systems of fisheries management, based on scientific principles, which concentrate on the need to protect and conserve the biological resources on which the fisheries depend. That will be our next subject.

4. The science underlying fisheries management

To his discredit, the eminent nineteenth century English biologist Thomas Henry Huxley once said: *"I believe that it may be affirmed with confidence that, in relation to our present modes of fishing, a number of the most important sea fisheries, such as the cod fishery, the herring fishery, and the mackerel fishery, are inexhaustible."* Huxley was of course wrong. Decline in the fish stocks subsequently became the subject of great concern as the demand for fish progressively increased and fishing became more mechanised and efficient. Over a relatively short time period, fishing changed from an industry based on ships propelled by oar and by sail to one pursued by vessels driven by steam, and then by internal combustion engines.

From medieval times, statistics on the quantities of fish caught were collected for taxation purposes. By the nineteenth century, however, they began to be collected for a completely different purpose – to regulate the fisheries. Responsibility for the collection of statistics was often handed to agencies with special responsibility for fisheries. Thus, in the UK the Commissioners of the British White Herring Fishery were charged in 1808 with monitoring and protecting the state of the sea fisheries.

Once fishery management agencies had been established, the need arose for expert advice on those fisheries and especially on the state of the fish stocks. By the late nineteenth century laboratories and institutes were being established around the world to investigate the biology of fish and provide advice on the fisheries. Thus, in 1871 the United States Commission of Fish and Fisheries (precursor of the National Marine Fisheries Service) was established, and its first director, Spencer Fullerton Baird, set up a temporary collecting station in Woods Hole to study marine life. A permanent laboratory was built in 1875; fisheries research had begun.

The principles of scientific fisheries management were largely developed within national fisheries research organisations. From the start, efforts were focussed on the need to safeguard fish and shellfish stocks. The research programmes had strong formal links with the system of management itself, and the scientists usually worked directly for management bodies. For the countries around the North Atlantic, fisheries science also developed with a strong element of international cooperation, most notably through the International Council for Exploration of the Sea (section 7).

The new fisheries research institutes initially concentrated on the biology of fishes and other organisms living in the sea, and on the operation of the fisheries themselves. Additional studies later began into the physics and chemistry of the seas. Progressively however, research became concentrated on the dynamics of fish populations and how they responded to fishing. By the nineteen forties and fifties a theoretical approach had developed, which sought the optimum exploitation of fish populations. In a telling remark at the time –Michael Graham, who was at the forefront of these developments, opined *"unfortunately the individual fisherman is not in a position to make this assessment himself"* (Graham, 1943). The management of fisheries was seen as a task to be undertaken by experts.

Graham was especially concerned, as Hardin (1968) was later, with the problem of free access to fisheries. He formulated what he called 'The Great Law of Fishing': *"Fisheries that are unlimited become unprofitable"*. Graham believed that an important corollary of his law was that limiting fishing activity would indeed make fishing more profitable. Much of his work, and that of his colleagues, was therefore aimed at defining an appropriate level of fishing activity. From the start, there were difficulties in defining the 'best results' for fisheries. Graham developed the concept

of the '*greatest sustainable yield*' from the fishery, but was aware that the economic structure of the fishery had also to be taken into account. These two aspects, the biological and the economic, were regarded as to some extent competing and what was 'best' was essentially a compromise between them.

Most of the fisheries research of this time was essentially empirical, and involved the collection and analysis of statistics on the fisheries to determine the level of fishing which would give the greatest yield. Research was also underway to examine the age structure of populations, the age at first maturity, the fecundity of fish and other aspects of fish biology. Most importantly, an analytical approach was being developed which investigated changes in fish population size and structure at different levels of fishing. Mathematical models were emerging which allowed scientists to examine the effect of changing different aspects of the fishery upon idealised fish populations.

The development of fisheries models

One especially productive approach to the mathematical modelling of fish populations came from Graham's own laboratory at Lowestoft in England. Two young scientists, Ray Beverton and Sidney Holt, produced a series of models on how fish populations responded to fishing (Beverton & Holt, 1957). At the same time, equally forward-looking development work on fisheries models was being undertaken at other centres, most notably by William Ricker (1954) working on salmon and freshwater species for the Fisheries Research Board of Canada, and Milner Schaefer (1954), Director of Investigations for the Inter-American Tropical Tuna Commission, in the United States. Since the 1950s interest in the modelling of fish populations has expanded greatly and the models employed have become increasingly sophisticated.

Fisheries models are essentially mathematical tools used to assess the state of fish stocks, set safe and sensible limits for their harvesting and determine how close actual exploitation is to those limits. Fishery scientists attempt to estimate the quantities of fish that can be caught without reducing the spawning stock to a size where recruitment to the stock is seriously threatened. Historical data are very important for setting the limits for the fish stocks. Old data sets are examined to see how spawning success and recruitment has varied with the size and composition of the stock. Scenario analysis may be performed to examine the effects of different management decisions.

One of the commonest models is based on Virtual Population Analysis (VPA). It attempts to back-calculate the size of the fish stock from the numbers and ages of fish that have been caught over a long time period. Data from the fisheries are collected and pooled, the models are run and the results are compared with other sources of knowledge on the stocks. As well as estimating the sizes of fish populations, usually as the biomass or total weight of fish, attempts are also made to forecast the likely catches of fish at different levels of fishing activity.

In practice the models, despite their mathematical elegance, rarely yield clear and uncontroversial predictions. There is often great uncertainty about the actual levels of biomass which will be sufficient to maintain or grow populations. There are great variations in spawning success from year to year, which cannot be predicted but which may affect fish stocks profoundly. There are many variables affecting both the successful mating of fish and survival of the eggs and larvae and changing

environmental factors may play an important role. Although intuitively scientists believe that there is a relationship between the numbers of spawning adult fish and the subsequent production of offspring it is often difficult to demonstrate that relationship in practice. The task of setting minimum levels below which stocks should not be allowed to fall is difficult and beset by uncertainty.

The limitations of the models are accepted by those who use them. They are often regarded as work in progress. Their requirement for data often outstrips the data actually available. Discussions within the North Sea Commission Fisheries Partnership (section 7) have identified some of the flaws:

- The models deal in the main with single stocks, without considering the interactions between other species, including prey and predators. Multi-species models are being developed, but are still at an early stage.
- The models demand a wide range of data, much of which is, in reality, of poor quality and not fit for purpose. In particular, there is:
 - A lack of reliable data on fish catches and where they came from. Fish caught as a by-catch or surplus to quotas are often discarded at sea without being recorded. The location where they were caught may be misreported.
 - A problem in the estimation of natural mortality; deaths from causes other than fishing
 - Only poor information on commercial catch per unit effort (CPUE) because of changes in the regulations and gear specifications and in the way the data are collected
 - A lack of information on the distribution of fish and other important biological parameters, like growth rate and age at maturity
- The VPA models are less certain in the determination of population numbers and the losses through fishing in the most recent years. There is also delay in collecting and collating data; essentially the biomass is being determined for previous years, not the current year.
- The models require better diagnostics and error analyses. More emphasis needs to be placed on the quantification and communication of measures of uncertainty.
- The models may not be able to accommodate major changes to the fishery including levels of effort, fleet behaviour, reporting procedures and practices, mesh sizes, and levels of discarding.
- The models are expressed in a mathematical format which makes them opaque and incomprehensible to lay-people. The inherent assumptions are not always apparent and the caution with which specialist scientists regard the results are not always conveyed to others, including fishery managers.

These criticisms do not deny the value of current fishery models. Retrospective analysis of biomass assessments has shown surprising consistency. In general, for areas like the North Sea the assessments have been robust – the scientists have got them right. However, it is also apparent that for many fisheries the assessments are poor in quality. Some important stocks, like cod in the North Sea, cannot currently be subjected to full analytical assessment, mainly because key data from the fisheries themselves are lacking. Fishery-related changes resulting from management measures and changes in catches and catch locale may go un-recorded. The required improvements in data quality can only be provided by closer cooperation between fishers and scientists.

The Precautionary Approach

The recognition that caution must be exercised in managing fisheries has led to acceptance of the need for a precautionary approach. The Rio Declaration on Environment and Development of 1992, and the UN Agreement on Straddling Stocks of 1995 have endorsed this approach, and the FAO Code of Conduct for Responsible Fisheries of 1995 has included guidelines on its implementation.

The precautionary approach to fisheries management requires that more caution be exercised when uncertainties are greater. The essential features include:

- The need for a management plan.
- Specified, measurable targets and reference points.
- Controlled access to the fishery.
- Capability to limit fishing capacity and fishing mortality rate.
- Pre-agreed action.
- Consideration of uncertainty.
- The need to heed early warning signs.
- The need for monitoring on the part of both the scientific and enforcement authorities.

Maximum Sustainable Yield (MSY)

It is now evident that there may be considerable doubt about how far stocks can be allowed to decline before their ability to recover is seriously compromised. Currently, the level of fishing mortality on many stocks is very high, and some stocks, like cod in the North Sea, are thought to be close to danger point. There is a wish to move back from this position and re-establish levels of exploitation which are closer to the optimum.

Michael Graham first proposed that there was an optimum point in the relationship between the yield from the fishery and the fishing intensity. This was later defined by Schaefer and others as the point of maximum sustainable yield (MSY).

The value of MSY is highly dependent on the relationship between the size of the stock and the subsequent recruitment of young fish, which is often difficult to ascertain. It has also become apparent that the MSY yield or biomass can easily be set too high and may encourage fishing at too high a level. The concept of MSY has other flaws. It encourages the idea that fish stocks show a high degree of stability; that they are unaffected by environmental change; and that single stocks can be managed without regard to the other stocks with which they co-exist. It is now

evident that many stocks are not stable; the recruitment of young fish and their survival to adulthood can vary greatly. The environment favouring one species can change, favouring another species – which may be a predator of the first. Above all, most fisheries exploit a number of different fish stocks which interact with one another. They cannot all be managed to provide MSY.

The MSY concept was convincingly demolished by Larkin (1977), who wrote a short and apposite poem which he presented to the American Fisheries Society:

*'Here lies the concept, MSY.
It advocated yields too high,
And didn't spell out how to slice the pie.
We bury it with best of wishes.
Especially on behalf of fishes'*

For many fisheries MSY has been superseded by a more conservative target based on lower levels of biomass and fishing mortality. Remarkably, however, the concept of MSY has recently received a new lease of life. The World Summit on Sustainable Development (WSSD) at Johannesburg in 2002 undertook a commitment to bring stocks to maximum sustainable yield levels by 2015. Thus the European Union and other participants, agreed *inter alia*:

'To achieve sustainable fisheries, the following actions are required at all levels: Maintain or restore stocks to levels that can produce the maximum sustainable yield with the aim of achieving these goals for depleted stocks on an urgent basis and where possible not later than 2015.'

The European Commission has since proposed that its own Common Fisheries Policy (CFP) should be developed in accordance with the Johannesburg accord.

Others (like the North Sea Regional Advisory Council, see section 7) have accepted that lower fishing mortalities would bring higher yields and have agreed that managers, together with stakeholders, should prepare long term management plans for the major fisheries. However, following Larkin, they have suggested that MSY is too simplistic a target for practical use. A more utilitarian and pragmatic management framework is necessary which incorporates all aspects of sustainability. Each fishery should be looked at case by case, focusing on strategic objectives for each of them. The aim should be to bring all stocks above safe biological limits, at higher biomasses, with alternative management strategies being evaluated with the aid of economic as well as biological models.

Despite the high degree of development of fisheries models, there is wide disappointment over the effectiveness of management based on these models. Roberts (1997) recognises that fisheries science has contributed valuable theoretical advances in our understanding of exploited animal populations but points out that it has a poor record in the management of real-world fisheries.

Management measures

The first step in fisheries management is establishing the state of fish stocks, and the impact of fishing upon them. In general, this involves scientific advisers considering whether:

- Yields from the fishery are increasing or decreasing.
- Recent recruitment of young fish has been high or low.
- The death rate from fishing, the fishing mortality, is rising or falling.
- Spawning stock biomass, the total mass of fish old enough to spawn, is high or low.

Having arrived at an assessment of the state of the stock, it is then necessary to decide whether the fishery can be allowed to proceed as before, or whether management measures must be introduced to control fishing activities.

There is a whole suite of measures which can be applied to restrain fishing activities. The input into the fishery can be controlled by limiting fishing capacity; that is, by restricting the number of fishing vessels, or by reducing the size and fishing power of individual vessels (fishing power is the ability of a vessel to catch fish, which depends on the engine power, the type of gear used and other factors). Input can also be controlled by limiting the fishing effort through restricting the time which fishers can spend fishing. Restricting the fishing season will also restrict fishing effort and at the same time may protect fish during a vulnerable stage of their life history, such as spawning or reproduction. Very young fish may be protected by setting a minimum landing size. Spawning grounds or juvenile nursery grounds may be protected by restricting fishing to certain areas.

The outputs from a fishery may also be controlled. The catch which is permitted to be taken from the fishery may be restricted by setting a total allowable catch (TAC) which must not be exceeded. Restrictions may also be placed on the species to be landed to protect those which are especially vulnerable to fishing or which have particular conservation value. Technical measures may be introduced to make fishing methods more selective. For example a minimum mesh size may be specified for fishing nets or only large fishing hooks may be permitted; in both cases to allow small fish to avoid capture. Fishing gears may be especially tailored to catch particular species and allow other species to escape.

There are of course difficulties in applying these different measures. Although it is relatively easy to limit the quantities of fish being landed and sold at fishing ports it is more difficult to prevent fish being caught at sea and then discarded. The by-catch, the part of the catch which is not required, or which cannot be landed without breaching quota limits, may be a substantial part of the catch but may be thrown over the side of the fishing vessel without being monitored or declared. Fishing nets may be modified at sea so that their meshes close down, preventing small fish from escaping. It is difficult to ensure that management measures are properly adopted and enforced. Moreover, where breaches of the regulations take place and go unobserved there may be problems for the scientists who are subsequently required to use information from the fishery to estimate the state of the stocks.

Problems in managing fisheries

Garret Hardin (1968) was undoubtedly right about the continual pressure which would be placed on fisheries if control was not exerted over fishing capacity. Although fish landing statistics from FAO (the UN's Food and Agriculture Organisation) have shown a slight increase in catches year on year it is apparent that this is a false picture. Countries have inflated their landings statistics, as Watson and Pauly (2001) have shown. In fact, landings of fish are declining throughout the World's oceans. In many regional seas the number of fishing vessels greatly

exceeds that necessary to achieve current landings. Moreover, the effects of fishing are not just upon the species being exploited; there are wider ecological effects. Pauly and his colleagues (Pauly *et al.*, 1998) have written about the 'fishing down' of marine food webs, and have described how fishers have systematically over-fished larger, more valuable predatory fish, such as cod and groupers, forcing them to shift to less desirable species lower down the food web. In a widely quoted paper, Myers and Worm, (2003) investigated community biomass (the weight of all living organisms) and the composition of large predatory fishes in continental shelf and oceanic systems, using data from the beginning of exploitation. They have concluded that industrialized fisheries have greatly reduced community biomass. Compensatory increases in fast-growing species have been observed, but have often reversed within a decade. Myers and Worm estimated that large predatory fish biomass today is only about one tenth of pre-industrial levels. They concluded that declines of large predators in coastal regions have extended throughout the global ocean, with potentially serious consequences for ecosystems.

Thus, on this basis, there is an urgent need on a global scale to regulate fisheries and to reduce their impact both upon fish stocks and the wider ecosystem. There is a view that the biologically based fishery management principles laid out in the text books have largely failed (see for example Clover, 2004, for a caustic view of modern fisheries management). So far, regulation has not resolved conflict or conserved fishery resources. It has failed to protect the fisheries and those who fish for a living. Others have emphasised that scientific advice has often been right – it has simply not been followed by fishery managers.

Rose (2003) has pointed out the problems which have occurred in relation to the management of the northern cod in Canada (see also sections 5 and 10). After the major declines in the fisheries in the 1960s and early 1970s, and the extension of the Canadian Exclusive Economic Zone (EEZ) to 200 nautical miles in 1977, there was a rapid expansion of the fisheries research and management capacities of the newly-formed Department of Fisheries and Oceans. Scientific responsibilities became focused on stock assessment, and ecological work declined. Developments in more quantitative fisheries science led to a tacit assumption that science would inform management precisely how much fish could be harvested annually, based on surveys and modelling; that this would ensure that the stocks were allowed to rebuild and not be over-harvested. There was also an unflinching faith in the marine ecosystems of Newfoundland and Labrador to rejuvenate themselves in a manner consistent with earlier and more productive decades. Both these faiths proved to be unfounded when the northern cod stock showed a catastrophic collapse, from which it has yet to recover.

Hilborn (2006) has suggested that the fisheries community needs to look at itself and question whether there is not within its field a strong movement of faith-based acceptance of ideas, and a search for data that support these ideas, rather than critical and sceptical analysis of the evidence. He points out that the scientific journals *Science* and *Nature* have published a long string of papers on the decline and collapse of fisheries that have attracted considerable public attention, and occasionally gaining coverage in the *New York Times* and the *Washington Post*. He asserts that the peer review process which underpins science has totally failed and that many of these papers have been published only because the editors and selected reviewers believed in the message, or because of their potential newsworthiness. Hilborn cites the Myers and Worm (2003) paper mentioned above, which made the front page of major national newspapers. He points out that this paper raised a furore among many scientists specializing in pelagic fisheries who

knew the same data, knew it was being misinterpreted, and knew there was a large body of other data that contradicted Myers and Worm's results.

Hilborn's paper is important because it draws attention to the development of a community of belief whose credo has become "fisheries management has failed, we need to abandon the old approaches and use marine protected areas and ecosystem-based management." He suggested that any paper showing a significant decline in fish abundance or benefits of marine protected areas had a high probability of getting favourable reviews in some journals, regardless of the quality of the analysis. Critical peer review had been replaced by faith-based support for ideas and too many scientists had become advocates. An advocate knows the answer and looks for evidence to support it; a scientist asks nature how much support there is for competing hypotheses.

Finlayson (1994) summarised the crucial assumptions made by Canadian scientists which supported their strong belief in the possibility of successfully managing fish populations:

1. The universe is mechanistic and deterministic and its workings are governed by a few fundamental and unvarying laws
2. The marine ecosystem and its sub-systems are fundamentally robust. That is, they are relatively insensitive to small perturbations and tend to vary around natural dynamic equilibrium states.
3. These natural equilibrium states are dominated by relatively few significant variables. In this case they are fecundity, recruitment, natural mortality and fishing mortality.
4. These variables are knowable and their effects on stocks are simple, continuous, and can be realistically modelled by an equation with a small number of parameters. Therefore they are predictable.
5. Science-based management can manipulate some of these variables (primarily fishing mortality). It can monitor the others to effectively control the system and produce equilibrium states in general harmony with human needs and desires.
6. Having rebuilt stocks to the desired level they can then be retained at that level by relatively minor adjustments in the allowable catches.

Finlayson concluded that these assumptions were too simplistic. In particular, they neglected the impact of environmental change and its cumulative effect upon recruitment. Scientists did not take account of interactions between fish stocks, which are either predators or prey for other animals. They assumed that data on all the variables could be gathered together without too much difficulty. Experience has subsequently shown that the dynamics of fish stocks are not so easily understood and fish stocks are not always amenable to being manipulated by man.

Finlayson was approaching the problem of fisheries from the point of view of a social scientist, with the belief that we should treat as significant the specific social contexts within which we construct our analysis of the world. From his close examination of fisheries management in Canada he concluded that just as state bureaucracies are capable of producing stunningly irrational results so are groups of scientists. Irrational social forces can powerfully impinge upon scientific knowledge production

when science is embedded in the state. He argued that the institutional marriage of science and the state is fraught with irreconcilable differences. This aspect will be dealt with in more detail in section 5. Equally, however, if we follow Hilborn's argument, science may also become faith-based when it espouses the views of environmental organisations, or advocates a particular cause or idea which is popular with the press.

Future developments in fisheries management

Discussions in 2003 between European scientists and fishers within the North Sea Commission Fisheries Partnership outlined future options for improving the application of science to fisheries management. The Partnership accepted that scientists had made great improvements in the management of fisheries and had been at the forefront of the adoption of a precautionary approach. It was time, however, for management authorities to identify wider, longer-term fishery management objectives for fisheries in their charge.

It had become increasingly apparent that environmental factors might have a significant impact on recruitment, and therefore biomass. In future, it would be more meaningful to set fishery management objectives in terms of fishing mortality, with the biomass dimension serving as a limit. Although it might be possible for the biomass of individual prey and predator species to be higher than they currently were, it would not be possible to maintain all of them at their single species optimum biomass for all time.

Long-term targets for fishery management did not need to be derived from mathematical formulae. Simply increasing the biomass and decreasing fishing mortality to a more moderate value would be a considerable achievement. If fishing mortality were to be greatly reduced (say through a reduction in fishing capacity) the remaining fleet could fish with fewer restrictions.

There was much uncertainty in stock assessment, originating from poor information on the fisheries as well as imperfect modelling. These uncertainties could only be resolved by scientists and fishers working together. Science should be presented to decision-makers with all its uncertainties, not as the gospel truth (as managers and politicians tended to see it). Adjustments should be made to the management regime in the light of experience. The great uncertainty which is endemic in fisheries management has been emphasised by Cochrane (2000), who draws attention to two sources of uncertainty. Firstly the uncertainty associated with the dynamics of the stocks themselves – *process uncertainty*. Fish populations frequently demonstrate high variability, often driven by changes in the environment. Secondly, there is uncertainty in the observations made on the resource – *observation error*. Harwood and Stokes (2003) have added two additional sources of uncertainty from their own experience of fisheries science. *Model error* arises from models which do not adequately describe causal processes. For example, they may miss out important aspects of the process. *Implementation error* is created when the resulting measures are not implemented in the way that had been intended.

The Partnership recognised that the implementation of an approach which took account of the wider ecosystem as well as fish stocks would pose a considerable challenge. Fisheries and the environment were changing rapidly and the implications of those changes were poorly understood. How should a fishery management agency react when the conditions become less favourable for a species, as might be

the case for cod in the North Sea? Given such changes, the fishery management system would need to adapt, but the state of knowledge might be insufficient to do so. Discussion of the management options amongst all the various stakeholders would be especially helpful.

Adaptive management

These suggestions have paralleled the proposals which have emerged from ecologists like Charles Holling, who have introduced the idea of '*adaptive resource management*' (Holling, 1978). Adaptive management is a process for achieving optimal decision-making in the face of uncertainty. Its key feature is a willingness to learn from experience. Adaptive management calls for management interventions that involve experimentation and flexibility, so that scientific uncertainty can be reduced and the management system can be adjusted or adapted to what is learned.

There is no doubt that the scientific basis for fisheries management is changing. Recent discussions on the recovery of cod in the eastern North Atlantic have focused on the management of fisheries in the absence of sound analytical assessments of the state of stocks. Harvest control rules have been developed in the past which were triggered by the estimates of spawning stock biomass coming from the assessments. How do you manage when the data are no longer capable of yielding those estimates? In these circumstances it has been suggested that a wider range of 'indicators' of the state of stocks are needed. Some of these might be qualitative rather than quantitative. The essential feature of such an approach would be reliance on a set of simple indices which can be determined relatively easily, without recourse to complex analytical models.

There is also increasing recognition that fisheries are often mixed – they exploit a range of species. One of the problems of modern fisheries management is how to manage those fisheries to avoid damage to one fish stock, while recognising the wish of fishers to exploit other stocks which are more abundant

Wider objectives of fisheries management

The focus of mainstream fisheries science has been investigation of the state of fish stocks and their response to fishing. Important though it is to establish the state of the stocks there are wider concerns. Much of the work of fisheries managers is concerned with other matters: reducing conflict between fishers; allocating fishing opportunities in an equitable way; defining legitimate fishing methods; specifying appropriate fishing locations and seasons; promoting sound economic operation of fishing enterprises;; ensuring stability of fish supplies; reducing the impact of fishing upon the environment; and enforcing fishing regulations.

The distinct objectives of fisheries management differ when viewed from the perspectives of different stakeholders.

From the standpoint of politicians and fishery managers the objectives might include:

Continued existence of the resource itself – sustainability.

Maximising the economic yield from the fishery, whilst maintaining an appropriate balance between fishing capacity and the resources available.

Maintaining employment both in the fishing industry and the other ancillary industries which depend upon fishing (boat building, net-making, the supply-chain).

Ensuring equity and fairness in allocating fishing opportunities.

Establishing a management system at minimal cost, with minimal political controversy.

From the standpoint of environmental interests, the objectives might include:

Protecting and conserving species targeted by the fishery.

Reducing the by-catch of other living creatures, especially charismatic animals like dolphins, birds and turtles.

Protecting key habitats and vulnerable biological communities.

From the standpoint of fish consumers the objectives might include:

Ensuring a good and varied supply to the market of high quality seafood at reasonable prices.

Providing traceability of the product and a guarantee that the fishery is sustainable.

Reducing the 'air-miles' travelled by fish products; supporting local producers where possible.

Fishers themselves have their own objectives:

Maintaining high profits from the fishery with minimal investment.

Ensuring the long term economic viability and stability of fishing enterprises.

Ensuring that changes will not be introduced which will affect the viability and stability of the industry.

Ensuring that there are good opportunities for marketing fish.

Many of these objectives are economic and social, as recognised by the Brundtland Report (section 2). At the moment, most fishery management systems depend on advice which comes from narrowly specialised fishery biologists. However, a wider range of expert advice is required by fishery managers and that advice must be provided in the right context. The whole issue of how that expert advice is provided will be our next subject.

5. The role of expert advice

The basis on which expert advice on fisheries is provided

Governments and fishery management organisations draw upon scientists and other technical experts for advice on fishery management. In this section we look at the wider issues raised when expert advice is sought.

It is evident that science does have a major role to play in the management of fisheries. In the words of the FAO Code of Conduct:

‘Conservation and management decisions for fisheries should be based on the best scientific evidence available, also taking into account traditional knowledge of the resources and their habitats, as well as relevant environmental, economic and social factors. States should assign priority to undertake research and data collection in order to improve scientific and technical knowledge of fisheries including their interaction with the ecosystem’.

In a wider environmental context, science does not always play a direct role in influencing policy. Clark *et al.*, in a review of international scientific assessments, conclude that the majority of assessments are not effective in influencing policy. Their impact is more long-term. By contrast, science is deeply embedded in fisheries management (see sections 4 & 7).

However, McCay and Finlayson (1995) have pointed to the alarming occurrence of fish stock declines and collapses throughout the world despite the application of science. They have concluded that these events have now been accompanied by more critical appraisals of the specific tools and the more general philosophies of fisheries management. They call for a system of management, which explicitly acknowledges uncertainty in natural systems and acknowledges that science is imperfect.

McCay and Finlayson (1995), both social scientists, have opined:

“Fisheries management is a thoroughly modernist venture, imbued as are so many other of the applied ‘natural resource’ areas with a very pragmatic, utilitarian, science-dependent, and mostly optimistic perspective on the ability of people to ‘manage’ wild things and processes”

It is evident that not all commentators are happy with the way science has been applied to fisheries management, or indeed to other areas of public administration. Dealing with environmental issues, like fisheries, seems to pose special problems as the challenges in dealing with these issues are not just technical. There are cultural challenges in responding to environmental issues, as Wynne (1992) has pointed out.

The nature of science and scientific advice

Since that period known as the Enlightenment it has been commonplace for people to believe that decisions are best taken on rational grounds, through the exercise of reason. The Cartesian world view is that we are capable of gaining enough rational

understanding of the world to achieve desired ends. From this view, science provides universal truths about the world, and this truth is regarded as eternal and incontrovertible. The statement '*scientists have shown that...*' is often uttered by politicians in support of policy decisions. Equally, the converse '*There is no scientific evidence to support.....*' is used to dismiss other propositions. It is often taken for granted that science is the only valid method for analysing a material world, and that all aspects of the world we live in would be capable of being understood through science if only we had the time and money to apply to it. The remarkable advances made through science and technologies have tended to reinforce this view. Science is regarded as neutral, objective, dispassionate and all-powerful. Scientists, producing scientific knowledge through unbiased scientific activities, are following the laws of reason, and are not motivated by other pressures or concerns or influenced by their social position.

This enlightenment approach is often characterised or caricatured by philosophers as the Modern view. In contrast to it stands the Post-Modern view, which places emphasis on the lack of stable or objective reference points for communication between individuals and cultures. To the post-modernist, scientists represent a particular interest group, which though it may be allied with the dominant ones in society has no unique claim to objectivity or truth. Science and scientists are social constructs, which are present only within certain cultures. The status of science is subject to assumptions and is constrained by the institutional structures within which it operates.

The development of a more sceptical view of the role of science has paradoxically been accompanied by recognition that science is often the key institution that people look to in order to relieve their anxieties. Beck (1992) has introduced the idea that we now live in a 'risk society', where anxiety over uncertainty is the driving force in the development of institutions. He emphasises that risk and the practice of risk management as essential features of modern society and that the production of potentially catastrophic risks is now endemic. However, Beck is sceptical of the value of science in allaying our anxiety. Indeed, he suggests that science has changed from an activity in the service of truth to an activity without truth which has generated much of the anxiety we currently experience. "*We don't know, what it is we don't know - but from this dangers arise, which threaten mankind!*" Like many other social theories, Beck's argument is difficult to follow,

An important question when we are seeking advice on issues which really matter to us is whether the experts proffering assistance are really providing objective, independent information, based on a systematic way of working; or whether they are putting forward a point of view which is their own or that of a particular group, which requires to be treated with suspicion and examined closely before it is accepted as truthful. Are they putting forward an objective view or are they advocates for a particular cause (in the sense used by Hilborn, 2006). Does the fact that an adviser is a member of a particular profession – a scientist or a doctor – mean that their advice must be accepted without question? Indeed, can an individual expert be assumed to be the fount of all knowledge and incapable of being contradicted except by other scientists? Or are scientists, like most other people, capable of making misjudgements? Does it matter where advice comes from? Are there precautions we should take before accepting scientific advice?

To many scientists it is implicit that science does not necessarily provide the truth. It is only a means for seeking the truth. The real essence of science is that it aims to put ideas to the test in a rational, quantitative and unbiased way. Scientists give their advice tentatively, and express their ideas or theories in a way which allows them to

be tested. This view conforms to Karl Popper's argument that no number of positive outcomes can confirm a scientific theory, but a single failure is logically decisive: it shows the theory to be false (Popper, 1959). One scientific proposal or theory is not better than other because it comes from an eminent scientist at the top of his or her profession, or because it is approved by their peers. It is better because it is not contradicted by observations and the results of experiments. The essential principle of science is therefore that ideas or theories must be capable of being tested, and the results of those tests must be reproducible by others. Science must be transparent and must map out its assumptions and limitations so that it may be understood by others. These principles do not just apply to the big theories; they are important for all work which is to be labelled 'science'. Scientists should become accustomed to having their evidence and ideas questioned and not just by other scientists. It is open to anyone to question scientific findings provided they do so through arguments based on observation and experiment.

In practice, however, eminent scientists may be just as likely to stand on their dignity and claim that their position gives their advice extra weight as any other professional persons. Scientists form clubs, Royal Societies and National Academies. Their presidents wear gold chains of office. Their associations spend much time deciding who is eminent enough to be favoured with membership. They expect their reports, surveys and pronouncements to be taken seriously by governments. They claim special privileges.

What are the real characteristics that separate scientists from others? Merton (1942), from discussions with working scientists, identified a set of behavioural norms to which scientists themselves believed they subscribed. They included universalism, communalism, disinterestedness, and organised scepticism. These norms were said to constitute the *ethos* of modern science. However, Merton was careful to point out that these attributes are those to which scientists might aspire, rather than inherent characteristics of all scientists.

Thomas Kuhn, in his work *The Structure of Scientific Revolutions* (Kuhn, 1962) argued that science goes forward in stages. At each stage a particular paradigm is adopted: a framework within which problems are to be understood. Science shows successive transitions from one paradigm to another through a process of evolution. Moreover, Kuhn argued that most scientists were not objective and independent thinkers. Rather, they designed their instruments and conducted their experiments within the current paradigm. Research was therefore not about discovering the unknown, but rather "*a strenuous and devoted attempt to force nature into the conceptual boxes supplied by professional education*". Scientists often tended to ignore research findings that might threaten the existing paradigm and trigger the development of a new and competing framework. New science – a new paradigm – required exceptional thinking which only emerged from time to time. Kuhn questioned whether there is one, full, objective, true account of nature. He believed that science simply went through various stages towards an increasingly detailed and refined understanding of nature – science was an evolutionary process.

The notion that scientists tend to show allegiance to a particular paradigm, which may later be overthrown, leaves us with the possibility – perhaps inevitability – that the current scientific view may be rejected and replaced by a more useful one (in the sense of fitting the observations better). What was once regarded as the truth may subsequently be seen to be false. The view of a scientist is always provisional. In addition, if Kuhn is right about adherence to a particular paradigm, there is also the likelihood that scientists are under pressure to adhere to a prevailing dogma. They

are operating within institutions which may have a great deal of inertia, where free and open debate may be discouraged.

In the current, post-modern era, the idea that scientists can be wrong, and that their ideas simply reflect a particular paradigm which is inherently transient, has resonance with those social scientists who argue that what we call knowledge or science is simply a story or account which is pleasing or useful to a particular culture. Indeed, the extreme post-modernist view denies that there is such a thing as objective knowledge. Different cultures or groups of individuals see the world in different ways, and any viewpoint is just as valid as another. The view expressed by the dominant culture –the scientific establishment – is not the only view. Some might even argue that all facts are relative, all opinions are equal and that empirical, peer-reviewed science has to compete with all and every other view. Certainly, many of us take that point of view in everyday life. We pick and choose. We consult astrologers and priests, accept potions and cure-alls advertised on television and hang on the words of celebrities. We do not pay special attention to the views of scientists!

This is not the place to explore post-modern philosophical concepts in detail, except to say that even the most committed post modernist will accept the benefits science brings. When travelling by air they commit themselves to navigational systems which assume that the earth is spherical, they covet an iPod, and if they are really ill they may avail themselves of the benefits of modern medicine. What emerges from the current debate is that there are misconceptions about science and its significance. When scientific advice is being presented to managers and stakeholders there may well be a clash of cultures. One group may well have difficulty understanding the methods, assumptions presentations and limitations of the others. In particular, politicians and administrators may well misunderstand the import, context and significance of scientific advice.

There is a risk that in the sphere of public administration governments will falsely claim scientific support for their political actions. When politicians claim that there is a scientific consensus which underpins their stance they show a marked ignorance of how science works. Any institutional approach which emphasises the role of scientific consensus (*vide* Haas, 2004) is inherently flawed. Science is not about certainty or consensus. Science moves forward by finding gaps or flaws in current ideas about how things are. It will always be necessary to guard against the assertion that one source of information is the most authoritative. The most popular theory is not always the longest-lasting. Research funding must not be directed only along lines which support or extend a favoured paradigm. Investigation is also required of contrary hypotheses. A spirit of rebellion and dissent must be encouraged within the scientific community to ensure that science goes forward.

It may be especially foolish to place scientists in charge of public decision-taking, as if they constitute the only source of authority. Winston Churchill is alleged to have said '*Scientists should be on tap, not on top*'. The clear implication was that although he believed that scientific advice was often worth listening to, the key decisions should not be taken by scientists. They should be taken by others with a wider perspective.

At this point it will be useful to consider the context within which most scientists work, and the role that scientists play in public life.

The organisation and funding of science

Science is no longer an activity which can be carried out by a single individual. Fisheries science, in particular, involves scientists working together in teams, often in large institutes which bring together expensive facilities like research vessels, laboratories and libraries. Many specialised fisheries research institutes now exist around the world, owned and run by government agencies and reporting directly to an arm of central or regional government. Many of them were established before the beginning of the 20th century and have developed their own traditions and cultures.

Thus, for many years, fishery managers have sought scientific advice from large, dedicated scientific establishments which are separate from the main scientific infrastructure of the universities and research councils. Rather than take advice from scientists engaged in strategic and basic science, fishery managers have tended to seek advice from specialised institutes, established specifically to provide them with advice. Have they set up these institutes simply to promote efficiency? Or do they also wish to exert some degree of control over their outputs?



Figure 5. The Fisheries Research Vessel *Scotia*. Fisheries Research Institutes require expensive facilities like this ship to operate effectively

Scientific advice is expensive and has to be paid for. There are several different funding models. Under some systems there is a pool of research funding which has to be bid for. Scientists present their proposals to other scientists on a competitive basis, with some expectation that the 'best' projects will be funded. Some of the funding for applied institutes may be obtained as a large uncommitted sum which is subsequently allocated by the director to the topics which are considered to be most appropriate. It is more common, however, for the bulk of funding to be allocated to specific topics or subheads, approved by civil servants working for the parent department. In many countries funding for research in support of policy is allocated through contracts placed with institutes which work directly for the government.

It is, of course, in the long term interests of government departments to seek objective and independent information and advice, completely free from political influence. Nevertheless, within departments there will inevitably be pressure to seek advice which meets the department's own administrative and political needs and preferences. There will also be pressure from government departments to seek

control of the release of information to others. Thus, there is a risk that in commissioning research to support their own policies government departments may influence unduly the topics to receive attention, the nature of the advice and the openness of that advice. Finlayson (1994) has drawn attention to the likely conflicts which will arise from the marriage between scientific rationality, on the one hand, and bureaucratic rationality with its own pragmatic and political tradition on the other. In general it is in the interests of politicians to weaken the boundary between the state and its scientific advisers, while it is in the interests of scientists to circumscribe and strengthen that boundary.

A recent development within some countries has been the introduction of the customer/contractor principle for funding science. In the UK, this principle was formulated in 1972 by Lord Rothschild, the government's Chief Scientific Adviser. Rothschild was critical of the autonomy of many government research institutes and their freedom to devise their own 'applied' research programmes. He concluded that however distinguished, intelligent and practical scientists might be they could not be left to decide upon the scientific needs of the country. Applied research and development must have a customer. He propounded the idea that applied research must be done on a customer/contractor basis, whereby: *'the customer says what he wants; the contractor does it (if he can); and the customer pays'*.

The notion that government, representing the public at large, should decide on the priorities for the research and advice required and paid for by the nation seemed eminently sensible. The same principles would not of course apply to basic, 'blue skies' research, or exploratory research, where the views of scientists themselves were of particular value in deciding priorities. However, it was deemed entirely appropriate that where a government department needed research for its own direct use, then it should have a strong influence on what was to be done and paid for.

These reforms in funding, which took place throughout Europe and North America, put government departments firmly in charge of deciding on priorities for applied research and development. Departmental customers were empowered to direct science to the areas that they deemed most appropriate. The research institutes themselves became dependent on short-term contracts from the departments. Some loss of scientific independence was inevitable. There was a temptation for departments to fund research into politically preferred management options, while research into other areas was neglected. The power of research scientists to steer the scientific programme and ensure that science was independent was significantly eroded.

Control over the findings of government-funded science

One of the potential risks when science is funded by governments is that control will be exerted on the release of information. Governments and civil servants may not be content to allow the release of information which shows that a policy is not working, or points to a policy other than the one adopted. Most governments impose rules on the disclosure of information upon their civil servants, including their own scientific advisers.

Thus, in Canada, scientists from the Department of Fisheries & Oceans (DFO) are subject to Media Relations Guidelines. The guidelines state that a scientist is free to provide only 'factual' information to the media and only then if their statement *"describes or explains programs or policies that have been announced or*

implemented by the government". DFO scientists are discouraged from releasing facts which contradict policies adopted by government. The guidelines have been rigorously enforced in the past, affecting the openness of scientific advice, as documented by Hutchings *et al.* (1997), although Doubleday *et al.* (1997) have disagreed.

Restrictive rules over the disclosure of information certainly apply in many countries. They came to the fore in the 1980s, when there were a number of instances of information being released by civil servants to the disadvantage of the government. There followed extensive debate about the responsibilities of civil servants to their Ministers. In 1985, the head of the UK Civil Service drew up guidance on *The Duties and Responsibilities of Civil Servants in Relation to Ministers*. That guidance said: *'The civil service as such has no constitutional personality or responsibility separate from the duly elected Government of the day. It is there to provide the Government of the day with advice on the formulation of the policies of the Government, to assist in carrying out the decisions of the Government, and to manage and deliver the services for which the Government is responsible . . . The civil service serves the Government of the day as a whole, that is to say Her Majesty's Ministers collectively . . . The duty of the individual civil servant is first and foremost to the Minister of the Crown who is in charge of the Department in which he or she is serving'*. It continued: *'When, having been given all the relevant information and advice, the Minister has taken a decision, it is the duty of civil servants loyally to carry out that decision with precisely the same energy and goodwill, whether they agree with it or not'*.

This statement did not allow for the certainty that civil service scientists would sometimes be faced with the release of misinformation from the government, or with distortion of their scientific advice. It did not acknowledge that some civil servants were professionals with their own codes of ethics. Nor did it accept that obedience to a Minister had its limits. Recognition of these difficulties subsequently led to a new code emerging in 1996. The new code maintained the position that civil servants were servants of the Crown and of the Government of the day. However, this position was set in the context of a broader duty on civil servants to act *'with integrity, honesty, impartiality and objectivity'*. Civil servants had broader responsibilities to the public and Parliament as well as to their departmental Ministers. Indeed, the code set out what the civil servant should do in the event of perceived maladministration.

However, it is evident that the loyalty of government scientific advisers is primarily owed to the government of the day. Formally, a scientific adviser cannot contradict a Minister, or a statement from the parent department. Although such a position does not limit the scope of the advice given to the Minister, it does limit the release of that advice to the general public or to the media and it may result in any advice which is contrary to the Minister's position being suppressed or simply not made available. Public statements by scientific advisors responsible to government departments must always be treated with caution.

Legislation has been introduced in a number of countries which enables the press and general public to seek information from government. It remains to be seen whether these 'Freedom of Information' acts will influence civil servants in the way they brief Ministers.

Independent scientific advisers

It is comparatively rare for scientists, working in universities or elsewhere, to become heavily involved in providing day to day advice on the management of fisheries. There have been a few notable exceptions. A number of consultancy companies, some with links to universities and others operating as independent companies, provide advice to governments around the world, often through international development agencies, the World Bank and the United Nations Development Program. Independent scientists, many of them formerly from government institutes, also act as advisers on fisheries matters to organisations like development agencies, with a changing portfolio of projects. In some instances, government departments or the European Commission may contract out elements of their programmes to achieve benefits from competition, but generally fisheries scientists work for governments.

Some use may be made of 'expert witnesses' where there are legal disputes with respect to scientific or management issues. There are academic scientists and industry experts who will provide research, consultation, and expert testimony for use by litigators and lawyers. Such experts have often been schooled in legal processes and form part of an expert witness community – sometimes going from one inquiry or court room to another. They have become skilled at translating science into legal language which can be understood and accepted by the court. There is some controversy over the role which is played by such professional expert witnesses, particularly with respect to the issue of whether the evidence they give is specifically tailored to suit the interests of their client, rather than independent advice to the court. There is also the accompanying issue of whether they should be penalised by the court for evidence which is subsequently discredited, as has often been the case. The UK Attorney General has stated: *'It is crucially important that expert witnesses should assist the court conscientiously and objectively, rather than being tempted to give any evidence that suits their client's case. To that end, the threat of fitness to practice proceedings against them provides an important check which is calculated to assist significantly in the administration of justice and also to promote public confidence in the judicial process.'*

Nevertheless experts, whether they work for governments or other organisations, may be put under pressure to lie. The distortion of science and scientific knowledge is a particular problem where interest groups may benefit from generating false science or by bringing scientific knowledge into question. Lobby groups may, for example, deliberately seek to falsify data relating to the presence of toxic substances in foodstuffs. Particular industries may seek to refute or undermine information coming from the scientific and medical community on the dangers of their products, or may seek to exaggerate the efficacy of medicinal products. It is not entirely out of the question that government scientists will present information in such a way that it favours the views of those who have funded their work or provided the authority for it to be carried out.

Sheila Jasanoff has written extensively on the admissibility of scientific evidence in courts of law. In the *The Daubert versus Merrell Pharmaceuticals Inc* case in the USA in 1993, the Supreme Court ruled on the admissibility of scientific evidence, opining that it was for a judge to decide whether evidence passed the test of relevance and reliability. Especially important was Daubert's assertion that scientific criteria should govern the assessment of science in legal settings. Jasanoff (2005) has questioned whether this embrace by the courts of the imagined clarity, certainty, and rationality of science is appropriate. She has called for a re-evaluation of the

decision's fundamental assumptions about law, science, and their inter-actions. The law develops knowledge as an aid to doing justice in a particular case; by contrast, science seeks truths that are, as far as possible, detachable from their context of production. Jasanoff asks how courts can better render justice under conditions of uncertainty and ignorance. She points out that both courts and laboratories can be thought of as experimental spaces in which assertions about reality are constructed, presented, tested, held accountable to standards, and eventually determined to be reliable or unreliable. Moreover, through cross-examination and peer review, witnesses in both law and science are held accountable to sceptical inquirers, who are free to question the foundation of the witnesses' claims.

The boundary between science and non-science

Wilson (2007), as part of the SAFMAMS project, has looked at the boundary between what is science and what is not science. He emphasises that the distinction is not always easily made, but on the other hand it cannot be assumed that such a boundary does not exist.

Haas (2004) has argued that there where there is no scientific consensus then science must be kept separate from policy. Where agreement exists within scientific communities then a strong influence may be exerted by science upon policy. Wilson points out that the situation is much more common where consensus is patchy or incomplete. Earlier it has been pointed out that science does not work through consensus. Dissent and questioning of the established view is the way that science moves forward. Basing policy on a consensus view runs the risk of being based on ideas which may subsequently be shown to be false. This does not mean that a barrier must always exist between science and policy, however. What it does mean is that public policy cannot always be justified and rendered immune from criticism simply by saying that it is based on scientific consensus. A particular policy cannot be justified on the grounds that it is dictated by science or has the support of science.

Wilson draws attention to the heavy burden which policy-making places upon science. Policy processes use different standards of evidence and burden of proof than science. Policy makers want science which will underpin and justify policies and make them immune from criticism. Real science cannot always provide such clear and incontrovertible support for policies.

Wilson concludes that the attributes which make a set of findings useful for policy are saliency, credibility and legitimacy.

Saliency reflects whether a scientific assessment is addressing questions relevant to the policy

Credibility reflects whether the arguments meet standards of scientific plausibility and technical adequacy

Legitimacy reflects whether the assessment is perceived as unbiased and meet standards of political fairness

There may be trade-offs between these attributes, and efforts to boost one may be at the expense of the others.

Wilson examines various established theories from social scientists about the science-policy interface. He concludes that mechanisms for maintaining saliency, credibility and legitimacy often involve scientists and non-scientists working together. Four principles facilitate this interaction. The first principle is evaluation and reflection; management measures must be treated as experiments (the adaptive management concept of Holling, 1978). The second is to search for consensus between scientists and decision-makers – although the consensus must not go so far that either party is uncomfortable with it. The third is participation; there are advantages in involving stakeholders in science-based policy. The fourth principle is transparency; findings must be freely available to others

Inquiries into scientific advice

There have been a number of instances where science has come under suspicion and scrutiny. In some cases, conventional science has been dismissed by a significant number of people in favour of false science. The controversy over the role of the MMR vaccine and autism in children is one example. The MMR vaccine is a mixture of three live attenuated viruses, administered via injection for immunisation of children against measles, mumps and rubella. In the UK, the MMR vaccine was the subject of controversy after publication of a paper reporting a study of twelve children who had autism spectrum disorders and bowel symptoms; in many cases with onset observed soon after administration of MMR vaccine. The paper was responsible for triggering a decline in vaccination rates, with the result that children were placed at risk of developing three serious diseases. The paper was subsequently criticised on scientific grounds for the way the research was conducted. Authorities later concluded that there was no evidence of a link between the MMR vaccine and autism.

There are real instances where scientific advice has led to errors in judgement on major public issues. We shall look at two examples where the presentation of scientific advice to governments has come under close and independent scrutiny.

The UK Inquiry into BSE

The application of science to solving a major incident of modern times was examined very closely in the UK BSE Inquiry (Anon., 2000).

Bovine Spongiform Encephalopathy (BSE, or mad cow disease) is a chronic, degenerative disorder affecting the central nervous system of cattle. The first clear cases were diagnosed in 1985-6 in the UK, where the disease itself and policies for dealing with it subsequently inflicted major damage upon the livestock rearing industry. Subsequently, the consumption of meat infected with BSE was found to cause a major disease of humans (vCJD; variant Creutzfeldt-Jakob Disease) with devastating effects upon the individual. BSE has since been found in cattle in other countries.

BSE presented baffling scientific problems. Initially it was not known how it had originated, how it was transmitted, whether it posed a threat to humans, or how best to contain it. Ministers and civil servants had to take decisions amidst considerable uncertainties in an area that straddled animal and human health, involved public and private sector interests and high economic stakes, and rapidly became the focus of continuing media scrutiny. It was a challenging test of the capabilities of the public

administration, and in many respects that administration failed. The risk from meat infected with BSE was underestimated. Approved practices exacerbated the spread of BSE.

The inquiry into these failures concluded that it was best to involve the wider scientific community in seeking advice on controversial issues; not simply to rely on advice from government advisers. The report also pointed out that in its anxiety to act in the best interests of human and animal health the government had frequently sought and followed the advice of experts when decisions could have been reached more swiftly and satisfactorily within government.

The experience with BSE provided lessons for the future about the proper use of experts by the Government. The inquiry concluded that expert groups have a particular role to play in advising on future research. However, in terms of communicating with the public the role of experts is less effective. Warnings about the real risk to humans from BSE were not communicated to the public or to those whose job it was to implement and enforce precautionary measures. Indeed, the gathering of data about the extent of the spread of BSE was impeded by an embargo within the government veterinary service on making information about the new disease public. The public was also repeatedly reassured by experts that scientific advice had confirmed that it was safe to eat beef, when this was not so. The inquiry concluded that the Government and its advisers were preoccupied with preventing an alarmist over-reaction to BSE. It remarked: "*there may always be a temptation for experts advising government to 'lean into the wind' or to provide reassurance to the government when such reassurance is dangerous*".

The inquiry emphasised the need to identify the best sources of expert assistance; competition for research projects; peer review of projects; and efficient arrangements for exchanging material and data. The inquiry also made extensive recommendations regarding the establishment of scientific advisory committees.

Gerodimos, (2004) has written his own critical account of the BSE crisis. He argues that developments at the centre of government in the UK had resulted in a fragmentation of interests, responsibilities and resources and made co-ordination difficult. He concludes that the handling of the BSE crisis was a disaster in terms of public administration, risk assessment and governmental management of public health issues. It brought to the surface deeper problems within Whitehall, such as the culture of secrecy and inter-departmental conflicts. Additionally it raised constitutional questions regarding ministerial responsibility, accountability and the role of unelected civil servants. In Gerodimos' view, the Ministers responsible for handling BSE depended excessively on civil servants and experts for the formulation of their decisions. Lack of political scrutiny by Ministers became more damaging because civil servants actively tried to influence the outcome of committees' deliberations so as to give a message of reassurance to the public and industry. The scientific advice itself was neither conclusive nor always correct. Ministers used scientific advisory committees to legitimise their decisions. It was tempting, when faced with a risky or unpopular decision, for Ministers and their civil servants to fall back on committees of experts as the source of their decisions: '*We have to follow the advice of our scientists...*'. Politicians and officials during the BSE outbreak tried repeatedly to hand responsibility for the management of the crisis to experts. Gerodimos concludes that by doing so they hoped they would avoid being held responsible themselves for the consequences of the crisis.

Gerodimos also draws attention to the significant problems that arose with transparency of information: "significant decisions were based on (confidential)

expert advice by (unelected) civil servants (under oath of secrecy) with minimum consultation". Gerodimos decided that what emerged was the image of an insecure government that wanted badly not to be responsible for what was happening. By giving away responsibility for decision-making to experts the government tried to avoid its own culpability.

The collapse of Canadian cod stocks

In 1992, the once abundant northern cod stocks off the coast of Newfoundland and Labrador collapsed. This event was remarkable, given the great abundance of cod which had originally drawn European adventurers to explore the region. From the 15th century onwards, French, Portuguese and English adventurers had found huge schools of Atlantic cod in the coastal waters around Newfoundland and Labrador. The cod fishery became a dominant economic activity in the northwest Atlantic which was sustained until the 20th century. The collapse of the cod in the 1980s and 1990s profoundly altered the relationship between fishers, the government and scientists. It resulted in major changes to the fisheries management structure in Canada.

In July 1992, the Canadian Federal Minister of Fisheries announced a moratorium on fishing for cod in the waters surrounding Newfoundland. Although that moratorium was initially intended to remain in place for only two years the ban has lasted until today, with only small exceptions in terms of sentinel fisheries (fisheries intended to monitor the state of stocks). Rural Newfoundland, where the fishery was one of the largest employers, was economically crushed (Steele *et al.*, 1992). Historical records suggest that northern cod had previously experienced fluctuations in abundance (Harris, 1993), but not on the scale of the final collapse.

The collapse was preceded by a period of high catches. Northern cod catches peaked at almost one million tonnes *per annum* in the 1960s, with many foreign vessels fishing offshore. However, in 1977, as part of the United Nations Law of the Sea negotiations, Canada declared a 200-mile exclusive fisheries zone. Fishing by foreign vessels was phased out, or forced further offshore. The main offshore fishery became a Canadian one, for which the federal Department of Fisheries & Oceans (DFO) developed a science-based system of fisheries management (Parsons, 1993). There followed a period of optimism and expansion.

Scientific assessments of the state of cod stocks were carried out annually by Canadian scientists and adjustments to the fishery made from year to year. In 1982, and again in 1986 and 1989, crises in the fishery led to the setting up of task forces to report to government on the state of the fishery. An early Task Force Report (Kirby, 1982) concluded optimistically that cod stocks would increase in strength. Investment in the fishery was increased and landings continued to grow. By 1986, however, it was evident that catches by the inshore fleet were declining – although offshore catches continued to increase. There was pressure to investigate the inshore decline, leading to a further report (Keats, Steele & Green, 1986), commissioned by the Newfoundland Inshore Fisheries Association. This report was highly critical of DFO's data sources, statistical procedures and conclusions. DFO itself deemed the report superficial. A task force was subsequently established by the Minister of Fisheries and Oceans, consisting of three independent biologists from outside Canada. The subsequent Alverson Report (1987), named for the independent and eminent American biologist Lee Alverson who led the group, reported that estimates of the growth of the stock may have been over optimistic and expressed concern over the low estimates of fishing mortality.

Finlayson (1994), in later examining the causes of the subsequent collapse, opined that the task group's internal assessment of the science was more critical than the impression conveyed by their actual report. The release of the report was closely followed by a change to a more conservative assessment methodology. Publicly, DFO maintained that the task force had come to much the same conclusions as the actual assessments. Nevertheless, by 1989 the assessments from DFO had changed. A revised model indicated that cod abundance may have been over-estimated, perhaps by one third. The Harris Commission (Harris, 1990), formed to investigate the discrepancy, was critical of the earlier DFO assessments. It concluded that the northern cod was being fished at levels that pointed towards commercial extinction. Quotas were progressively lowered but it became apparent by 1992 that cod stocks were in a poor state and that a serious imbalance had developed between the size of the fishing fleet and the state of the northern cod stock. The fishery was closed.

Most of those writing after the event have concluded, unsurprisingly, that over-fishing was the primary cause of the cod collapse. Rose (2003) has, however, pointed out that such an explanation is unhelpful in understanding how a collapse could have occurred in fisheries that were thought to be well-managed and informed by state-of-the-art science. He concluded that scientific understanding of the cod fisheries had simply been inadequate and that 'signals of change' in the northern cod ecosystem were not sufficient to trigger management action. A number of scientific reviews have also concluded that environmental changes were important in influencing various aspects of the decline (e.g., Rice, 2002; Drinkwater, 2002).

There have been several accounts of the role played by fishery scientists in the cod crisis (Finlayson, 1994; Rose, 2003). It has been argued that DFO scientists set the catch quotas for the cod fishery at too high a level (Steele *et al.*, 1992). A view prevalent at the time was that there had been a failure in the stock assessments (Finlayson, 1994). Government too was blamed for setting the quotas above the levels recommended by the scientists in some years.

Finlayson (1994) conducted extensive interviews with scientists and managers in DFO. He concluded that the failure to predict and foresee the collapse in fish stocks arose from an inability on the part of scientists to recognize how their interpretations of natural reality were the result of the social context they found themselves in. This makes the scientific failure associated with the cod collapse a particularly fascinating one, and one which we must try to understand if we are to manage fish stocks better in the future.

Estimates of the cod stock made by DFO scientists were based largely upon commercial catch rates, with adjustments for growth and natural mortality. There were problems with this method of estimation. With the increasing technological efficiency of the fleet and the improved knowledge on where to find cod (the technology creep mentioned in section 2), the catch rate remained high although the stock was in steep decline. In addition, misreporting of actual catch, unreported landings, and the large by-catch of cod from fishers harvesting other species meant that more cod were being taken than the estimates allowed for. By the mid to early 1980s, before the collapse occurred, inshore fishers were reporting that cod were declining, and that increased effort was needed to maintain catch levels. It was pressure from fishers within the Newfoundland Inshore Fisheries Association which resulted in the Alverson report, which indicated that the abundance assessments were optimistic and queried the low estimates of fishing mortality (Alverson, 1987).

Rose (2003) has since pointed out that the Canadian trawler fleet data series were misinterpreted by DFO scientists. Catch rates of the fleet were continuing to increase and those increases were interpreted as evidence of increasing abundance in the northern stock. Dissent from other scientists about the state of this stock went largely unnoticed at the time. Stock assessment was seen as the task of DFO. There was no independent fisheries science programme, and scientists outside DFO were unable to gain access to the data on which the stock assessments were based. An anomalously high survey result in 1986, which occurred for reasons still largely unknown, gave support to DFO's optimistic view of northern cod and led to continuation of unsustainable harvest rates. Offshore fishers were not neutral during these controversies and maintained that northern cod were as plentiful as ever. Remarkably, the trawler CPUE continued to increase, right up until the closure of the fishery in 1992.

Finlayson believes that DFO scientists in the 1980s constructed their own version of reality which has now been accepted as erroneous. Although scientists may have been unduly influenced by the government's wish for high TACs, there appear also to have been other internal influences at work. Rose (2003) has pointed out that there was no effective opposition to the prevailing optimistic view of cod either within or outside DFO. The barrage of scientific papers condemning DFO for mismanagement of the northern cod did not appear until the mid to late 1990s; in hindsight. Some of the early signals of ecosystem change and cod decline were recognized by fishers and scientists. However, this recognition was insufficient to influence management decisions. Alcock (2001) has contrasted the circumstances leading to the collapse in the cod fishery in New England and Newfoundland. He concludes that the scientific assessments proved ineffective determinants of sustainable policies in both cases. However, in New England, ominous assessments were ignored by decision-makers, whereas in Newfoundland more optimistic assessments led decision-makers astray.

Guidelines for providing scientific advice

The task of ensuring that scientific advice was objective and fit for purpose were subsequently addressed in Canada as a result of the crisis arising from the collapse in the cod fishery. In 1999, the Council of Science and Technology Advisors (CSTA) produced *Science Advice for Government Effectiveness* (the 'SAGE Report'; which was adopted as the standard for scientific advisory processes in Canada. A set of SAGE Principles and Guidelines followed soon after.

'Science advice' was defined by the CSTA as: '*value-added guidance deriving from scientific theories, data, findings, and conclusions provided to inform policy and regulatory decision making*'. The SAGE report pointed out that the emergence of a knowledge-based society had underscored the importance of sound science advice as a key input to policy formulation both nationally and internationally. Science and technology now affected most core government functions. The issues facing governments were increasingly complex and required decisions that had profound impact on societies and economies. Many of these decisions involved risk assessments that aroused public concerns about their health, safety and long term well-being; others attempted to capitalize on the opportunities afforded by advancements in science and technology.

The principles outlined by SAGE required:

- Early identification of any problem requiring scientific advice.

- Advice being drawn from a variety of scientific sources and from experts in many disciplines.
- Measures to ensure the quality, integrity, and objectivity of the science, and to ensure that science advice was considered seriously in decision making.
- The assessment, communication, and management of uncertainty and risk.
- Openness and transparency.
- Subsequent review of the advice given and decisions taken.

Conclusions

The faith that people may once have had in science has been eroded in recent years. The failure of science to resolve a number of major issues has undoubtedly contributed to this lack of confidence, but there also appears to have been a change in overall attitude towards experts and their advice. There is greater recognition that experts can be wrong and that their advice can be influenced by the context in which they provide it. In some instances, experts may give false evidence, not always knowingly, to support a particular point of view.

Bäckstrand (2003) has considered how science is used in a public context and has concluded that public trust in science can only be restored by re-orientating it to deal with the complexity of modern day problems. There is a need to increase public participation in the production and use of scientific knowledge through a triangular interaction between scientific experts, policy-makers and citizens. The idea that scientific ideas should receive full discussion and examination is of course not new. It is fundamental to the ethos of science that ideas should be questioned by others.

It is clear that there is a major difference between science in support of public policy and private academic science which makes it especially important that scientific arguments emerging from government should be subject to debate and questioning. Getting public science wrong can affect adversely the health of many people, cause the slaughter of large numbers of valuable cattle, bring economic disaster to fishers and their dependents or alternatively cause the collapse of valuable fishery resources. Rather than engage in extended discussion about the philosophical import of science it seems better to base our use of science on the experience which has been gained in the past by governments and others

At the beginning of this section we asked what precautions we should take before accepting scientific advice. It is evident that there are a number of steps which can be taken.

Scientific advice must be expressed in language comprehensible to ordinary people. We have seen that when scientific advice is being presented to fisheries managers and fisheries stakeholders there may be a clash of cultures. The methods, assumptions and forms of discourse of the scientists may differ substantially from those of other participants. In these circumstances we must ensure that scientific arguments can be understood by others, so that they may be questioned and debated. The rationality of scientific arguments needs to be examined by lay persons as well as by experts.

Advice must be sought from several sources. Currently, much of the advice required by government departments is commissioned through a customer/contractor principle from in-house experts in government-owned institutes. Overall command of the research is in the hands of the government, and the release of information is controlled by civil servants and politicians. Even where advice is sought from national and international working groups there is a strong tendency for the members to be drawn from government institutions. Such strong top-down control may have severe consequences.

As the BSE Inquiry found, there is a loss of diversity in the science; which may result in serious errors developing. Moreover, control of the release of information by government ensures that these flaws go unnoticed. Assurances from government scientists during the BSE crisis that beef was safe to eat, and the refusal of DFO scientists to reassess the state of northern cod stocks both demonstrate this problem. Perhaps most seriously, without bringing in outside scientists the advice may not be completely independent; it may be influenced by the wishes and priorities of those seeking the advice. It is no longer satisfactory to regard scientists as completely objective and independent observers. Rather than rely on the impartiality of a narrow cadre of specialists it may be better to seek a diversity of expert advisers.

The role of scientists in providing advice on policy questions must be decided at the outset. Are they present to provide independent information and advice or are they there to present the point of view of their employers? This leads to a further question. Are the experts present being asked to take management decisions? Or are they present simply to give advice? It will often not be appropriate or sensible to expect experts to decide on policy, where political factors may be more important. The BSE Inquiry pointed out that if an advisory committee is asked to advise on policy, there may be little alternative but to follow the advice given.

Where policy involves the balancing of considerations which fall outside the expertise of the advisers, it is not appropriate for those advisers to decide on policy. Questions to advisory committees (or to individual scientists) must therefore be formulated with great precision to make sure that the advice falls within their particular expertise and does not go beyond it. It is often forgotten that individual experts may have very limited experience outside their own fields. As Mary Midgley (2001) has pointed out, the learned are often importantly foolish. The case histories examined above have stressed the value of involving lay persons when issues of public interest have to be resolved.

Maintaining the independence of science from management and political processes is critically important. Arrangements must be put in place to ensure that both the quality and direction of science is not unduly influenced by the wishes of government. It is always essential to question assertions by government that their decisions are supported by science. There are strong pressures on politicians to seek the authority of science to justify unpopular decisions rather than admit that decisions were taken for other reasons.

Data underlying scientific advice must be available for re-analysis by others and the process for obtaining data must be transparent. There are significant disadvantages to considering scientific evidence behind closed doors or denying access to the underlying data. Yet this may be practiced, on the basis that others cannot be expected to understand the technicalities and may misinterpret the findings. The BSE Inquiry stressed that openness was especially important when there were uncertainties and concluded that *'If doubts are openly expressed and publicly*

explored, the public are capable of responding rationally and are more likely to accept reassurance and advice if and when it comes'.

Scientists themselves benefit enormously from exposing their work and their assumptions to criticism by others. As Kuhn suggests, it is commonplace for particular scientific ideas to become dominant, and to exclude consideration of other hypotheses or explanations. Review of science by other scientists –peer review – is also important with the proviso that the 'peers' must be drawn from a sufficiently wide pool.

The Canadian SAGE principles on the provision of expert advice give especially valuable guidance, based on experience of a crisis in fisheries management. The principles stress the need for early identification of scientific problems. They point to the need for quality assurance, through peer review and other mechanisms. They draw attention to the importance of taking account of uncertainty, together with the need to publish and disseminate widely all scientific evidence and analysis. They agree with the BSE Inquiry in underscoring the need for advice to be drawn from a variety of scientific sources and from experts in many disciplines in order to capture the full diversity of scientific thought and opinion. Indeed, they consider that due weight also needs to be given to the 'traditional knowledge' of local peoples.

Our next step is to consider the role of the wider community in providing advice on the management of fisheries.

6. Participation in the management of fisheries

The benefits of stakeholder involvement

The philosopher Jürgen Habermas (1984) has argued that the law derives its validity from the consent of the governed. Democratic public life only thrives where institutions enable citizens themselves to debate matters of public importance. Habermas emphasises the potential for transforming the World through dialogue to arrive at a more humane, just, and egalitarian society. Although Habermas' arguments are exceedingly obscure they do make a convincing philosophical case for greater involvement of those being governed in government itself.

Gray (2005) has drawn a distinction between the hard concept of *government*, with its connotations of a legally-based, centralised, sovereign state authority, formally elected and possessing constitutional powers, and the softer concept of *governance*, with its connotations of informally-based, decentralised, shared, collective and inclusive decision-taking structure. With the former, popular participation is through the electoral system, with national and local government elections, open to all, choosing representatives to take decisions on behalf of the general populace. With participative governance the state plays a less intrusive role and elements of decision-taking are devolved to stakeholders.

There is a risk that any system of participative governance, where a restricted number of 'stakeholders' are chosen to take part in decision-taking, might be seen as undermining the system of representative government. Certainly the elected representatives of the populace may be by-passed by interest groups and their role diminished. Gerodimos (2004) in his examination of the BSE crisis points out that the delegation of policy-making and implementation to informal networks creates a major problem for governments in terms of accountability. Thus, within a traditional system of representative government there may be legitimate opposition to the handing down of management powers and responsibilities to unelected stakeholders, who may be seen by some as lobbyists or representatives of special interest groups. With respect to fisheries, it could be argued that members of fishing communities are already adequately represented through their democratically elected representatives in national parliaments. Handing over or devolving power to fishers, even partially, diminishes the democratic process.

There are several circumstances where these arguments can be set aside. If decision taking and regulation is not democratic, but is exercised by unelected officials, then a democratic deficit exists. It is legitimate to seek greater involvement of those being regulated. Equally, if regulation through the legitimate democratic process has proved ineffective and has resulted in mismanagement or failure to conserve resources then there is clearly a case for considering alternatives. It has been argued that both these conditions prevail with respect to decision-taking within the European Common Fisheries Policy (CFP). There is undoubtedly a democratic deficit. Both Symes (2005) and Hawkins (2005) have drawn attention to the dominance of bureaucrats in decision-taking under the CFP and the lack of involvement of elected representatives through the European Parliament. Moreover, the actual process of managing EU fisheries has run aground. The European Commission's own Green Paper on the reform of the CFP has acknowledged the major difficulties which have been encountered (sections 7 & 8).

Political scientists, for example Rhodes (1996), have made rather a meal out of discussions of new systems of governance. Rhodes has associated governance with minimal state interference, the 'hollowing out of the state' and new systems of public management. It is evident, however, that the concept carries different meaning for different people. Some take the term governance as describing recent changes in the public sector associated with new systems of public management, the establishment of executive agencies, the devolution of powers and even the privatization of public functions. Others think in terms of the transfer of responsibility for management decisions from the state to networks of stakeholders. Though such discussions have their place, here we are simply considering the development of new political structures for enhancing decision-taking. The crux of the problem is designing new structures for decision-taking which improve upon the *status quo* in terms of their effectiveness and degree of satisfaction to stakeholders, but which are equitable and can still be held accountable by the public at large.

An independent inquiry has recently been carried out into democracy in Britain, by the Joseph Rowntree Trusts. Their report - the Power Inquiry – (Anon., 2006) was critical of the state of formal democracy in Britain. It pointed out that many people actively support campaigns by Greenpeace or the Countryside Alliance, and millions more take part in charity or community work; but political parties and elections are receiving less and less support. The inquiry concluded that the cause was not apathy. People simply did not feel that they had real influence over decisions made in their name. Nothing less than a major programme of reform was needed to give power back to the people. The inquiry recommended a rebalancing of power away from the executive; greater responsiveness and choice in the electoral and party systems; and allowing citizens a much more direct and focused say over political decisions and policies. Power should be passed downwards. A culture of political engagement should be created in which it becomes the norm for policy and decision-making to occur with direct input from citizens. That is the essence of what Habermas was also saying. There is political as well as philosophical support for new forms of participative governance.

The governance of fisheries

Both Hawkins (2005) and Gray (2005) have emphasised a loss of faith in the abilities of governments and inter-governmental agencies to manage fisheries, and a current unwillingness by fishers to defer to bureaucrats and experts. Hawkins has emphasised the particular distrust of fishers of stock assessments and advice given by scientists. Fishers are aware that in some instances the information available to them may be more up to date and detailed than the information being used by scientists

Science often deals with difficult and controversial subjects, especially in trying to resolve issues of risk to the environment and natural resources. New ways of obtaining expert advice are required in these areas where unpredictability, uncertainty and poor control over management are the norm. Dialogue between interested parties – stakeholders – becomes important, especially when the economic and social implications are large. For example, where people's livelihoods are at stake but there may also be threats to the environment; where alternative interests are at stake. Thus, the increasing pressure to involve stakeholders in decision-taking has emerged, not just because of dissatisfaction with the way scientific advice has failed in some contexts, but also because it has become apparent that there are real advantages to be gained from public dialogue over

critical scientific issues. Brian Wynne's study of sheep and nuclear safety drew attention to the importance of the interaction between "formal" and "informal" expertise (physicists and farmers) in understanding and dealing with nuclear pollution risks on the Cumbrian fells resulting from the Chernobyl incident (Wynne 1996).

Wilson (2007) proposes that participation by stakeholders in science-based policy increases the legitimacy of the advice. It promotes buy-in to the process itself. It also ensures that the experienced-based knowledge of stakeholders is not neglected. Wilson draws attention to the idea of Ravetz (1999) that effective science-based policies in arenas of high stakes and high uncertainty require an open dialogue with all those affected. The term '*extended peer community*' is used to define those people who have the knowledge to contribute to analysis of the problem, who can contribute to reality-checking.

Paul Nutt in his book *Why Decisions Fail* (2002) carried out a thorough analysis of a large number of strategic decisions. He found that many decisions 'failed' because decision makers did not attend to the interests and information held by stakeholders. Much of the management literature reports similar findings. Integrated thinking and wide agreement are important, especially with respect to regulation of the environment. Friedrich Hayek has pointed out that knowledge is inherently dispersed. No single manager or administrator can know all that should be known. Others must be consulted. There are therefore major benefits to be gained from involving stakeholders in the agreement of policies, plans or practices whether at a strategic or local level. Without stakeholder engagement, proposals lack the support and information they need for successful implementation. Their introduction may become confrontational, with any benefits being lost in argument, delay and legal challenge.

There is a strong case for arguing that those affected by fishery regulations should not just be informed or consulted on management proposals; they should have a genuine opportunity to influence the outcome and agree the best way forward. Public participation is a key ingredient of good governance, aimed at engaging the public; resolving conflict; and improving decision quality. Hatchard (2005) points out that stakeholder participation improves the perceived legitimacy of governance, and may improve compliance. Participation is also a particular feature of adaptive management (Holling, 1978), where managers join with others to learn from the results of their actions. Thus, there are philosophical, political (in terms of legitimacy and fairness) and pragmatic (better decision-taking, increased compliance) advantages to be gained from involving stakeholders in management.

The essence of participatory governance is the bringing together of stakeholders to solve problems and take decisions themselves, with experts involved in a subsidiary position as facilitators and advisors. Much has been written about participatory governance, but there is a lack of information on how to go about it. As Coffey (2005) remarks, 'public participation' is an ill-defined concept and the term 'public' itself is often interchanged with the terms 'stakeholder, user, interest, or citizen'. First, however, it is necessary to decide and define those people who should participate.

Stakeholders in fisheries management

The original definition of a stakeholder was a person who held a stake or resource for someone else, during a legal dispute or pending resolution of an argument. That

definition has now been superseded by much broader use of the term, where a stakeholder is any person with an interest in an activity or resource or with a 'stake' in any activity. The definition has shifted from an independent third party to someone with an actual interest. Because of this ambiguity some individuals are not happy with the use of the term and prefer to speak of 'interest groups'. We shall continue to use the term stakeholder but in its new sense which includes all those with an interest in fisheries, whether they are dependent upon the fisheries, like fishers themselves, or are concerned about the impact of fisheries upon other activities or upon the wider environment. We will not include regulators, enforcers or advisers as stakeholders. They have their own roles to play, which are well defined. They could be included in the stakeholder group, as their own careers are dependent upon the fishery, but their representation in fisheries management is already guaranteed.

The role of stakeholders

Stakeholders may simply be consulted in advance on proposed regulations. Indeed, within such consultation mechanisms there may be competition between different stakeholders, each seeking to ensure that their particular interests are well served. An example of this is the EU's Advisory Committee on Fisheries and Aquaculture (ACFA), where many stakeholders, representing a variety of interests, are gathered together to respond to fully worked-up proposals from the Commission. There is no attempt to reach consensus. Different interests present their disparate views and the Commission then decides what weight, if any, should be attached to them.

If stakeholder participation is the objective, then that engagement should involve more than *post hoc* consultation over decisions which have already been taken. Participation implies involvement in the decision itself.

Coffey (2005) has analysed public participation in a systematic fashion. She has drawn a clear distinction between the general provision of information to the public (weak participation) and intensive dialogue leading to conflict resolution and implementation of policy (strong participation) (figure 6). With all levels of participation, however, the challenge is to select appropriate people and then to engage with them.

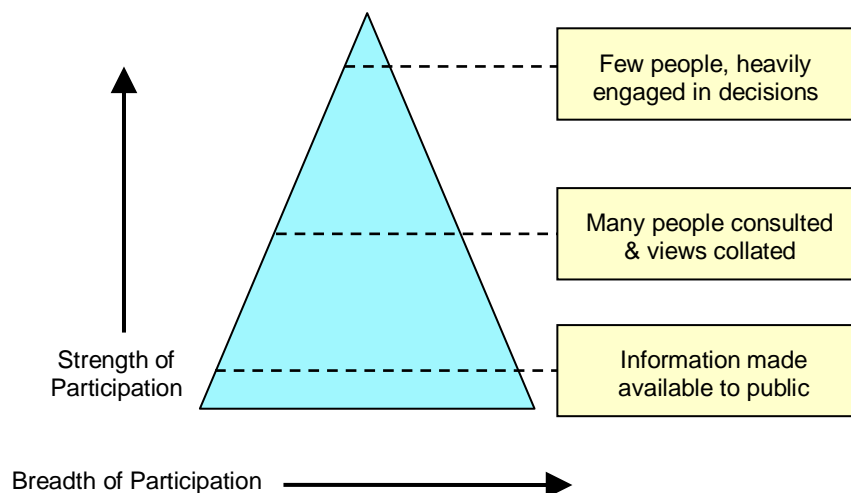


Figure 6, Levels of public participation (After Coffey, 2005)

It must not be forgotten that there are significant structural constraints that can operate against the involvement of stakeholders in management. Some stakeholders may have limited time and resources, while others may have more pressing matters to attend to. Inevitably, a plethora of stakeholders will emerge, representing many disparate interests. Reaching a consensus may be difficult.

The priority to be given to different stakeholders

It is evident that some stakeholders may have a stronger claim to interest than others. In seeking advice on fisheries management, a fisher whose activities may be regulated, whose livelihood may be curtailed by the fisheries management regime and who has a deep knowledge of fishing perhaps has a stronger interest than someone with an appreciation of wildlife who is simply concerned over the impact of fishing upon the marine environment. That does not mean that the views of the fisher are more important or more correct. It is simply that the fisher has a larger stake in the outcome. There is an issue in deciding on the weight to be given to various stakeholders.

Hatchard (2005) has pointed out that individuals with an interest in fishing may be wary of being treated as 'stakeholders'. Previous participants in earlier flawed stakeholder consultation exercises were openly derisory about the concept of 'stakeholding'. Some fishers perceived the concept to be a tool whereby non-fishing interests could be brought into decision-taking, thereby reducing the role of fishers themselves. There was also anxiety on the part of environmental interests, however, who saw the concept as one which might exclude some interest groups. In selecting stakeholders for a particular consultation exercise on the North Sea, Hatchard drew a distinction between those who were *dependent* upon the North Sea and those who *had an interest* in the North Sea. The former were regarded as primary and the latter as secondary. That distinction would seem to give greater weight to those who are dependent upon the outcome, and needs clarification.

As a first step in evaluating the weight to be given to different stakeholders we can consider those factors that would result in someone qualifying as a stakeholder. Such factors would include:

- **Direct interest.** The magnitude of a person's 'stake' and degree of direct interest in the activity to be regulated. In relation to fishing this might be the quantity of capital invested, the past income from the fishery, and the degree of dependence of income upon fishing. Thus, fishers, boat-builders, workers in the fishing industry, local shop owners and fish processors are all important stakeholders as they benefit substantially from fishing and may be strongly affected by any regulation of fishing activities.
- **Indirect interest.** The degree of impact of regulation upon the interests of those who are not engaged in the activity itself, but whose interests are nevertheless affected in some way, perhaps even improved, by its regulation. For example, fish farmers, other users of port facilities and recreational fishers. Although their interest in commercial fishing is indirect, their own lives may be affected to a considerable degree by any changes in the fishing industry. In some cases their stake in their own industry or activity may be very large, and their industry may be of considerable importance to the economy.

- **Public concern.** Those with genuine political concerns about fishing, who wish to influence decisions and make claims to representing public views. These persons may have no financial stake in fisheries management, but may nevertheless wish to influence management in favour of their wider anxiety about the environment and the impact of fishing upon wildlife and nature conservation.
- **Parallel interest.** Where others are engaged in activities which may compete and conflict with fisheries. Thus, gravel extractors, or proprietors of offshore wind-farms may qualify as stakeholders simply because their activities may have a significant impact upon fishing and its ability to be regulated. Privileges granted to fishers may impair the ability of such competitors to operate.

The degree of knowledge and experience of an individual or group may also have a bearing on the validity of their claim to be considered as stakeholders. Someone with a deep knowledge of fishing may have a stronger claim than someone who has never been to sea in a fishing boat. Equally, however, environmental interests may claim that they have access to high levels of scientific advice through the size and financial resources of the organisations they belong to.

Rather than attempt to evaluate the relative status of different stakeholders from a theoretical standpoint it may be better, on purely practical grounds, to identify those stakeholders who are essential to the successful regulation of any activity. Which parties cannot be left out if participation is to be effective? On this basis the selection of stakeholders would involve the creation of a viable group of influential people, able to work together, where the omission of any one of them would seriously impair the likelihood of public acceptance of any decisions made. Many descriptions of stakeholder selection point to the need to identify and select such key stakeholders through some form of collective process. It is necessary for potential participants to sit around a table, together with those who will carry ultimate responsibility for the decisions taken, to consider the arguments for including particular interests.

In addition, on grounds of natural justice, it would be wise also to include any persons who although lacking in power and clout may nevertheless regard themselves as key stakeholders. Selection must be seen to be equitable; it must be possible for all with an interest in the regulated activity to be represented; and if there is to be any weighting attached to stakeholders then it must be explicit and capable of justification.

Hernes *et al.* (2005) have attempted to apply principles of social justice in fisheries management with particular reference to a quota allocation system developed in Norway. They point out that moving from the free-for-all described by Garrett Hardin to an allocation of fishing rights to individuals cannot be criticised if the change results in more sustainable fisheries with benefits for all. Nevertheless, some people will lose while others win. The allocation of rights is inherently unjust, even though it may resolve the race for fish. There are, for example, human rights concerns. Rights to natural resources may be essential for preserving the culture and material existence of indigenous peoples (like the *Sami* in Norway, *Native Americans* in the USA, the *First Nation* in Canada and the *Maori* in New Zealand). The concept of indigenous people may be extended to include the inhabitants of fisheries-dependent areas.

Hernes *et al.* point out that the justice principle is especially important in the allocation of fish quotas, which is why individual transferrable quotas (ITQs) are so controversial. They also suggest that there is a justice principle in allocating stakeholder participation to some and not others. They pose the question: if there are limits to how inclusive co-management institutions can be, then exactly where should limits be drawn for decision-making to be just and fair? In distributing subsidies to Norwegian fishers, a principle of 'just desert' was introduced. The more fish fishers had caught in the past, the greater the subsidies they received. Similarly, quota rights were reserved for those who could demonstrate a minimum catch level, thereby excluding part-time fishers (and recreational fishers). Hernes *et al.* suggest that in this context 'just desert' is an accurate measure of need, in terms of having an economic stake in the resource. The award of privileges to those with a track-record also constitutes a reward for previous efforts.

Hernes *et al.* also introduce the idea of a right to be recognised. Some individuals have the right to participate, even though their track-record in terms of catch may be small or non-existent. Ethnic and cultural identity is important, as is territorial dependence, despite the reluctance of politicians and bureaucrats to give preferential treatment to ethnic or territorial groups. Moreover, there are those who are not fishers to be considered. Hernes *et al.* opine that the drawing up of 'social contracts', specifying legitimate stakeholders, have particular merits in fisheries management. Such contracts cannot be imposed from the top but must be based on democratic principles, where all affected stakeholders are allowed to voice their concerns.

Under some systems for involving stakeholders the government or its agencies may select the stakeholders. Some individuals may be chosen in their own right; other individuals may be chosen as representatives of interest groups; or particular interest groups may be selected who will subsequently decide themselves who should represent their interests. There is an argument, however, that true stakeholders should decide themselves who should represent them. If individuals or groups representing stakeholders are selected by government then those who are especially compliant or amenable to pressure may be chosen. There is an element of this breach of good practice in both the Canadian and American systems of fisheries management and in the selection of members of Sea Fisheries Committees in England. In general, it is fairer, more open and more likely to be more acceptable to stakeholders if the process of selection involves stakeholders themselves.

Representation may become an increasingly contested issue which may need to be approached critically, especially since even within the fishing industry there are disparities in the way that different parts of the industry are represented. Svein Jentoft, at a discussion between scientists and fishers organised by ICES, argued that if groups of fishers were invited to participate in management, we had to ask whether these groups were truly representative of the whole industry. If they were not, then in the attempt to achieve greater democracy we might have substituted one set of problems for another.

Finally, in selecting stakeholders to participate in fisheries management there is a school of thought which says that fishers should not be in a majority; that fishers are responsible for the damage done by fisheries and fishers' interests should be subordinate to those of the public at large. In deciding on representation on the newly emerging European Regional Advisory Councils (section 8) a number of environmental groups considered that they should be in a majority, as they represented the wider public interest. Charles Clover (2005) has argued that '*the sea and all the living things in it have been stolen from the people and given to*

fishermen'. He believes that responsibility for fisheries management under the CFP has been given to fisheries ministers, who run the seas in the interests of fishers.

Who are stakeholders representing?

There is a need for clarity on whether those selected as stakeholders are acting for themselves or serve wider interests, especially when the selection has been done by government. If a trawl fisher is chosen is he/she there because of special expertise, or does he/she represent all trawl fishers, or fishers in general? If the latter, what mechanisms can be put in place to ensure that the representative is genuinely serving wider interests?

It is commonplace for organisations to be selected as representing others with similar interests to themselves, but it cannot be assumed that they necessarily have mechanisms in place for consulting others. Indeed, it is difficult to ascertain how some groups claiming to represent a particular sector or community arrive at their views, or consult their 'membership'. Is an employee of environmental group, funded through a large number of voluntary donations, really able to speak for those who are members? This stricture applies not only to environmental groups but also to trade associations or fishers organisations. To what extent does a national fishers' organisation represent all fishers, or only a part of the industry? In drawing up plans for stakeholder organisations, whether the selection is done by government or by the stakeholders themselves, it is a sensible precaution for each organisation to be required to present its constitution and rules of procedure and to explain the mechanisms it adopts for sounding out its members and ensuring that all relevant views are considered.

We shall see in section 10 that in selecting stakeholders in Canada emphasis is placed on choosing individuals with expert knowledge rather than representatives of particular interests.

Different forms of governance

Gray (2005) has classified the different forms of participatory governance into four distinct types each involving its own segments of civil society:

Industry self-regulation	Industry
Co-management	Industry and Regulators
Community partnership	Local communities
Environmental stewardship	Industry & Environmentalists

Industry self-regulation

Industry self-regulation is where members of the fishing industry, or holders of fishing rights, assume responsibility for running the fishery. As mentioned in Section 1, when resources have been held in common for some time there are often social conventions or regulations developed within groups of fishers which limit exploitation. It is entirely possible for fishers to regulate themselves by mutual agreement or

through the establishment of institutions which serve both to protect the resource and those who exploit it. Since the earliest times fishers have formed associations or guilds like the *cofradías* of Spain and the *prud'homies* of France to avoid conflict and exclude others. Such systems of cooperative management may be successful in avoiding the race for fish. Fishers' organisations are indeed capable of taking responsibility for their own destiny.

In practice, the autonomy of fishers in these arrangements is always limited. Fishers have to abide by legislation laid down by governments and conform to international fishery agreements. There may also be pressure from those excluded from the fishery, and from political groups seeking to remove privileges granted to some and not others. It was such pressures that eventually led to the decline of fishers' guilds.

Where there is private ownership of the resource; that is, where ownership of fishing rights has been conveyed or sold to groups or individuals, then self-regulation becomes especially important. Thus, the District Salmon Fishery Boards in Scotland, where the owners or proprietors of fishing join together to promote fisheries management, have clear responsibility for regulating the fishery and enforcing the regulations imposed. Even here, however, ultimate power rests with the state (section 3).

Industry self-regulation does not depend completely on fishing rights being sold or allocated to fishers. Within the Common Fisheries Policy, a hierarchical system of management, there is scope for local delegation of powers. Thus, Regulating Orders may be issued by the Scottish Executive which transfer responsibility for managing local fisheries for shellfish to fishers' organisations – for example the Shetland Shellfish Management Organisation, established as a limited company. The organisation has to abide by wider regulations set out in the CFP and by the Scottish Executive but is able to establish its own regulations for the inshore shellfish fisheries.

Experience with self-regulation has shown that it is not without problems. The question of eligibility for membership of a management organisation may be difficult to resolve. On what grounds can fishers forming a management organisation exclude other fishers? There may also be problems over policing and enforcement of the regulations. Fishers may be reluctant to take action against one another within the management organisation and they may not have the power or capacity to protect the resource from other fishers outside the organisation. Governments themselves may be reluctant to support enforcement of the regulations and policing of the fishery when only a few will benefit. Why should those benefiting from the fishery not provide their own enforcement (as the Scottish District Salmon Fishery Boards do)? There is also the fundamental problem that the management organisation may not adequately represent all interests. Environmental interests in particular may feel that the fisheries management organisation will not give priority to safeguarding the wider environment and protecting wildlife.

Co-management

Co-management is where responsibility is shared between government, fishers, and perhaps other interests. It has been pointed out, however, that with co-management participation by fishers and other interests is not merely passive or reactive. It involves real decision-taking (Symes & Phillipson, 1999). The US Fisheries Management Councils (Hall-Arber, 2005) and the English Sea Fisheries Committees

have some of the elements of co-management although the selection of participants is under the firm control of government in both cases.

Hall-Arber emphasises that co-management is often triggered by a perceived crisis. She refers to the concept of adaptive co-management, a management philosophy which combines the iterative learning dimension of adaptive management (Holling, 1978) with the linkage dimension of collaborative management in which rights and responsibilities are jointly shared. Olsson *et al.* (2004) have developed the concept of adaptive co-management and have emphasised its focus on learning-by-doing, its role in bringing together different knowledge systems, the collaboration it promotes at community, regional and national levels, and the management flexibility that it conveys.

As Gray (2005) points out, co-management is advocated by many writers as a prescription for success, but it is difficult to find examples of fisheries which involve real power-sharing. Indeed, co-management systems may simply represent an ideal that can never be attained.

Community partnership

Community partnership is a system where the management of fisheries is shared amongst those in the wider community. Around the world there many areas where fishing and the associated industries play a dominant role in the local economy and where there are few other options for industry and employment. Examples from Europe are the Shetland Islands, the west coast of Norway, and the Spanish province of Galicia. Such areas are traditionally described as fishery-dependent, and it is often argued that they should receive special treatment when the regulation of fisheries is being contemplated. Certainly, the fishing industry within these areas often receives strong support from local and national politicians.

Within such communities there is a strong wish to protect the local fishing industry and protect it from external pressures. Thus, within the CFP local regions like the Shetland Islands have operated community quota schemes, where the local community has purchased fishing quotas on behalf of the local fishing fleet. This initiative has partially foundered because of European Community competition rules. Indeed, it appears to be increasingly difficult under the CFP for local regions to ring-fence fishing rights for use by local fishers. The extent of fisheries dependence or reliance is now much lower than it was in the past and governments are reluctant to afford special privileges to particular communities. Instead, they are given special treatment in terms of grants and subsidies intended for more general purposes.

Environmental stewardship

Increasingly, environmental groups have asserted their right to have a say in the management of fisheries. In addition, governments themselves have extended their control over activities which affect the environment adversely and have signed up for international agreements and accords which increase their responsibilities to conserve and protect the aquatic environment. The concept of an ecosystem-based approach to fisheries management has been almost universally accepted, although it has been poorly defined and has proved difficult to implement. Gray (2005) points out that the prevalence of concern over the environment has developed into a wish on the part of environmentalists to participate fully in fisheries management. Indeed,

participation by the public is a fundamental part of the ecosystem-based approach and the objectives of marine resource management are reported as being a matter for choice by society at large.

Dunn (2005) has described the Shetland Sandeel Fishery Partnership. The Partnership was formed after a period of conflict between the Royal Society for the Protection of Birds (RSPB) and Shetland fishers over the decline in local sandeel stocks and reductions in the breeding success of sandeel dependent seabirds. The collapse of the sandeel fishery brought about unprecedented cooperation between government, fishers, scientists and the RSPB resulting in the formation of the Partnership. The current management regime balances fishing and environmental interests, with the RSPB having an active voice in the management of the sandeel fishery.

Interaction between stakeholders and advisers

With the introduction of stakeholders into a system of fisheries management the relationships between the other main actors must change. We have previously defined the participants as regulators (more broadly the policy-makers), enforcers, advisers and those whose activities are being regulated. We are now allowing representatives or individuals from the latter group to participate in management. However, there are issues over the contact and influence which stakeholders may exert upon advisers and enforcers, as well as the regulators.

Advice is now being given to the regulators by both advisers and stakeholders. There may be differences in the advice being given, which have to be resolved. Stakeholders may also wish to influence and comment upon the advice which is given by scientists and other experts. Fishers, for example, may wish to reduce the regulation of their activities by seeking to obtain more optimistic scientific advice on the state of the stocks.

There is clearly a requirement for advisers to be independent and free from undue pressure. That does not mean, however, that advisers must operate completely independently of stakeholders. Expert advisers require information from stakeholders and must be aware of the nature of the fishery and conversant with the details of fishers' activities. Serious management problems may develop where expert advisers are ignorant of important aspects of a commercial activity, as became evident during the Foot and Mouth epidemic in the UK (Anderson, 2002). There is also the post modernist issue of the nature of 'independent' advice (see section 5) and the role which should be played by experts, as well as the issue of the weight to be given to local ecological knowledge held by stakeholders themselves.

Wilson (2007), as part of the SAFMAMS project, has reviewed literature on the science-policy interface. He emphasises that the boundary between scientists and those involved in policy formulation must be recognised and respected. However, the boundary must be porous. The purpose in recognising the boundary is not to maintain scientists' authority. The boundary is there to make a contribution to democratic decision-taking. Wilson believes that there is an important distinction to be drawn between statements about nature which can be established *in principle* as objective facts and statements about shared meaning. We must respect science. However, in policy areas where the science is uncertain it may be difficult to determine where the boundary of science lies. In these circumstances scientific deliberations need to include people other than scientists if policy is to be successful.

An important finding to emerge from Wilson's review is the idea that boundary organisations are important. Others have noted that the emergence of organisations along the policy/science interface which facilitate communication and bring science and policy together.

It is the relationship between stakeholders, policy makers, and advisers which is the subsequent focus of this report.

7. Fisheries management within the European Union

The role of governments in fisheries management

It was Ronald Reagan, a former President of the United States, who asserted that the scariest words in the English language were “hello, I’m from the Government and I’m here to help”. Although there are some people who would like to see governments run every aspect of our lives, at the other extreme there is also a conservative political philosophy that governments are not only incapable of devising policies which will help; they are also inherently incapable of implementing policies effectively (Scruton, 2006). An important feature of Magna Carta, subsequently incorporated as the fifth amendment of the American Bill of Rights, was its emphasis on the rule of law having a power higher than the sovereign.

In Sections 1 & 2 it was pointed out that it is common in many societies for governments to be given powers to manage fisheries. These powers are often quite far reaching and contrast with the lack of powers for managing other industries and activities. The onion growing industry in the United Kingdom has about the same financial turnover as the fishing industry but it has far fewer legal constraints placed upon it. This difference may have arisen for two reasons. Firstly, fisheries often lead to disputes between fishers. Any lack of definition of ownership of fishing rights tends to lead to arguments between those exploiting the resource. Governments have established rules for the operation of the fisheries which are meant to protect the weak and responsible from the strong and irresponsible; although in practice they may not so. Secondly, fisheries resources are, as we have seen, often regarded in law as being in common ownership, or held in trust by government for the people. Government has been given authority to control access to the fishery to prevent fish stocks being over-exploited, or to prevent fishing from damaging or interfering with other activities or resources.

Those who have worked for governments are often especially aware of the limitations upon governments to govern. This view is not entirely born of cynicism. The general public are often unaware of the limitations placed on government by the law, or by the absence of powers which enable the government to act. Powers are only given to the government through legislation. Even where there is legislation it often constrains the abilities of the government to take the desired action. In other instances where government wishes to take action there is no legislation giving it the power to do so.

Severe difficulties may arise when governments attempt to manage or regulate fisheries directly. There are many examples of fisheries failing despite being subject to strong government control. Why should this be so? One factor is the difficulty experienced by civil servants in understanding the complexity of the fisheries and in anticipating the effect of management measures. It is simply not possible for individual civil servants to understand all aspects of the fisheries they are attempting to manage. They may also be affected, as we all are, by cognitive bias – the tendency we have to seek or interpret evidence favourable to our existing beliefs, and to ignore or reinterpret other evidence. In addition, there are often unintended consequences from the imposition of regulations. Not least, ingenious schemes may be devised to circumvent management measures. Fisheries often involve fishers from a number of states, acting under different jurisdictions and there is scope for differences in their response to the regulations – a lack of a level playing field. Furthermore there are undoubtedly difficulties in shore-based regulators adequately

enforcing regulations imposed upon activities carried out at sea, in circumstances where fishing cannot readily be observed or controlled. Finally, there are inherent difficulties in regulating the exploitation of natural resources which fluctuate and behave in a way which is often unpredictable. It is not possible to manage the resource itself – only the activities of fishers and others whose activities may affect the resource can be regulated, and that can only be done with difficulty.

There are other problems. Clark (1990) has said '*thoughtful social analysts have proposed that a fundamental duty of the state is a concern for the welfare of future generations. How this duty is to be fulfilled in a democratic society whose individuals are concerned largely with the demands of the present is a dilemma that has yet to be resolved*'. Advice and action on fisheries must be long-term, whereas democratic government tends to be short-term. The implication is that elected representatives will not be prepared to look at severe options for managing fisheries if the anticipated benefits will be a long time in coming. They will tend to favour measures that are cosmetic rather than effective.

The management of north east Atlantic fisheries

Traditionally, management of fisheries within the coastal zone has been the prerogative of the state. However, as mentioned in Section 2, fisheries in offshore waters may be shared by a number of states. In these circumstances international commissions have been established to bring together governments to manage the fisheries collectively.

A Permanent Commission was founded in 1953 to manage North Atlantic Fisheries under a 1946 international convention for the regulation of meshes of fishing nets and the size limits of fish. By the early 1960s, it had become apparent that a wider range of powers were required to regulate for the effects of technological advances in fishing methods. In 1963, the North-East Atlantic Fisheries Commission (NEAFC) was formed under the North-East Atlantic Fisheries Convention. In addition to assuming the powers of the Permanent Commission, NEAFC could establish closed fishing areas and seasons, and regulate catch and fishing effort.

Following withdrawal from NEAFC of the member states of the European Community and the general extension of fishery limits to 200 miles, negotiations between present and former members of the NEAFC resulted in new agreement on a 1980 convention. The convention, which entered into force in 1982, differed from the previous convention in providing for the EC, rather than its Member States, to be a signatory.

There are now six contracting parties to the convention: Denmark (on behalf of the Faeroe Islands and Greenland), the European Community, Iceland, Norway, Poland and Russia. In addition, there are a number of other states, such as Canada, Japan, Korea, Latvia, Estonia and Ukraine, whose vessels fish in international waters in the north-east Atlantic. In general, however, the European Union now manages many of the North-Eastern Atlantic fisheries on its own account, or in direct consultation with Norway.

The European Union (EU) itself is a relatively recent grouping of European States, which have agreed to join together for their mutual benefit. Within the EU, primary legislation applying to all the Member States is proposed by a body of civil servants (the Commission) and agreed by direct negotiation between their governments

(within a Council of Ministers). These agreements are in the form of treaties, which are then subject to ratification by national parliaments. The original treaty establishing the European Community was the Treaty of Rome (1957). Treaties have been revised several times through:

- the Single European Act (1987),
- the Treaty on European Union - the 'Maastricht Treaty' (1992),
- the Treaty of Amsterdam (1997), which entered into force on 1 May 1999,
- Treaty of Lisbon signed on the 13th of December 2007

Secondary legislation is based on the treaties, and takes the following forms:

- **Regulations** which are directly applicable and binding in all EU Member States without the need for any national implementing legislation.
- **Directives** which bind Member States as to the objectives to be achieved within a certain time-limit, while leaving to the national authorities the choice of form and means. Directives have to be implemented in national legislation in accordance with the procedures of the individual Member States.
- **Decisions** which are binding in all their aspects for those to whom they are addressed. Decisions do not require national implementing legislation. A Decision may be addressed to any or all Member States, to enterprises or to individuals.
- **Recommendations** and **Opinions** which are not binding.

The Common Fisheries Policy (CFP)

The European Union has developed a Common Fisheries Policy (CFP) through which it aims to manage fisheries for the benefit of both fishing communities and consumers. Responsibility for management of the CFP lies with the Directorate General of Fisheries and Maritime Affairs based in Brussels. DG Fisheries, together with the Council of Fisheries Ministers from the EU Member States, proposes and implements measures in support of the CFP.

Provision for the Common Fisheries Policy was first laid down in the Treaty of Rome (1957), which gave birth to the European Economic Community (EEC), with six member states (France, Germany, Luxemburg, Italy, the Netherlands, and Belgium). Article 39 set out the objectives for the Common Agricultural Policy (CAP). These objectives were shared by the Common Fisheries Policy (CFP), as Article 38 defined agricultural products as 'the products of the soil, of stock-farming and of fisheries'. The original objectives were: *'to increase productivity, stabilise markets and ensure availability of supplies at reasonable prices for the consumer'*.

An important provision of the Treaty of Rome, under Article 40, was that the organisation established *'shall exclude any discrimination between producers or consumers within the Community'*. This was later interpreted by the six founder members as providing open access to fisheries within Community waters by all member states. Common rules for fisheries, adopted at Community level, were intended to be implemented in all Member States.

When additional States joined the Community in 1972 (The United Kingdom, Denmark and Ireland), the original open access provided under the Treaty of Rome was modified by a derogation defined in Article 100 of the 1972 Act of Accession. This derogation provided for only limited access by Member States to the coastal waters of other Member States. The Article also specified the nature and the importance of the rights which Member States might enjoy in the coastal waters of the others. Regulation 170/83 extended this access regime to a coastal band of 12 miles and made it applicable until 31 December 1992, renewable for a further period of 10 years.

Some Member States extended their exclusive economic zones to 200 miles after the 1972 Act of Accession (the UK by an Act of Parliament in 1976) in anticipation of retaining control of fisheries within these extended areas. Subsequently, by a resolution adopted on 5 November 1976, the Council of the European Communities agreed that Member States, by a concerted action, would extend, from 1 January 1977, the limits of their fishing zones to 200 miles from coasts bordering on the North Sea and the North Atlantic (note that this did not apply in the Mediterranean) effectively giving the EC itself the right to a 200-mile limit. Subsequently, the Court of Justice of the European Communities opined that the Community was competent to take conservation measures for biological resources in all areas of the sea. The Court made it clear that this competence, once exercised, was exclusive of all diverging provisions of the member states. Thus, although oil and gas reserves out to the 200 mile limit were to be the exclusive reserve of the Member State, fishery resources were regarded as the responsibility of the Community. This decision represented a very large loss of competence over fisheries for countries like the UK and Ireland, which had extensive areas of sea within 200 miles of their coasts.

Meanwhile, Canada, Iceland and Norway had also extended their limits to 200 miles, barring Community vessels from many of their traditional fishing grounds and creating over-capacity in Community waters.

A system for the conservation and management of fishery resources was first established through Regulation 170/83. In accordance with Article 2 of that regulation conservation measures had to be formulated in the light of the available scientific advice, and in particular of the report prepared by the Communities own Scientific and Technical Committee for Fisheries (STECF). The conservation measures included limits placed on catches by establishing a total allowable catch (TAC) for each fish stock. The share of the TACs allocated to the Community, taking into account arrangements with third countries, were shared between the Member States (as quotas) in a manner which assured the relative stability of fishing activities within each Member State. The TAC and quota system adopted therefore served two important functions. Firstly, it was intended to restrict catches to promote the conservation of fish stocks. Secondly, it was intended to share catches out between the Member States in accordance with past track records of their fishing fleets. Quotas were and are still determined by means of an allocation key through what has become known as the '*Principle of Relative Stability*'.

Member States were able to develop their own detailed rules for the sharing out of quotas between different sectors of their fishing fleets. Regulation 2057/82 laid down rules for the control of catches in order to ensure that the quotas fixed were observed in practice. The inspection of landings was intended to be carried out by Member States' authorities. However, the Commission of the European Communities was empowered to verify the implementation of this Regulation.

Technical measures were also adopted under Regulation 170/83 for the conservation of fishery resources in Community waters, except the Baltic Sea and the Mediterranean Sea. These technical measures specified the mesh size of nets, by-catch rates and minimum landing sizes for different species of fish as well as the limitation of fishing within certain areas and periods and with certain gear as laid down in an additional Regulation 171/83. Further national measures of a strictly local character could be taken subject to examination by the Commission of their compatibility with Community law and conformity with the CFP.

The European Economic Community (EEC) underwent several major changes in the 1980s. Initially the Community benefited mainly the industrialised economies of Northern Europe, but it subsequently extended membership to emerging democracies, with Greece joining in 1981 and, subsequently, Spain and Portugal entering in 1986. The enlargement resulted in marked regional imbalances among the Twelve, giving rise to the need for a common regional policy.

The accession of Spain and Portugal to the European Community in 1986 was a major challenge to the CFP. Both States had large fishing fleets, facing reduced fishing opportunities on their traditional fishing grounds, which extended into the western North Atlantic. Portugal had the larger fleet in terms of tonnage, but many of the vessels were small and old. Spain, in comparison, had a large and active fleet, many of them powerful long-distance freezer trawlers.

The enlargement created a large expansion in Europe's fishing capacity. Negotiators of entry had faced the difficult task of retaining an effective and relatively new CFP while accommodating the Spanish and Portuguese wishes to gain access to the waters of the whole Community.

Prior to enlargement, Portugal had no access to EU waters. Spain had gained limited access to some Community waters, which by 1983 had meant that nearly 10% of the Spanish catch was taken there. On accession, Spanish fishers were given limited access to waters to the west of Scotland, to the west and south of England and Ireland, in the Bay of Biscay and off Portugal, but not to the more sensitive North Sea. This limited access did not meet Spanish wishes, and has been a source of contention ever since. Some Spanish owners responded by operating under the British flag, or 'quota-hopping', a practice banned by a 1988 UK Act of Parliament but reinstated when the European Court overruled the English courts. Quota hopping, where fishers from one Member State buy vessels in another Member State and use them to fish against the quota allocated to the latter, has since become commonplace, especially by fishers from Spain and the Netherlands.

Under the CFP Spanish and Portuguese fishers gained access to restructuring funds and new access rights negotiated in third country waters by the Community. For example, Spanish vessels gained access to squid in the waters around the Falkland Islands, as well as hake and squid off the coast of Africa and in the South Atlantic.

In February 1986, the Europe of the Twelve adopted the Single European Act (SEA). In so doing, the Community gradually discarded its purely economic character and moved towards a more closely-knit Community equipped with greater powers in the political and social spheres. The Community became the European Union (EU), through the Maastricht Treaty in 1992.

Subsequently, enlargements of the European Union (following German reunification in 1990, and the accession of Austria, Finland and Sweden in 1995) have not created significant difficulties for the CFP, although the subsequent accession of 10 further

States in 2004 (Estonia, Latvia, Lithuania, Poland, the Czech Republic, Hungary, Slovakia, Slovenia, Malta and Cyprus) and 2006 (Romania and Bulgaria) has added to the potential problems of over-capacity of the fishing fleets within the European Union.

Under the Treaty establishing the European Union in 1992 (Official Journal of the European Communities 24.12.2002) the objectives of the CFP were further amended:

- to increase productivity by promoting technical progress and by ensuring the
- rational development of production and the optimum utilisation of the factors of production, in particular labour;
- to ensure a fair standard of living for the (fishing) community, in particular by increasing individual earnings;
- to stabilise markets;
- to assure the availability of supplies;
- to ensure that supplies reach consumers at reasonable prices
- to ensure the principle of non-discrimination

Article 6 of the Treaty also stipulated that environmental protection requirements must be integrated into Community policies, in particular with a view to promoting sustainable development. Moreover, Article 174 required, inter-alia, that Community policy on the environment shall be based on the precautionary principle.

Changes to the Common Fisheries Policy

The CFP was further changed in 2002 through the adoption of three new Regulations. One of these, Framework Regulation (EC) 2371/2002, specifically concerned the conservation and sustainable exploitation of fisheries resources. The Regulation proposed that the CFP *'should be improved to ensure the long-term viability of the fisheries sector through sustainable exploitation of living aquatic resources based on sound scientific advice and on the precautionary approach'*. It also stressed that *'the management of the Common Fisheries Policy is guided by the principles of good governance'*.

Thus, one of the main current objectives of the reformed CFP is to promote biological conservation - to protect fish resources by regulating the amount of fish taken from the sea, by allowing young fish to reproduce, and by ensuring that protective measures are respected. It is accepted that management must be based on sound scientific advice offered through the Commission, although decisions are ultimately taken by the Council of Ministers.

Recently, a new draft Constitutional Treaty for the European Union was prepared (www.europa.eu/constitution/index_en.htm). It was signed in October 2004 but subsequently proved to be controversial, and was rejected by France and the Netherlands in 2005. After a two year period of reflection, on the 23rd of June 2007 the EU leaders agreed on a detailed mandate for a new Intergovernmental Conference. The task of this Intergovernmental Conference was to draw up a Reform Treaty by the end of 2007. On the 19th of October 2007, the informal European Council in Lisbon adopted the final text of the Treaty. The Heads of State and Government of the 27 Member States of the European Union signed the Treaty of Lisbon on the 13th of December 2007.

Remarkably, the CFP is one of only five areas of exclusive competence for the European Union within the Treaty of Lisbon. Article 2 B of the Treaty reads:

1. The Union shall have exclusive competence in the following areas:

- (a) customs union;
- (b) the establishing of the competition rules necessary for the functioning of the internal market;
- (c) monetary policy for the Member States whose currency is the euro;
- (d) the conservation of marine biological resources under the common fisheries policy;
- (e) common commercial policy.

Thus, in the new Treaty the CFP stands alongside the major areas of customs union, competition rules for the internal market, monetary policy and common commercial policy. This extraordinary elevation of fisheries policy reflects the complexity of fisheries management within the EU and the difficulties in managing fishery resources which are regarded as common, but which are exploited by fishers from a large number of Member States.

The European Parliament has played a relatively minor part in the administration of the CFP. Currently, the Parliament has only a consultative role as far as fisheries legislation is concerned, although this consultation is obligatory in some cases and may introduce long delays in the adoption of fishery management measures. The Parliament is able to express its opinions on various aspects of the CFP, and on occasions it may issue own-initiative reports. However, the detailed scrutiny, ability to overthrow legislation and capacity to introduce new legislation which exists within many national parliaments has been lacking. Although in their Member States citizens can influence national policy making through their elected representatives, in the European Parliament their elected representatives have only limited powers.

The Treaty of Lisbon sees a strengthened role for the European Parliament: the Parliament, directly elected by EU citizens, will acquire new powers over EU legislation, the EU budget and international agreements. In particular, the increase of co-decision procedure in policy-making will ensure the European Parliament is placed on an equal footing with the Council, representing Member States, for the vast bulk of EU legislation.

The Fisheries Council of the EU, which effectively takes the most important strategic decisions under the CFP, is composed of Fisheries Ministers from all the Member States, normally chaired by the Minister from the Member State which holds the EU Presidency. Most of the important decisions under the CFP are taken at the December Fisheries Council, which has become a traditional annual event. There, the civil servants of the European Commission present their recommendations to the Council against a background of strong lobbying from fishers (who are not formally part of the proceedings). The Ministers then negotiate amongst themselves to meet a compromise position which balances recommendations for conservation measures against the concerns of the industry and the communities affected. The Council's members are required by the Treaty of Rome to be *'authorised to commit the government'* of their Member States. This provision diminishes the power of national parliaments to exercise control over decisions which affect their interests. The

Fisheries Council meets behind closed doors and reaches most of its conclusions by a process of bargaining. It cannot be called to account for its actions in any formal sense. The Council's decisions are subject to qualified majority voting, and although every effort is made to avoid putting contentious issues to a vote, the knowledge that the mechanism exists is generally enough to extract concessions from a country that is in a minority.

Some authors (Mair, 2003) have pointed to a '*democratic deficit*' in the operation of the EU. This deficit exists particularly with regard to responsibilities like the CFP, where the Commission has extraordinary powers. Crombez (2003) has outlined the federalist view that the solution to the democratic deficit consists of giving more powers to the European Parliament, which is the directly elected EU institution. Proponents of a Europe of nation-states, by contrast, are of the opinion that democracy is best served by maintaining the powers of the Member States with their well established democratic traditions. Successive revisions of the new constitutional treaty have sided with the former and have proposed an increase the power of the directly-elected European Parliament in an attempt to reduce the perceived democratic deficit.

The Advisory Committee on Fisheries and Aquaculture

To consult more widely with stakeholders on the operation of the CFP, the Commission has established an Advisory Committee on Fisheries and Aquaculture (ACFA). This Committee, which represents all major groups of stakeholders at European level, was created in 1971, renewed in 1999 and again renewed in 2004. The ACFA is composed of representatives of organisations from the production sector, the processing industry and trade in fishery and aquaculture products as well as non-professional organisations representing the interests of consumers, the environment and development. Members of ACFA are appointed by the Commission following proposals from organisations set up at Community level which are the most representative of the interests concerned. They meet according to an annual work programme adopted in agreement with the Commission.

On the initiative of its chairman or at the request of one or more of its members, the ACFA may take up or be consulted by the Commission on measures that the Commission may propose within the framework of the CFP, as well as economic and social questions in the fisheries sector, apart from those which concern social partners, employers and workers. The Commission produces consultation papers (often in the form of communications and 'non-papers' - documents which provide food-for-thought but which are provisional) which are circulated to ACFA members for comment. Many people attend ACFA meetings, and the disparate comments they make tend to reflect the diversity of the organisations represented.

The ACFA has reflected on the effectiveness of its own work and concluded that differences between the stakeholders represented in the ACFA can be a source of difficulty, although the ACFA can provide majority and minority opinions. There is unwillingness by some groups to accept the existence of different viewpoints and to reach a compromise. Subjects are, at times, handled too superficially, with little room for in-depth discussion. However, members of ACFA are pleased that the organisation exists and for some sectors – like aquaculture – it is the only forum through which stakeholders can comment in advance on the Commission's proposals.

To an extent, the role of ACFA has been superseded by the recent establishment of Regional Advisory Councils as part of the reform of the CFP discussed later.

The provision of expert advice within the CFP

For many years, advice on fisheries in northern Europe has been provided by the International Council for Exploration of the Sea (ICES).

At the turn of the last century, there was much discussion amongst scientists and politicians on the need to coordinate marine science in the North Atlantic. An International Conference for the Exploration of the Sea, held in Stockholm in 1899 produced a proposal for a Central Laboratory and a Central Bureau for promoting a programme of cooperative marine biological and hydrographical research. A second conference held in Kristiania (now Oslo) in 1901 established a Central Laboratory in Kristiania with Fridtjof Nansen as its first Director (Nansen was an eminent explorer of the polar regions, awarded the Nobel Peace Prize in 1922 for his work as a League of Nations High Commissioner). The inaugural meeting of what was to become the International Council for the Exploration of the Sea (ICES) was held in May 1902 in Copenhagen.

From the start, ICES was funded by the participating states in return for scientific advice on fisheries. Committees were established with responsibility for advice on particular topics, and in some cases those committees recommended particular management measures. ICES received full international recognition in 1964 through an International Convention.

Nowadays, amongst its other activities, ICES brings together information on the state of the stocks from various sources and then presents it in the form of advice to the Fisheries Commissions, DG Fisheries and the EU Council of Fisheries Ministers. The advice is provided to the EU Commission through a Memorandum of Understanding in the form of an exchange of letters between the Commission and ICES. The MOU stipulates that the advice will be independent and free from political influence. ICES expenses in providing the advice are funded by the Commission on the basis of 100% of the costs, taking into account also the contributions to ICES from Member States which have membership of ICES.

The European Commission also consults its own Scientific, Technical and Economic Committee for Fisheries (STECF) on the state of the fisheries and on management measures. STECF is largely made up of national experts from the Member States' own institutes. In addition, the Commission makes occasional use of the EU's own Joint Research Centre (JRC) based in Brussels and other locations. The JRC was established to provide scientific and technical support for the conception, development, implementation and monitoring of EU policies. It is intended to be independent of special interests, whether private or national.

Discussions take place between the EU and non-Community countries which have an interest in the same fishing grounds or stocks (such as Norway). There is consultation with relevant regional fisheries organisations involving non-EU states (such as the North East Atlantic Fisheries Commission, the International Baltic Sea Fishery Commission and the North Atlantic Salmon Conservation Organisation). The Commission takes account of the advice from these bodies before setting out its management proposals for the Council of Ministers. The final decisions regarding

total allowable catches, quotas and any related measures are taken by Fisheries Ministers, often at their end-of- year meeting in December.

Very recently, bilateral discussions between the EU and Norway have resulted in agreements which pre-empt decision by the Fisheries Council. Effectively, far reaching decisions are taken on the management of fish stocks in closed negotiations with Norway, leaving fishers within the individual Member States unable to comment or participate.

The formulation of scientific and technical advice on fisheries

The need for expert advice is at the heart of fisheries management under the CFP. Advice is required on the state of fish stocks and the impact of fishing upon them. In addition, ecological advice is needed on the state of marine ecosystems, the interactions between fish stocks and other key species, and the impact of fishing upon non-target species and the wider environment. The advice required is not limited to scientific questions. It is also important for the Commission and Member States to have advice available on the appropriateness and practicality of management measures, and, in addition, on the economic and social impact of those measures upon fishers and fishing communities.

In practice, advice mainly comes from biological scientists employed by governments within the fisheries laboratories of the Member States. These scientists gather the data required, country by country, and then bring it together within ICES for analysis and the preparation of advice.

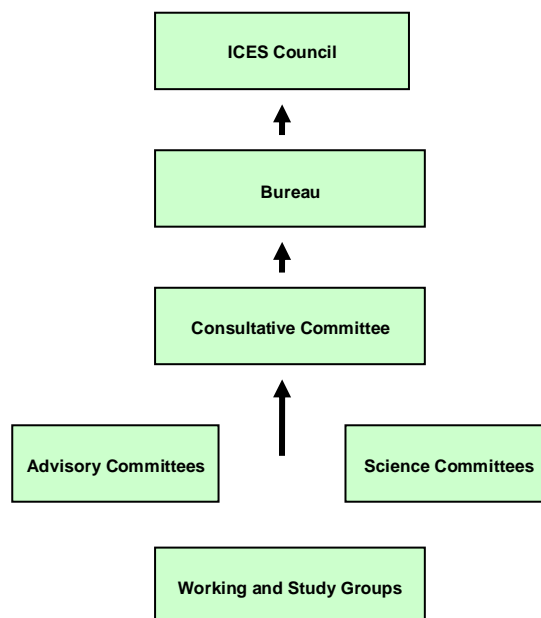


Figure 7. The ICES Committee Structure

ICES has a complex internal structure. It plans and coordinates marine research, and provides advice to the client commissions through a system of committees and working groups. It also organises study groups, symposia, and an Annual Science Conference and publishes its own scientific journal, the ICES Journal of Marine Science. The 19 member countries of ICES are: Belgium, Canada, Denmark,

Estonia, Finland, France, Germany, Iceland, Ireland, Latvia, the Netherlands, Norway, Poland, Portugal, Russia, Spain, Sweden, the United Kingdom and the United States of America. The Secretariat is based in Copenhagen Denmark.

The ICES Advisory Committees essentially provide the advice and oversee the Working/Study Groups. Members of the Advisory Committees consist of a scientist from each of the member countries plus the chairs of relevant Science Committees. Three Committees exist: the Advisory Committee on Fishery Management (ACFM), the Advisory Committee on the Marine Environment (ACME) and the Advisory Committee on Ecosystems (ACE). A Management Committee on the Advisory Process (MCAP) is responsible for management of ICES advisory processes, and for providing strategic direction and leadership.

ACFM is responsible, on behalf of the ICES Council, for providing the advice and information on fisheries, living resources and their exploitation and the interaction by fisheries and the ecosystem, as requested by the Fishery Commissions, by the EU, and by member countries of ICES. ACFM meets twice a year (in summer and late autumn) to prepare its advice on some 135 stocks of fish and shellfish. ACFM uses information prepared by numerous stock assessment Working Groups.

ICES has more than 100 Working/Study Groups, many of them concerned with assessing the state of fish stocks. Examples are:

Herring Assessment Working Group for the Area South of 62° N

Northern Pelagic and Blue Whiting Fisheries Working Group

Pandalus Assessment Working Group

Working Group on North Atlantic Salmon

Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak

Working Group on the Assessment of Southern Shelf Stocks of Hake, Monk and Megrin

It is the Working Groups which assemble the data collected by national institutes, perform the stock assessments and forward reports to ACFM for the formulation of advice. While reports are being drafted they are only available to Working Group members. As soon as reports are finished they are freely available on the ICES website. The reports themselves are regarded as reports of an expert group under the auspices of ICES. They do not necessarily represent the views of the ICES Council, and ACFM may choose to take a different view from the Working Group in formulating its advice to the EU.

The format of the advice has changed with time and with changes in the requests coming forward from the ICES clients. Formerly, the requests coming forward from the European Commission mainly concerned the setting of TACs and quotas for individual fish stocks. Now, fisheries management by the Commission is moving into a new phase, where it is concerned with the formulation of long-term targets and objectives, the development of harvest control rules triggered by the state of the fish stocks in relation to those objectives, and an evaluation of ecosystem considerations. However, change poses a problem for ICES, with its complex committee structure and responsibility to a large number of member countries with differing opinions.

The process of fish stock assessment

The advice to fisheries managers within the CFP concentrates on assessing the biological state of particular fish stocks. Several Member States, and sometimes countries outside the EU, are involved in almost every fishery of importance. Scientists from the national fisheries laboratories routinely collect commercial fishery information on catch and effort for nationally registered vessels and such information is combined with similar data from other countries' fleets in order to build a time series of international catch and effort data. These data form the basis of the assessment, but are supplemented with the results of research vessel surveys. The surveys are particularly important, since they provide essential information on the numbers of young fish that will subsequently become available to the fishery in future years (the recruitment).

The results of assessments, together with information on future recruitment are used to predict future catches. The results of the catch predictions form the basis of scientific advice to fishery managers.

Since management in the ICES area is primarily through Total Allowable Catches (TAC's), it is important that the best information on stock status and predicted catch levels is made available to managers on a timely basis. ICES has developed a series of assessment methods over the past decade, tailored to particular fish stocks. Important parameters for the assessments are:

SSB: Spawning Stock Biomass - an estimate of the total weight of fish from a given stock which are involved in the spawning process at spawning time. It is derived from estimates of numbers of fish at each age in the stock at spawning time, multiplied by the proportion mature at each age, and finally multiplied by the estimated average weight of an individual fish at each age. The total weight given by this process is known as the Spawning Stock Biomass (SSB).

F; Fishing Mortality Rate is the rate at which fish are removed from the stock by fishing. It often refers primarily to fish that are landed in the catch, not to '*discard mortality*', which may be significant in some fisheries. Fishing mortality should reflect all deaths in the stock that are due to fishing, not just those fish that are actually landed

The fishing mortality rate is an "instantaneous" rate that is useful in mathematical calculations, but is not easily translated into the more easily understood concept of '*percent annual removal*'. A fishing mortality rate of 0.2 implies that approximately 20% of the average population will be removed in a year due to fishing. While it is easier to think about a percentage of the stock being removed by fishing each year, fishing actually takes place throughout the year, and new fish are coming into the population continuously. For management purposes, it is important to consider how F is distributed among age groups.

CPUE: Catch per Unit Effort. The classic assumption is that catch divided by effort is proportional to the population size. This assumption allows the use of CPUE as an index of abundance. But the relationship is variable. The '*catchability coefficient*', Q, may change with changes in technology.

The current assessments methods used by ICES apply to single fish stocks and are deterministic; that is they yield single values for the level of fishing mortality, the state

of the stock (spawning stock biomass) and the level of recruitment. The assessments are based on the modelling of a virtual population of the stock from samples of age structure and catch data provided by the national laboratories. Time series from fishery-independent surveys, usually undertaken by research vessels trawling with standard fishing gears, are used as indices of abundance to tune the assessments and give indications of the level of recruitment. Until recently, there has been little emphasis on the degree of uncertainty associated with the estimation of SSB and F. With the introduction of a precautionary approach to fisheries management, it is accepted that there is now a need to describe, in a quantitative way, the uncertainty associated with the results of the assessments.

Advice is provided for particular species, in particular regions. In addition, ICES also provides advice in relation to special requests from the Commission. The assessments are generally aimed at providing advice on the setting of TACs, but there may be variations from this general aim.

Earlier (in section 5) we considered the application of the precautionary approach to fisheries management, and reported the suggestion from FAO that measurable target and limit reference points should be established for fisheries on particular stocks. The approach adopted by ICES has been to define limits for both biomass (SSB) and fishing mortality (F). For any stock it is possible to identify a critical SSB below which recruitment to the stock is likely to be compromised and where the stock will be in danger.

Limits are set for both SSB (B_{lim}) and F (F_{lim}). Thus, B_{lim} is the lowest level of biomass to which a stock should ever be allowed to fall. Below this level the stock is considered to be at risk. For fishing mortality, F_{lim} is the highest level which should be tolerated. Management seeks to avoid these levels. Indeed, the precautionary approach requires that fisheries be managed away from these values and defines more cautious levels. The setting of precautionary biomass limit (B_{pa}) and a precautionary fishing mortality limit (F_{pa}) recognises that there is uncertainty both in estimating the state of the stock, and defining the level which might endanger the stock.

The better the information on the stock the closer B_{lim} and B_{pa} can be. Essentially, the precautionary benchmark is set to reduce risk to the stock rather than allow the stock to reach a level where it will be in danger. The interval between the limit value (where the stock is entering unknown territory) and the precautionary value (where the stock is considered to be entering an area where precaution should be exercised) is greater for stocks where the assessments are less certain. The precautionary and limit values are set by ICES Working Groups specifically set up for the purpose. Occasionally the values are revised.

Target values may also be set for a particular fishery; for example it is possible to set a target of a biomass or fishing mortality which might provide Maximum Sustainable Yield (MSY), as discussed earlier.

The principles of the precautionary approach are outlined in Figure 8.

Specific management objectives may be agreed in advance for some stocks. Thus, reaching the benchmark SSB and F values may trigger particular harvest control rules, previously agreed by the Commission and in some cases also by Norway. Harvest control rules essentially lead to a TAC without the intervention of fishery managers. Thus, if SSB falls below an agreed precautionary level, then a particular TAC may be set aimed at reaching a specified value of SSB or F.

There is of course a danger in setting harvest control rules. This procedure effectively reduces the role of fishery managers by enabling decisions on management to be arrived at automatically. There are advantages in this where the state of stocks is well known, but where there is uncertainty it removes any flexibility which may be needed.

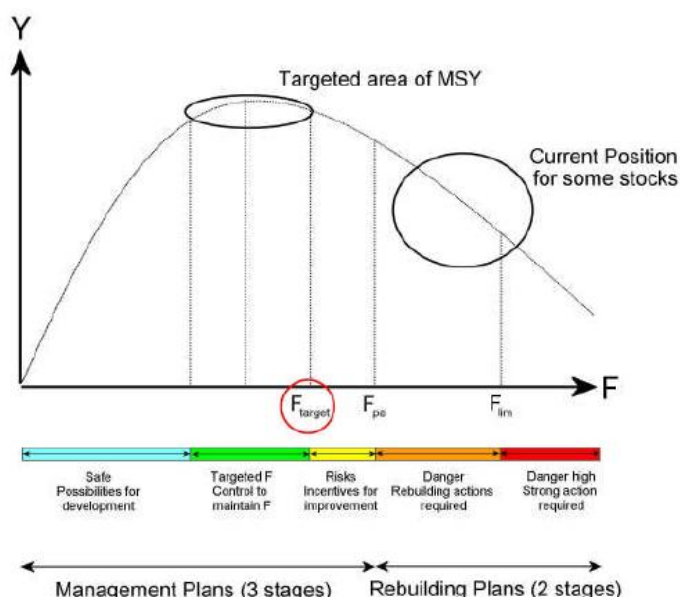


Figure 8. The application of a precautionary approach. A precautionary value may be set for fishing mortality (F), which provides less exposure to risk than operating at the limit value. A target value may also be set in accordance with a management plan for the fishery.

In preparing an assessment, concern may be expressed by ICES about some aspects of the fishery, or about the lack of scientific data. The level of recruitment to the stock may be discussed and comments on the state of the environment included.

The ICES committee structure

As we have seen, ACFM, the ICES committee which issues the advice, is provided with stock assessments by the ICES Working Groups.

The Working Groups which produce the stock assessments each meet for about 10 days to review a series of stocks, make short and medium term forecasts and summarise the state of the stocks. Each Working Group has a range of stocks to assess and the report which is subsequently generated may run to hundreds of pages.

The reports of the Working Groups are first presented to a small Review Group, which has three or four days to assess and comment on the work which has been done. The Review Group is made of scientists from ICES member countries. The Review Group looks at the rationale used by the Working Group in the assessments

and accepts or rejects the analysis. The output from each Review Group is a draft 'summary sheet' for each stock, which presents the filtered stock assessment and the relevant advice according to a standard formula. The summary sheets are then passed on to ACFM and form the basis of discussion during the ACFM meeting. The review process is not one of 'peer review', but one of distilling down the information to manageable proportions for ACFM.

ACFM is split into a series of drafting groups, one for each 'eco-region' (for example, the North Sea) to scrutinise each of the summary sheets for that region. After the Drafting Group has approved and redrafted the advice, and added any comments relating to conditions in that particular eco-region, the ACFM meets in plenary session to prepare the final approved advice.

Working Groups are predominantly composed of scientists from the national institutes of the ICES member countries with an interest in the particular stocks being examined. The Review Groups are also made up mainly of scientists from national institutes of other member countries, but usually those with less direct interest in those stocks. ACFM itself is composed of scientists representing member countries (one per country), plus the chairs of other key ICES committees. In 2006 observers from the Regional Advisory Councils were permitted to be present, together with an observer from the European Commission. Other observers were invited – for example from Environmental NGOs – but did not attend.

A representative of the SAFMAMS project attended the October 2006 meeting of ACFM, and the comments which follow are based on notes taken by that observer.

Of the 44 scientists eligible to attend the ACFM meeting 21 attended. Observers came from the European Commission and stakeholder organisations (the Regional Advisory Councils, described later). The meeting started with a half day plenary. The plenary discussed outputs from the ICES Annual Science Conference including recommendations from the Science Committees and the Advisory Committees, including the Management Committee on the Advisory Process. Planned changes to the assessment process were discussed and procedures for the current meeting agreed. The sequence for releasing the ACFM report to stakeholders and to the Commission was discussed and agreed.

ACFM then divided up into Drafting Groups to prepare advice for each eco-region, and these considered the summary sheets prepared by the appropriate Review Group. The chair led the group through the stocks, one by one. Text was agreed for each stock in turn. Occasionally, representatives of the Regional Advisory Councils were allowed to comment on matters of fact, or to provide background information on the fishing fleets or on current legislation.

Finally, the ACFM met in plenary session to go through each stock again. Any contentious text was highlighted and a final text agreed. Agreement was by consensus, with sub-groups being formed to redraft any difficult text. The procedure followed once the text was agreed is for ACFM to provide draft advice on the main stocks to stakeholders (who are anxiously awaiting it) and then to post a press release on the advice on the ICES website. The advice is then finalised and sent to the Commission a few days later. The delay between the delivery of draft advice to stakeholders and the final advice to the Commission can create difficulties for the Commission.

The advice presented by ACFM is complex in format, and has been criticised by fishers, lay persons and some scientists for its excessive use of technical terms.

Having received the stock assessments and other advice from ACFM the European Commission forwards recommendations on appropriate management measures to the Council of Ministers, where attempts are made to reach a consensus view amongst the Member States. As mentioned earlier, in recent years bilateral meetings between the Commission and Norway have often preceded the Fisheries Council, and management measures have been agreed which have subsequently constrained decisions by the Council. For stocks which are under threat a recovery plan may be in place, with decision rules which are triggered automatically by the stock assessment results. There is a move towards developing management plans for all stocks, which specify particular biological targets.

The overall system for managing fisheries under the CFP

We are now able to present the overall system for managing fisheries under the CFP (Figure 8). Thus, data collected by national fisheries research institutes from their national fishing fleets are assembled and the state of the stocks assessed by scientific Working Groups operating under the auspices of ICES. Advice on the stocks is then presented to the European Commission and other States by the ICES Advisory Committee on Fisheries Management. Proposals for management measures are forwarded to the Council of Ministers, although particular actions may also be negotiated with Norway before presentation to the Council. The Council of Ministers takes decisions on the management measures, which are then passed on to the fishing fleet. The Advisory Committee on Fisheries and Aquaculture, established by the Commission, may provide stakeholder comment on proposals. The European Parliament may comment on some proposals.

More recently, another influence has come to bear. Within the European Commission the Directorate General for the Environment is developing its own European Marine Strategy (EMS). Under this strategy new measures to protect and conserve the environment will be brought to bear. A new Directive is planned, aimed at achieving or maintaining good environmental status in the marine environment. In considering fisheries the strategy will require the status of fish stocks to be defined and to decide whether they are inside safe biological limits. The Directive will be applied on a regional scale and Member States will be required to act jointly. If there are problems with fisheries, then Member States will have to take these into account in formulating their environmental plans.

With the introduction of a new environmental policy two different legal frameworks, the CFP and the EMS, will have to be merged and will need to be consistent with one another. There will be two different 'traditions' with regard to fixing objectives, and in terms of taking science into account. In defining strict protection for the environment the European Court of Justice has decided that the only information to be considered is the scientific position. The social and economic concerns which are relevant factors within the CFP are not considered important. There is already evidence that the new environmental policy is beginning to affect the CFP. For example, the cod is now being given iconic status within the CFP, requiring strong measures for its protection, perhaps as a result of pressures from DG Environment.

It is evident that both the process and institutional arrangements for deriving scientific advice on the fish stocks are extremely complex and expensive. The process has grown by accretion, and has concentrated on producing scientific advice on individual stocks largely in isolation from stakeholders. In the next section we shall consider

the views of stakeholders on these procedures and institutions and will consider new channels of communication which have recently been added.

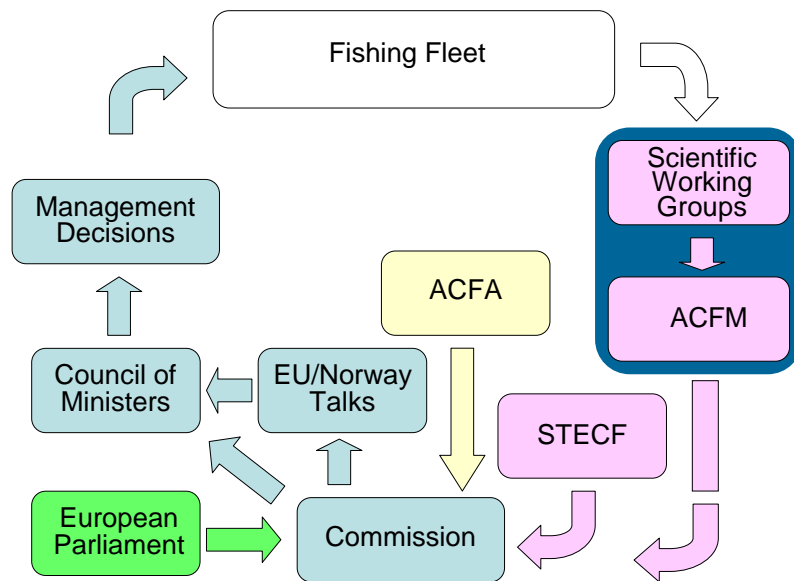


Figure 9. The system for managing fisheries within the European Union.

8. Stakeholder involvement within the Common Fisheries Policy

Problems with the CFP

The European Commission has admitted problems with the CFP, most notably in its Green Paper on the Future of the Common Fisheries Policy (EC, 2001). The Green Paper discussed the weaknesses and challenges of the Policy. It pointed out that the CFP had not delivered sustainable exploitation of fisheries resources and would need to be changed if it was to do so.

The shortcomings of the CFP could be expressed in conservation, economic and political terms. So far as conservation is concerned, the paper stressed that many stocks were outside safe biological limits. They were too heavily exploited or had low quantities of mature fish, or both. The situation was particularly serious for demersal fish stocks such as cod, hake and whiting, and if current trends continued, many stocks would collapse. At the same time, the available fishing capacity of the Community fleets far exceeded that required to harvest fish in a sustainable manner. In economic terms, the fisheries sector was characterised by fragility resulting from over-investment, rapidly rising costs and a shrinking resource base. Politically, stakeholders did not feel sufficiently involved in the management of the policy and many believed that there was no level-playing field in terms of compliance and enforcement.

Reform of the CFP

The Green Paper

The Green Paper was an advisory document produced in anticipation of a 2002 deadline for the expiry or renewal of three components of the CFP legislation which was then in force. The paper marked an acceptance by the European Commission that the CFP faced major challenges.

The paper concluded that the Commission must change the way that advice on the fish stocks and management of the fisheries was provided. There must be wider participation in the process of assembling and then producing expert advice. Participation by outside experts, by stakeholders and by the public, should not be considered as unnecessary or inconvenient but rather as a way of extending and enriching the process of gathering information.

The paper proposed that a thorough and urgent reform of the CFP was needed, independent from the legal requirements linked to the 2002 deadline

A new set of objectives was put forward for the CFP. Included among them was an intention to promote better governance. This was to be achieved by putting in place more transparent, accountable and flexible management and decision-making processes which involved stakeholders at the regional and local levels. In addition, there was an intention to improve the quality and amount of relevant data to support decision-making and to promote multidisciplinary scientific research which would

allow for obtaining timely and qualitative scientific information and advice on fisheries, associated ecosystems and relevant environmental factors.

The Commission suggested that a series of regional advisory committees should be to involve more and earlier the stakeholders in discussions about fisheries management while at the same time ensuring that fisheries governance remained compatible with the legal and institutional framework of the Treaty. The committees could include national officials, industry representatives, NGOs, fisheries biologists and economists from the Member States with a real interest in the fisheries concerned. Participation would also be open to industry representatives and officials from other Member States. The Commission did not wish to provide chairmanship and administrative support, and concluded that it would be necessary for the players involved to share the management and financing of the proposed scheme. The committees would provide advice to the Commission which would take it in due consideration when making proposals and management decisions.

The Green Paper stopped short of advocating devolution of management responsibilities to the regions. It simply concluded that the responsibilities for adopting, within the territorial waters, specific local conservation measures in some cases could be delegated to the Member States under conditions defined at Community level.

The Green Paper was an effective diagnosis of the ills of the CFP and it was intended to launch a wider discussion on the CFP. Interested parties were invited to send their comments to the Commission and to participate in a series of public hearings. The process of consultation was not an intensive one, and cannot really be described as a debate. Rather, in conventional fashion, the Commission announced its position and then invited comment. The Commission then simply collated those comments and proceeded to make up its own mind. The consultation culminated in 2002 with the publication of a Communication from the Commission on the Reform of the Common Fisheries Policy (The 'Roadmap').

The Roadmap

The Roadmap concluded that there was a broad consensus that the current CFP was incapable of reversing the increasing threats to important fish stocks and of providing economic sustainability to the fisheries sector. A future CFP would succeed only if environmental, economic and social sustainability were put at the heart of its objectives and if good governance principles such as openness, participation, accountability, effectiveness and coherence were fully implemented. The Roadmap agreed that stakeholders had not been sufficiently involved in policy shaping and that this lack of involvement had undermined support for and compliance with the conservation measures adopted in the past.

The Commission recommended that the new CFP must give priority to certain actions. Amongst these was an action plan for the improvement of scientific advice for fisheries management, and new measures to achieve effective and participatory decision-making. As the main component of the latter the Commission proposed the establishment of Regional Advisory Councils for fisheries management (RACs) to ensure greater stakeholder involvement at the regional and local level. The RACs would have the following advisory functions:

- To submit suggestions, of their own accord or at the request of the Commission or a Member State, on matters relating to fisheries management to the Commission or the Member States concerned;
- To give an opinion on Commission or Member State proposals on conservation and management dealing with a fishery relevant for the region concerned;
- To comment on and recommend improvements in the implementation of the Community legislation in the region concerned;
- To conduct any other activities which were necessary to fulfil their functions.

The Commission announced that membership rules would be flexible enough to ensure participation of all parties with a real interest in fisheries issues, although the configuration of interested parties would vary according to the subject to be addressed by the RAC. At the broadest level, membership would include fishermen's organisations, scientists, the relevant national, regional or local administrations, environmental and other interested NGO's, representatives from aquaculture and processing industries, recreational fishermen, wholesalers and fish-workers.

There was a clear wish to limit the mandate of the RACs. Emphasis was placed on their advisory role. The Commission and Member States would not be bound by the recommendations, opinions or reports of the Regional Advisory Councils but might explain in the explanatory memorandums of their proposals how they dealt with the opinion given by the competent RAC.

Coffey (2005) has reviewed the role of public participation in the 2002 reform of the CFP. She concludes that the Commission significantly stepped up its efforts to consult the public, enhancing the arrangements that existed before the reform period. However, she is clear that the Commission's good practice compared unfavourably with methods of public consultation that were being developed elsewhere. Although the RACs were a significant step forward in bringing the CFP closer to individuals and communities most affected by fisheries, consideration also needed to be given to ways of getting other 'less motivated' groups involved.

Development of the Regional Advisory Councils (RACs)

The RAC initiative was taken further forward when the new Council Regulation (EC) No 2371/2002 on the conservation and sustainable exploitation of fisheries resources under the Common Fisheries Policy was published on 20th December 2002. This '*basic regulation*' is now the current authority for management of the CFP by the Commission and Council of Ministers. It sets out the fundamental rules for operation of the policy.

The Basic Regulation

Included in its provisions of the basic regulation was a clear statement establishing the RACs and giving them their authority under the CFP. Thus, the regulation stated in an introductory paragraph:

'To contribute to the achievement of the objectives of the Common Fisheries Policy, Regional Advisory Councils should be established to enable the Common Fisheries Policy to benefit from the knowledge and experience of the fishermen concerned and of other stakeholders and to take into account the diverse conditions throughout Community waters.'

Article 31 of the basic regulation set out the basis for the operation of the RACs. The regulation made it clear that the RACs would primarily exist to provide the European Commission with advice for their own areas or species. They were intended to contribute to the achievement of sustainable exploitation of living aquatic resources. The RACs were principally to be composed of fishers and other interests affected by the CFP, including scientific experts from member States having fisheries interests in the sea area. Representatives of national and regional administrations could participate as members or observers. RACs might be consulted on measures proposed by the Commission that related to the fisheries in the area concerned. RACs could also submit suggestions of their own to the Commission or the Member State concerned or inform the Commission and Member State of any problems with the implementation of rules relating to the fisheries.

The full procedures for establishing the RACs were first set out in a proposal for a Decision from the Fisheries Council in October 2003.

The Decision

A draft decision listed the Regional Advisory Councils that the Commission proposed to establish. They were initially proposed for the Baltic Sea, Mediterranean Sea, North Sea, North Western Waters, South Western Waters, and Pelagic Stocks.

The draft proposed that representatives of the fisheries sector and other interest groups with an interest in one of the Regional Advisory Councils should submit a request concerning the operation of that Regional Advisory Council to the Member States concerned and to the Commission. The Member States concerned would check whether the request was in accordance with the provisions laid down in the Decision and would transmit a recommendation to the Commission on whether the RAC should be established. In the draft, 'Member State concerned' was defined as a Member State having fishing rights for regulated species in the area or fisheries covered by a Regional Advisory Council.

Each RAC would have two tiers. It would consist of a General Assembly and an Executive Committee. The General Assembly would meet at least once a year to review the work of the RAC and would appoint an Executive Committee of between twelve and eighteen members. The latter would manage the work of the Council and formulate its recommendations and suggestions.

Membership was carefully defined. Members of the General Assembly would be appointed by common agreement between the Member States concerned. In both the General Assembly and Executive Committee two thirds of the seats would be allotted to representatives of the fisheries sector and one third to representatives of the other interest groups affected by the CFP. At least one representative of the catching sector from each member state concerned would be represented in the Executive Committee. Thus, the fishing industry, and especially the catching sector, would predominate within the RACs.

Additional people would also take part in the RACs. Scientists from institutes of the Member States concerned or international bodies would be invited to participate as experts and National and regional administrations of the Member States concerned could attend meetings as observers. The Commission could attend, and representatives of third countries that had fishing interest in the area or fisheries covered by the RAC could participate as observers when issues which affected them were discussed. Meetings would be open to the general public.

It was proposed that the RACs should, where possible, adopt recommendations and suggestions by consensus. If no consensus could be reached, then dissenting opinions expressed by members should be recorded in the recommendations from the RAC.

RACs could apply to the Commission for funding but the aim was that they would become self-financing in the long-term. The financial contribution which was suggested was small and would diminish with time.

Although stakeholders were delighted that progress was being made in establishing the RACs, they were not entirely happy with the draft proposals and suggested a number of amendments. The European Parliament also commented on the proposal in an Opinion in April 2004. A series of subsequent draft Decisions during 2004 reflected some of these comments. At the request of some Member States, the countries eligible to participate in a RAC would be those *'having a fishing interest in the area or fisheries'*. Thus, countries would be able to participate in a RAC for an area where they had no fishing rights simply by expressing an interest in the fishery. Definitions of the *'fishing sector'* and *'other interests'* were also modified. The number of prospective RACs was increased to seven by the inclusion of a RAC for the high seas/long distance fleet.

At this stage the Commission had received strong representations about the small sum of money available for each RAC. The sum to be allocated to each RAC was increased, but the contribution would still be degressive. That is, it would diminish with time. An additional fixed sum was allocated to interpretation and translation costs

Stakeholder interest in the RACs

Following publication of the Green Paper in 2001, fishers' organisations and other interested parties had been keeping a close eye on developments with respect to RACs. One of these parties was the North Sea Commission Fisheries Partnership, which had been formed to bring together scientists and fishers from around the North Sea. The development of the North Sea Commission Fisheries Partnership has been described by Hawkins (2005). The Partnership included representatives of fishers and scientists from eight countries around the North Sea. Fishers were drawn from the national organisations. Scientists were drawn from the main government fisheries research institutes.

The objectives of the Partnership were to improve the exchange of views between fishers and fishery scientists and to promote dialogue between fishers from different countries around the North Sea. The intention was to make better use of information held by fishers to improve stock assessments and to develop consensus views on fishery management measures. The Partnership wished to progressively involve other stakeholders including fishery managers, fish merchants, processors and

conservation groups in discussions of the management of the North Sea fisheries and to work for the implementation of new and more sustainable management measures, taking full account of biological, economic and social factors.

The Partnership made considerable progress in developing greater trust between fishers and scientists. It was able to discuss sensitive and controversial subjects, and achieved major improvements in the process of assessing North Sea fish stocks. From the very beginning, discussions between scientists and fishers within the North Sea Commission Fisheries Partnership had focused on the suggestion that a fisheries management council should be established for the North Sea to provide a wide group of stakeholders with the opportunity to participate in governance of the fisheries. This idea developed in parallel with the proposals being developed by the Commission which culminated in the new basic regulation and its proposal to establish RACs.

The Partnership decided that it could serve as a model and pilot for a North Sea Regional Advisory Councils. A working group was established by the Partnership to take forward the development of a RAC for the North Sea. A model for a pilot RAC was outlined in the working group proposal which was subsequently sent to the Commission. The emerging structure is shown in Figure 10.

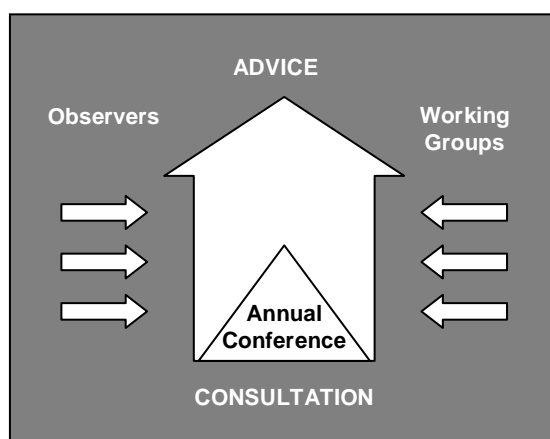


Figure 10. Initial suggestion for structure of Regional Advisory Council from the North Sea Commission Fisheries Partnership

By December 2003 the Partnership was already simulating the working of an actual RAC. A particular topic was chosen and the Partnership's RAC working group tried to reach a consensus view amongst interested parties. An agreed paper was issued by the working group, setting out arguments for defining areas of the North Sea where decoupling of cod from other species would be possible. It became evident that a North Sea RAC would be an especially useful institution which would encourage the development of a more integrated and sustainable approach to fisheries management.

A draft proposal was prepared for a North Sea RAC and was sent to a range of stakeholders for comment. Meetings were held with fishery managers from the Member States and the Commission to discuss the proposal and the text was progressively modified to reflect different views, and take account of the latest draft decision from Council. A draft proposal was submitted to the European Commission in September 2004. Organisations seeking membership of the NSRAC had been asked through advertisements in the fishing press to submit a letter of application.

Aberdeenshire Council, in Scotland, confirmed that it was willing to host a Secretariat for the prospective North Sea RAC. Formal approval of the RAC was awaited.

An Interim Executive Committee for the North Sea Regional Advisory Council (NSRAC) met in Copenhagen at the end of September 2004. There was much discussion of the membership structure of the NSRAC and a balanced composition for the Executive Committee was eventually agreed for recommendation to the First General Assembly. Everything was ready for the NSRAC to begin its work.

The first RAC

The NSRAC – the first of the Regional Advisory Councils - was formally agreed by the Commission on November 1st 2004. It held its first General Assembly in Edinburgh on November 4th 2004. Rules of Procedure for the NSRAC were adopted by the General Assembly and a chairperson elected. A company limited by guarantee had been established to give the NSRAC a legal identity. Membership of the Executive Committee was agreed. The NSRAC then began its work.

Since November 2004 additional RACs have been established for Pelagic Fisheries; North Western Waters; the Baltic Sea; and South Western Waters.

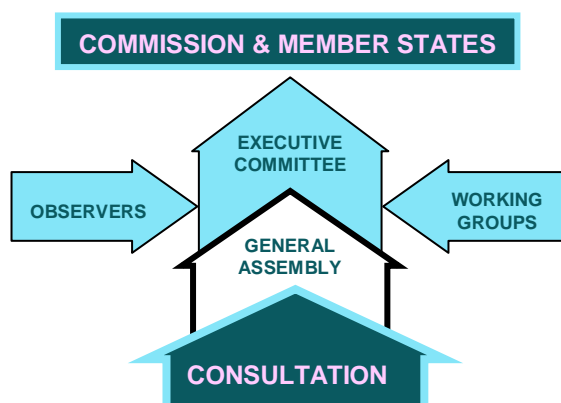


Figure 11. The basic structure of a Regional Advisory Council

The RACs now play a central role as stakeholder groups within the CFP (Figure 12). They are consulted extensively by the Commission and Council of Ministers, and are collaborating closely with ICES, the Commission and others in the development of new arrangements for providing expert advice on the operation of the CFP.

The RACs have already achieved a great deal. They are now responding regularly to requests from the Commission for advice. They have established their own working groups to assemble information and draft options for advice on a wide range of issues. They have produced reports on a range of topics and have promoted focus groups and symposia on critical issues.

One emerging problem for the new RACs is how advice from technical experts can be merged with the advice from the RACs and how the RACs themselves can make use of expert advice to ensure that their own advice is based on good evidence and takes account of all the information available. Before considering this problem it is instructive to look at two different management systems where stakeholder

9. Other fisheries management systems – the USA

Fisheries management in the USA

Fisheries management in the USA has developed on lines that are special to that country. Particular features include the formation of Regional Fisheries Management Councils, the preparation and implementation of Fishery Management Plans, and the protection of Essential Fish Habitat. In contrast to the European Union, the USA has for many years involved stakeholders in fisheries management. In addition, there has been strong emphasis on transparency, the free exchange of data and peer review of scientific advice.

In considering the American system of fisheries management, however, it is important to remember that it reflects the American constitutional system. The structure is federal, with much power retained by individual states, based on strong protection of the rights of individuals through a written Constitution. Moreover, in many parts of the USA there is little or no need to take account of fishing activities by other nations, who are too distant to have an impact upon local fisheries.

In the USA, responsibility for fisheries management falls between several overlapping agencies, each with their own responsibilities. The main agencies are:

- State agencies, dealing with fisheries in state waters
- Inter-state Fishery Commissions, for fisheries which cross state boundaries
- Tribal agencies, which serve the interests of indigenous peoples
- The National Marine Fisheries Service (NMFS) of the National Oceanographic and Atmospheric Administration (NOAA) of the US Department of Commerce
- The U.S. Fish & Wildlife Service, a federal service for fish and wildlife conservation

Stakeholder participation is an important characteristic of the work of all these agencies.

State agencies

State governments within the United States make their own provisions for the management of fisheries. There is no general template, although there are some federal obligations placed upon states including the Magnuson Fishery Conservation and Management Act, the US Endangered Species Act and the Marine Mammal Protection Act. A division is made between state waters and federal waters. State waters extend out to 3 miles from the coast (9 miles in the Gulf of Mexico) while federal waters bridge the gap to the limits of the EEZ (which is usually 200 miles from shore). Responsibility for fisheries management within state waters rests with the state, which may carry out its own stock assessments and set its own fishery regulations. The state is also responsible for enforcement within state waters.

The Florida Fish and Wildlife Conservation Commission (FWC) is an example of a state fisheries management organisation. Commissioners are appointed by the Governor and confirmed by the Florida Senate for five-year terms. There are currently seven commissioners who are to exercise the '*...regulatory and executive*

powers of the state with respect to wild animal life and fresh water aquatic life and shall also exercise regulatory and executive powers of the state with respect to marine life..'. A proportion of the Commissioners come from the commercial fishing industry, or are recreational fishers, or have an interest in fishing, although this is not obligatory. They may also include individuals with environmental interests Commissioners are chosen as individuals by the Governor for the legislature to confirm. An Executive Director serves at the pleasure of the Commissioners, and any new appointee to this position must be confirmed by the Florida Senate.

Funding for the Commission comes from state taxes and is agreed by the legislature. Additional funding may also come from taxes and licence fees imposed on fishers. Income from optional stamp duties and endorsements placed on fishing licences may be devoted to particular causes. For example, money derived from a snook stamp (which allows recreational fishers to retain one snook per day per person) is placed in a trust fund which is then used to fund work on snook. As a result, the fisheries science and assessments for snook is done to a very high standard.

There is a Fish and Wildlife Research Institute (FWRI) based in St. Petersburg. FWRI scientists conduct research and monitoring programmes and develop and implement techniques for restoring plant and animal species and their habitats. The institute collaborates extensively with other academic, non-profit and private research institutions on marine and wildlife conservation and management issues and is on the campus of the University of Southern Florida. Around half the FWRI staff members work at the St. Petersburg headquarters. The others operate out of field laboratories at inland and coastal locations throughout the state.

The Division of Marine Fisheries Management develops regulatory and management recommendations for consideration by the FWC Commissioners. The director of the division liaises with federal agencies on marine issues and is the state's representative and voting member on the Gulf of Mexico Fishery Management Council and the South Atlantic Fishery Management Council. Division activities include fisheries outreach and education programs, facilitating artificial reef development, carrying out stock assessments for local fish stocks, preparation of fishery strategic plans, the issue of special activities licenses, conducting wholesale fish dealer audits and assisting trap retrieval efforts. The division is responsible for the regulation of all recreational and commercial fisheries in Florida waters.

The Commission holds open meetings with stakeholders on issues of significance. Recreational fisheries are especially important in the coastal waters around Florida, many of the fishers coming from outside the state. There are sometimes conflicts between the interests of recreational and commercial fishers. Many of the fish stocks are not just found in Florida state waters but also extend into federal waters, or into the waters of other adjacent states and there are important mechanisms for co-ordinating state and federal activities. There may be disagreement between a state and the federal authorities over particular issues, and the federal authorities (The Department of Commerce) may impose emergency regulations in particular circumstances, although this power is rarely exercised.

Although particular fish species may be abundant within the waters of a particular state (for example, the yellow-tailed snapper in Florida) the snapper complex of species may be managed by the federal Regional Fishery Councils. Stock assessments involve cooperation between the state and federal authorities, and between adjacent states. Initiatives like the South East Data Assessment and Review (SEDAR) have been established to bring about better stock assessments

and to improve coordination between adjacent states and with the federal authorities. Within SEDAR, individual fishers participate in the assessment workshops and may bring their own data to workshops.

Local landings data are collected by the state commissions. Their quality is maintained by the existence of dealer and seller licensing systems, with the background threat of IRS investigation into defaulters. Use may also be made of statistics collected for the wider-ranging species by the regional offices of the federal fisheries agency.

Inter-State Fishery Commissions

In some areas of the USA, Inter-State Fishery Commissions exist to coordinate the management of marine fisheries. Thus, the Gulf States Marine Fisheries Commission (GSMFC) brings together five states (Texas, Louisiana, Mississippi, Alabama, and Florida) within the Gulf of Mexico. Similarly, the Atlantic States Marine Fisheries Commission was formed by fifteen Atlantic coast states (Maine to Florida, including Pennsylvania) to assist in managing and conserving shared coastal fishery resources. The Atlantic Commission's Interstate Fisheries Management Program (ISFMP) promotes the cooperative management of marine, estuarine and anadromous fisheries in state waters of the east coast through the development of interstate fishery management plans. Today, all states that have a declared interest in a fishery must comply with certain conservation provisions of the plan, or the Secretary of Commerce may impose a moratorium in that state's waters for the harvest of the species in question.

The public play an important role in the work of the Inter-State Commissions. Thus, the Atlantic Commission's fisheries management plans, involve advisory panels and also public information meetings and hearings. The advisory panels include representatives from the commercial, charter-boat, and recreational fishing industries, as well as conservation interests.

Tribal Fishing Agencies

Fish are especially important to the indigenous peoples and cultures of the USA. The need to ensure tribal rights to fishing were taken into account in the 1850's when treaties were negotiated with the indigenous peoples. Essentially the tribes, as co-managers of the resource, were entitled to a significant proportion of the fish, especially salmon, passing through their traditional fishing areas. However, legal battles over fishing rights continued until recently, as states resisted the recognition of treaty fishing rights and fought the tribes in federal courts.

Today, cooperation between states and the tribes has resulted in a number of programmes aimed at the protection, restoration and enhancement of fish stocks. Some regions or rivers now have their own tribal fisheries agencies employing biologists and other scientists dedicated to studying fish and aquatic ecosystems. Stakeholder participation is at the very heart of the various tribal initiatives. Interest is strongest regarding salmon and freshwater fish resources.

The U.S. Fish & Wildlife Service

The federal U.S. Fish & Wildlife Service exists to conserve protect and enhance fish, wildlife, and plants and their habitats for the continuing benefit of the American people. It is responsible for managing freshwater sport fishing on federal lands, including National Wildlife Refuges. It supports fishing through over 60 Fish and Wildlife Resource Management field stations located in 33 states. In addition to National Fish Hatcheries, the Service works in partnership with others to improve fish habitat and stream corridors. Initiatives include a number of fish passage projects and multi-agency showcase watersheds.

The Service is careful to consult stakeholders, especially in relation to particular areas or issues. For example, the Service is committed to working cooperatively with all stakeholders in the Columbia Basin to develop high quality fish and wildlife restoration and conservation plans, known as Sub-basin Plans, for the Columbia River and its tributaries.

One of the principal powers of the Service is the Endangered Species Act, which protects fish species which are under threat (see later).

The National Marine Fisheries Service (NMFS)

The US Secretary of Commerce is responsible for the National Marine Fisheries Service (NMFS), which is responsible for the overall stewardship of living marine resources at a federal level. NMFS's powers are provided by the Magnuson-Stevens Act, under which NMFS assesses and predicts the status of fish stocks, ensures compliance with fisheries regulations and works to reduce wasteful fishing practices. Under the Marine Mammal Protection Act and the Endangered Species Act, NMFS is also responsible for protected marine species (i.e. whales, turtles). NMFS is based at Silver Springs Maryland, and has six regional offices.

Regional Fishery Management Councils

The Magnuson Fishery Conservation and Management Act of 1976 is the main legislation affecting marine fisheries in the waters of the USA. The act established a 200-mile fishery conservation zone, and established Regional Fishery Management Councils. The geographical area of coverage for the Councils covers the Exclusive Economic Zone (EEZ), with the inner boundary being the seaward boundary of the coastal states (three or nine miles from shore).

The Act defines more specific objectives for fisheries management than the basic regulation of the CFP. It provides for management of fish and other species in the EEZ under plans drawn up by the Regional Fishery Management Councils and reviewed and approved by the Secretary of Commerce. It provides for regulation of foreign fishing in the management zone and issues vessel fishing permits. It also provides a mechanism for pre-emption of state law by the Secretary of Commerce. Enforcement of the fisheries regulations is undertaken by the US Coastguard and other agencies.

An essential feature of the Councils is they include stakeholders. Indeed they give stakeholders a key role in management of the fisheries as it is intended that they

should be comprised of knowledgeable people representing a variety of interests. The Councils develop recommendations for managing fisheries in federal waters which then form the basis of fisheries regulations implemented by the Secretary of Commerce. The Councils include nominees from each of the states they represent, and are expected to accommodate state, regional, and local interests. The Councils work collaboratively with the National Oceanographic and Atmospheric Administration (NOAA), state officials and scientists to establish the necessary knowledge base to formulate their recommendations. They also work closely with the state fisheries agencies and the Inter-state Commissions.

Eight Regional Fishery Management Councils have been established, as follows:

- New England Council
- Mid-Atlantic Council
- South Atlantic Council
- Caribbean Council
- Gulf of Mexico Council
- Pacific Council
- North Pacific Council
- Western Pacific Council

The Magnuson Act included provision for review every 10 years. The Sustainable Fisheries Act (SFA) of 1996 amended previous legislation. Greater emphasis was placed in the new Act on conservation by addressing over-fishing, reducing by-catch and restoring depleted stocks. The resultant federal programs gave greater emphasis to science, and emphasised the goals of preventing over-fishing, rebuilding over-fished stocks, protecting essential fish habitat, minimizing by-catch, enhancing research and improving monitoring.

The passage of the SFA, marked a significant change in NOAA Fisheries' legislative mandate to manage living marine resources. A fishery management plan (FMP) is now required to specify objective and measurable criteria for determining when a stock is over-fished and to establish measures for rebuilding the stock. The SFA also redefined '*over-fishing*'. New national standards were set for fishery management programs and plans. An extensive outreach campaign was launched to educate the public about the provisions in the Act (www.nmfs.noaa.gov/sfa/sfaguide/index.html).

Essential Fish Habitat

The Magnuson-Stevens Act called for direct action to stop or reverse the continued loss of fish habitats. The *Essential Fish Habitat* (EFH) provisions of the SFA required Councils to describe and identify EFH, and to minimize the adverse effects of fishing on EFH. EFH is defined as '*those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity*'.

Identification of EFH provides many opportunities for public involvement, enabling fishers to contribute their knowledge about the use of habitat by fish. For example, the North Pacific Fishery Management Council developed a process for the designation of *Habitat Areas of Particular Concern* that allowed the public and stakeholder groups to nominate specific locations for designation.

Once NMFS and the Councils identify and describe EFH for each species, they must assess fishing practices in their regions to determine if the resulting impacts on habitat are acceptable or not. If the Councils determine such impacts exist, they must take steps to minimize them; for example by restricting the use of certain fishing gears from specific areas.

The emphasis on protecting fish habitat seen in the US is not paralleled within the European Union, where greater emphasis is placed on the assessment and protection of individual fish stocks.

The Endangered Species Act

The US Endangered Species Act (ESA) was introduced by the Nixon administration in 1973 and provides for the conservation of species that are endangered or threatened with extinction throughout all or part of their range. It also provides for the conservation of the ecosystems on which these species depend. 'Species' is defined as including a species, a subspecies, or, for vertebrates only, a distinct population segment (DPS). Pacific salmon are listed as evolutionarily significant units, which are considered equivalent to a DPS. This width of definition is important within the Act, in allowing particular fish populations to be conserved.

NMFS and the U.S. Fish and Wildlife Service (USFWS) share responsibility for implementing the ESA. Generally, USFWS manages land and freshwater species, while NMFS manages marine species, including anadromous salmon (ocean species that return to rivers to spawn). NMFS has jurisdiction over 61 listed species.

A species is considered endangered if it is in danger of extinction throughout all or a significant portion of its range. A species is considered threatened if it is likely to become an endangered species within the foreseeable future. NMFS may choose to undertake a status review of any species. If the species is then considered warranted for listing, then NMFS announces its decision to propose listing the species in a notice in the Federal Register. Public comment is invited on the proposed listing. An individual or organization may petition NOAA Fisheries or USFWS to have a species considered for listing.

The ESA requires that listing decisions be based solely on the best scientific and commercial data available. It prohibits the consideration of economic impacts in making species listing decisions. The ESA also requires designation of critical habitat necessary for the conservation of the species; and this decision does consider economic impacts.

The ESA has its limitations. Most particularly, it lacks the emphasis on habitats which exists, for example within the European Habitats and Species Directive. Special areas like coastal lagoons or sandbanks or coral reefs cannot be designated for their own characteristics. Habitats can only be designated as critical if an endangered species is present. However, the ESA provides strong protection for any fish or fish populations which are designated as endangered. The listing of an endangered species generally protects the species from 'take' or exploitation. NMFS may also extend the 'take' prohibition to threatened species.

Endangered and threatened species of fish include Pacific salmonid species, various species of sturgeon (*Acipenser*), the delta smelt (*Hypomesus transpacificus*), the

sawfish (*Pristis pectinata*). The Goliath grouper, the largest of the western north Atlantic groupers, is listed as a Species of Concern.

Fisheries monitoring & research

Since the SFA was passed, NMFS has made significant efforts to modernise stock assessment through its regional science centres. Landings data have improved through the licensing of dealers and sellers. The centres also conduct observer programmes on fishing vessels, to monitor discarding and collect log book data from fishing vessels with the cooperation of fishers.

Stakeholder involvement in the Regional Fishery Management Councils

A key feature of the Magnuson-Stevens reforms was the involvement of stakeholders in fisheries management through Regional Fishery Management Councils. The Councils were established to serve as planning units to carry out provisions of the Act. Each Council is directed to prepare fishery management plans for implementation by the Secretary of Commerce through the National Marine Fisheries Service (NMFS).

We may take the New England Fisheries Management Council as an example. The Council is made up of eighteen voting members:

The Regional Administrator of the National Marine Fisheries Service (NMFS).

The principal state officials with marine fishery management responsibility for Maine, New Hampshire, Massachusetts, Rhode Island and Connecticut.

Twelve members nominated by the governors of the New England coastal states and appointed by the Secretary of Commerce for three-year terms.

Four non-voting members represent the United States Coast Guard, U.S. Fish and Wildlife Service, U.S. Department of State, and the Atlantic States Marine Fisheries Commission.

Within the New England Council, *Oversight Committees* meet regularly to review and discuss individual fishery management plans (FMPs). Their recommendations are forwarded to the full Council for their approval before inclusion in any draft or final version of an FMP.

Reporting to the Oversight Committees are *Advisory Panels* made up of members from the fishing industry (from both commercial and recreational sectors), scientists, environmental advocates, and others with knowledge and experience related to fisheries issues. They meet separately or jointly with the relevant Oversight Committees and provide input and assistance in developing management plan measures. Advisers are appointed every three years following a solicitation for candidates. The Council's Executive Committee provides the final approval of advisory panel members.

Plan Development Teams are made up of scientists, managers and other experts with knowledge and experience related to the biology and/or management of a

particular species. They serve as an extension of the Council staff and meet regularly to respond to any direction provided by the Oversight Committee or Council, to provide analysis of species-related information and to develop issue papers and other documents. A member of the Council staff generally chairs each team and the team members are from state, federal, academic or other institutions.

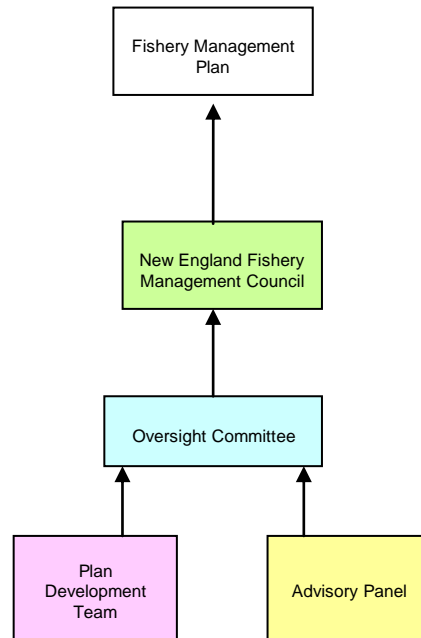


Figure 13. Team structure for preparing Fishery Management Plans within the New England Fishery Management Council

Thus, within this system there is an attempt to separate out the generation of technical advice (the Advisory Panel) from the deliberations of stakeholders (the Plan Development Team), but the two aspects are brought together by the Oversight Committee and by the Council itself. At the time of writing the New England Fishery Management Council had developed nine FMPs, all of which had been implemented by NMFS. The establishment and amendment of these plans involved public hearings, where a range of stakeholders were given the opportunity to have their say. Council meetings themselves are open, and are often held at regional fishing ports.

Councils may adopt far-reaching conservation measures. For example, the New England Fishery Management Council recently took the important step of closing two offshore canyons located southeast of Nantucket to protect deep-sea coral habitats from potential effects of vessels targeting monkfish. Introduced as an amendment to the Monkfish Fishery Management Plan, the measures required modifications to the gears used to catch monkfish to protect essential fish habitat and reduce discards of monkfish. A mechanism has also been established to support and fund cooperative research between scientists and fishers.

The actions proposed by the Fishery Management Councils are put into effect by the NMFS. In recent years there has been a tendency for stakeholders, and especially conservation interests, to challenge the adopted recommendations of Fisheries Management Councils in the courts.

The Magnuson-Stevens Act (MSA) was re-authorised and amended in 2005.

Science and stakeholders

There have been a number of initiatives where Fishery Councils have involved stakeholders in the preparation of technical advice.

South East Data Assessment and Review (SEDAR)

South East Data Assessment and Review (SEDAR) is a cooperative Fishery Management Council initiative which began in 2002. It aims to improve the quality and reliability of fishery stock assessments in the South Atlantic, Gulf of Mexico, and US Caribbean. SEDAR is managed by the Caribbean, Gulf of Mexico, and South Atlantic Regional Fishery Management Councils in coordination with NMFS and the Atlantic and Gulf States Marine Fisheries Commissions. SEDAR strongly emphasises constituent and stakeholder participation in development of the fish stock assessments, transparency in the assessment process, and a rigorous and independent scientific review of completed stock assessments.

SEDAR is organised around 3 workshops. The first is a data workshop where data-sets are documented, analyzed and reviewed, and data for conducting assessment analyses are compiled. The second is an assessment workshop where quantitative population analyses are developed and refined and population parameters are estimated. The third is a review workshop where a panel of independent experts reviews the data and assessment and recommends the most appropriate values of critical population and management quantities.

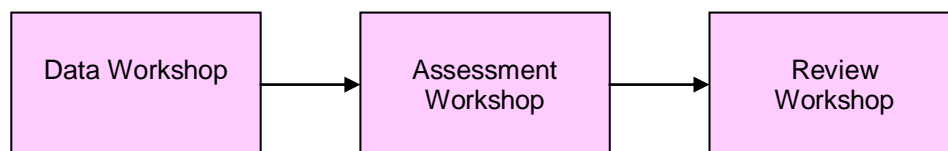


Figure 14. The workshop structure of South East Data Assessment and Review (SEDAR).

The data workshops take information from a wide range of sources, including independent laboratories and university researchers as well as individual fishers, who may give estimates of unreported landings. There is not the same narrowness of approach used within ICES, or in other parts of the USA where there has been criticism that only 'official' data (from NMFS) tend to be admitted to the assessments. Participants in the data workshops review the input data, including catch statistics, fishery sampling and population monitoring data. They make research recommendations and present the data in a readily assimilated form to the assessment workshops and to all interested parties.

The assessment workshops may include representatives of environmental groups, university and other independent scientists, and fishers. Participants in these workshops develop stock assessment models, estimate values for population

parameters and stock status benchmarks and predict the future state of stocks. The assessment workshops may also propose particular management measures.

At the review workshops an independent peer review panel provides a technical review of the data and of the assessment methods. Relevant committees from the Councils, such as the Science and Statistics Committees, must then certify the final assessment report before it becomes eligible for use in developing management actions.

All SEDAR workshops are open to the public and are attended by observers. Public testimony is accepted in accordance with each Council's Standard Operating Procedures. Workshop times and locations are noticed in advance through the Federal Register. It is apparent from reading the records of the workshops that full account is taken of stakeholder views, and discussions at the workshops can be far-ranging. Comments are included in the reports from individual fishers, company representatives, divers' organisations, environmental NGOs and other interested parties.

Altogether, SEDAR provides an open and transparent mechanism for developing and reviewing scientific information that is critical for the proper management of fishery resources. It presents an excellent example, which has been tried and tested, and which has been developed against a background of strong public interest in both fisheries science and fisheries management. SEDAR contrasts strongly with the traditional ICES system operated in Europe, where stock assessments and the provision of scientific advice is carried out by scientists alone, without stakeholder input.

Further information on SEDAR can be gained from the web-site:
<http://www.sefsc.noaa.gov/sedar>

The Federal Advisory Committee Act (FACA)

In 1972, the Federal Advisory Committee Act was enacted by Congress to ensure that advice rendered by the various advisory committees, task forces, boards, and commissions formed over the years by Congress and the President, be both objective and accessible to the public. The Act not only formalized a process for establishing, operating, overseeing, and terminating these advisory bodies, but also created the Committee Management Secretariat (MCC), an organization whose task it is to monitor and report executive branch compliance with the Act.

The Act essentially lays down rules for the operation of advisory committees. They have to have a charter, be open to the public, minutes have to be kept and their duration must be limited. FACA has defined an Expert contributing to an advisory committee as *'a person who is specially qualified by education and experience to perform difficult and challenging tasks in a particular field beyond the usual range of achievement of competent persons in that field, and is regarded by others in the field as an authority or practitioner of unusual competence and skill in a professional, scientific, technical or other activity'*.

The oversight of advisory committees through FACA is an initiative which sets an example to other countries.

The Fishery Council system

Undoubtedly, the Fishery Councils have pioneered stakeholder participation in fisheries management. The theory in establishing the Councils was that by combining federal and state managers along with 'knowledgeable' private citizens in the development of management plans the Councils would eventually arrive at sound, locally based decisions. The Councils have certainly made progress in bringing together stakeholders and scientists within the management system. Nevertheless, within the US there is still a view that the Councils are flawed.

Public members of the Councils are nominated by State Governors but selected by the Secretary of Commerce. It is alleged that NMFS specifies the types of individuals it is looking for, implying that if a particular Governor does not submit the people NMFS wants then the Secretary will reject the nominations. There has been particular criticism of the poor representation of fishers within the Councils. It is alleged that NMFS prefers association executives, industry lawyers and lobbyists instead of rank-and-file fishermen. That those selected are there to protect the interests of the groups they represent, rather than provide advice from those knowledgeable about the fish and fisheries themselves.

Strong federal authority is exerted within the system. The fishery management plans and any amendments to them have to be approved by the Secretary of Commerce, which, in practice, gives NMFS a veto. NMFS also provides much of the staff support to the Councils and the Councils depend heavily on NMFS or NMFS-funded research for their decisions. There has also been criticism of NMFS insistence that the Councils' utilize attorneys supplied by the office of NOAA General Counsel – NMFS' own lawyers. Finally, Council budgets have to go through NMFS first for Congressional appropriations and NMFS therefore exercises strong control over what the Councils can do

There has also been criticism that the track record of the Councils is poor. It is said that the Councils have allowed the depletion of the very stocks they are charged with conserving. In both New England and the West Coast, there have been problems with the ground-fish fisheries, with some stocks over-fished or on the verge of collapse. Stock rebuilding programs have had poor success.

Conservation groups have been especially critical of the Councils. Both the U.S. Commission on Ocean Policy (USCOP) and the Pew Oceans Commission concluded that the current system is in large part responsible for the alarming decline in the health of US fisheries.

The Pew Oceans Commission commented that *'the fishery management process faces many challenges, with ample room for improvement. Fishery management is increasingly inflexible, stifling innovative solutions to problems. The process is slow and bureaucratic, often without adherence to timelines. Accountability is lacking and litigation is placing fishery management decisions in the hands of federal judges. As management complexity increases, additional funding is necessary for more sophisticated data collection, management programs, and enforcement. There is a sense that as depleted stocks recover, the management process may strain under new and more controversial allocation decisions.'*

The Commission went on to comment that there is a need for more and better science to inform management decisions. The lag time between data collection and use can take years, even when technology exists for real-time data collection. This

often results in management decisions based on outdated information. The data collection process is also limited in its ability to consider fishermen's observations. Many would like to see more cooperative research between fishermen and scientists. The Commission also concluded that the availability of socio-economic information is limited. All these criticisms sound familiar. They have also been made of the Common Fisheries Policy.

One clear conclusion from examination of the US Fishery Council system is that increased stakeholder involvement is expensive and time-consuming to manage. It creates a great deal of work for managers and scientists, and the complexity in the management system creates delay and gets in the way of clarity. Nevertheless, the provisions made for the involvement of stakeholders is valued by all concerned and especially the stakeholders themselves. Much of the support for the stock assessments comes from institutes and organisations outside the formal management system, like Universities and independent laboratories as well as stakeholders themselves. Institutions like SEDAR provide a good example to follow. SEDAR shows how a diversity of information on the fisheries may be brought together from a variety of sources.

10. Fisheries management in Canada

Canadian Fisheries

The collapse of fisheries off the coast of Newfoundland & Labrador in the 1990s (sections 5) led to a fundamental reappraisal of fisheries management in Canada. The main fish stock to collapse was the northern Atlantic cod (*Gadus morhua*), but this was only one of many stocks that reached historically low levels of abundance. Others included the redfishes (*Sebastes* spp.), haddock (*Melanogrammus aeglefinus*), and the American plaice (*Hippoglossoides platessoides*) as well as pelagic fishes including the capelin (*Mallotus villosus*), and species of lesser or no commercial importance.

As discussed in section 5, the cause of the collapse of the fishery is still the subject of intense debate (Steele et al., 1992; Finlayson, 1994; Walters & Maguire, 1966; Harris, 1998; Rose, 2003). It is evident that scientific advice was over-optimistic. The subsequent closure of the fishery proved extremely costly to both taxpayers and the affected fishing industries and communities. Large sums of money were spent on restructuring the industry including projects aimed at moving employment out of fishing as well as providing direct income support to those fishers most affected. In spite of that investment, progress has been very slow in terms of recovery of the affected fish stocks. Instead, new fisheries have developed, based largely upon crustaceans like the snow crab (*Chionoecetes opilio*) and northern shrimp (*Pandalus borealis*). It has been suggested that the increased abundance in these species during the 1990s resulted from a marine ecosystem regime shift associated with changes in ocean climate, compounded by a reduction in predators, in particular cod (Rose, 2003).

Recent developments in fisheries management in Canada

The Canadian government has federal jurisdiction over the management of freshwater and marine fisheries. The Minister of Fisheries and Oceans has the power to take decisions on fisheries management, while the Canadian Provinces have property rights for the fish contained within their provincial territory and jurisdiction over processing and marketing. As in the USA, aboriginal groups play a role in fisheries management particularly with respect to salmon. Rulings by the Supreme Court in the 1990s gave the First Nations priority access to some fisheries. There has since been much discussion and negotiation over the allocation of quotas for those fisheries.

The Department of Fisheries and Oceans (DFO) is responsible for developing and implementing policies and programmes in support of Canada's ecological, social and economic interests in oceans and fresh waters. DFO's guiding legislation includes the Oceans Act (which charges the Minister with leading oceans' management and providing coast guard and hydrographic services) and the Fisheries Act of 1868 (which confers responsibility to the Minister for the management of fisheries, habitat and aquaculture).

DFO had firmly based its fishery management decisions in the years leading up to the cod collapse upon the advice of scientists. In the late 1970s a structured peer review process, led by the Canadian Atlantic Fisheries Scientific Advisory Committee (CAFSAC), was developed for providing fisheries advice on Canada's east coast. In

retrospect, Hutchings *et al.* (1997) have criticised fisheries management within DFO at that time for being closed and lacking in transparency. Attendance at assessment review meetings was restricted to a narrow group within DFO's Science Branch, with other departmental scientists and all outsiders excluded. The failure to foresee the steep decline in fish stocks has been attributed to an over-reliance on the science and over-confidence in the process of quantitative fish stock assessment (Finlayson, 1994; Walters and Maguire, 1996). Alcock (2001) has examined the failures in both New England and Newfoundland at the time of the cod collapse. While scientific assessments proved ineffective determinants of sustainable policies in both cases, Alcock's comparative analysis revealed important differences. In New England, ominous assessments were largely ignored by decision makers. In Newfoundland, more optimistic assessments led decision makers astray. Alcock concluded that this contrast in outcomes illustrates the countervailing perils associated with the degree to which scientific assessments are embedded within management organizations.

Following the collapse of the fishery, CAFSAC was abandoned in favour of a new approach to management. Under the new system the fishing industry became much more involved in data collection and in the interpretation of the data collected. These improvements came about through reforms within DFO, largely under pressure from the industry and other organisations. The fundamental programme of change placed much greater emphasis on conservation, sustainability, economic viability and adopting a co-management approach, allowing fishers more control and involvement in management. Extensive stakeholder involvement is now evident throughout Canadian fisheries management; much of it arising through initiatives by fishers themselves.

DFO now conducts its stock assessments through a new Regional Advisory Process (RAP). Academic scientists and fishers now take part in the stock assessments, and most of the assessments are now peer-reviewed. At one stage, the ground-fish stocks were then subject to further review and consultation through a higher organisation, the Fisheries Resource Conservation Council. More recently, that Council has been given a more strategic role and responsibility for the annual advice to government has been returned to DFO.

The Fisheries Resource Conservation Council (FRCC)

One of the first initiatives by the Canadian government following the collapse of cod was to create the Fisheries Resource Conservation Council (FRCC). The Council was formed in 1993 as a partnership between scientific and academic expertise, and all sectors of the fishing industry. In part, the Council was intended to provide the Minister of Fisheries and Oceans with independent advice, taking some of the responsibility for recommending conservation measures away from civil servants. Initially, the Council made public recommendations to the Minister on management measures for the Atlantic fishery.

The Council consists of 12 members, appointed by the Minister of Fisheries and Oceans, with an appropriate balance between 'science' and 'industry'. Members are chosen on merit and standing in the community, and not as representatives of organisations, areas or interests. 'Science' members are drawn from government departments, universities or international positions, and are from a mix of disciplines, including fisheries management and economics. 'Industry' members are appointed for their knowledge of fishing and the fishing industry, and for their understanding of the operational and economic impacts of conservation decisions. Members from

DFO itself are *ex officio*. The four Atlantic Provinces, Quebec, and Nunavut may each nominate one delegate to the Council.

The objectives of the Council were initially very wide. They included defining conservation, economic and social objectives for the fishery, managing the pattern of fishing, developing a more profound understanding of fish-producing ecosystems, reviewing scientific research, and considering resource assessments and conservation proposals. On occasions the Council held public hearings. Initially, then, the Council's focus was on improving annual advice on total allowable catches and other conservation measures related to Atlantic ground-fish stocks. An important aspect was its role in integrating scientific expertise with the knowledge and experience of all sectors of the industry. However, in 2002, following a review of the FRCC's mandate, the Council was given a different task: it was asked to focus on long-term conservation strategies. Now, the Council no longer plays an active part in providing immediate advice on fisheries management

The original function of the Council seems to have been to strengthen the advice given to the Minister by ensuring that a range of informed views were offered up. It may even have been intended to take some of the blame from the Minister in the event of further disaster. The change in emphasis from commenting on the annual advice to the preparation of more strategic advice may reflect a wish to restore full responsibility to DFO now that events are more stable.

Changes within DFO

The Regional Advisory Process (RAP)

The new RAP system essentially devolves management to a regional level, and pays stronger attention to the principles of transparency and inclusiveness, while still maintaining the central role of DFO. RAP has evolved very quickly, sometimes diverging to address interests or capabilities of the individual regions (Rice, 2005). There has been strong support among stakeholders for its open approach, but the rules for outside participation and privileges of outside participants have differed and these differences have been the subject of concern. Moreover, although initially developed to provide science information and advice on fisheries questions at a regional level, the RAP has also been modified to provide wider scientific support for other legislation, including the Canadian Environmental Assessment Act, the Oceans Act and the Species at Risk Act.

RAP involves meetings which provide the scientific basis for the management of marine and freshwater resources within a particular region. Meetings are also held to provide advice on the appropriate objectives, strategies, and regulatory measures for the fisheries. A RAP meeting will review all pertinent scientific data and analyses, conduct its own analyses to establish the status of stocks, and then advise on management. Wider issues are also discussed and commented upon. Attendance at RAP meetings varies in relation to the issues being discussed and can involve experts from DFO, outside agencies, Universities, the fishing industry and other sources which can provide meaningful input. There is great diversity in the kinds of meeting which may be held, depending on the issue to be resolved. However, often there is an initial discussion of the issues, before deciding upon the way the stock assessment is to be done. This allows consensus to be reached between scientists, stakeholders and managers before analysis begins. The stock assessments are also subject to review as part of the RAP.

Principles and guidelines have been laid down to facilitate the RAP. The main goal is to provide the best possible science to the Minister, managers, management boards, stakeholders and the public. The participants in RAP meetings are not there to be informed about conclusions on science questions, or to represent different sectors. They are there to challenge and review the information available, often including traditional or fishers' knowledge, leading to objective consensus. The reviewed information and advice can then be communicated widely, and recipients can be confident of their reliability. The quality control function is not separated from RAP. RAP includes both the technical review and the development of advice.

The fact that the process is 'open and transparent' has not led to unrestricted public participation. Meetings are structured by DFO to do their work efficiently, and to maintain highest achievable standards of rigour and objectivity. There is a strict requirement that participants must be knowledgeable about the issues being reviewed. All participants have equal status at the table.

The Canadian Science Advisory Secretariat (CSAS)

DFO uses a national advisory body – the Canadian Science Advisory Secretariat (CSAS) - to facilitate and strengthen its advisory process. CSAS coordinates the peer review of scientific issues for DFO. CSAS is intended to foster national standards of excellence, and promote exchange and innovation in methodology, interpretation, and insight. CSAS also coordinates communication of the results of scientific reviews and advice. Reports on the status of fish, invertebrate and marine mammal stocks, environmental and ecosystem overviews, research documents featuring detailed scientific information, as well as proceedings of peer review meetings are available from CSAS. CSAS also holds special meetings to develop advisory frameworks and guidelines for emerging environmental issues.

There are some similarities between the CSAS system and the FACA oversight of the advisory process which exists in the USA. In both cases there are powerful federal advisory bodies which set standards for the provision of advice to government bodies. Such standards are lacking within the European Union.

Science Advice for Government Effectiveness (SAGE)

In Canada there are external policy guidelines for how science advice is to be provided to the Government. In 2000 a report on *Science Advice for Government Effectiveness* (the "SAGE Report"; <http://www.csta-cest.ca/>) was adopted by Cabinet as the standard for all science advisory processes. The SAGE Principles and Guidelines followed soon after, setting the methods and standards for implementation.

'Science advice' was defined by the Council of Science and Technology Advisors (CSTA) as '*value-added guidance deriving from scientific theories, data, findings, and conclusions provided to inform policy and regulatory decision making*'. The SAGE principles are discussed in section 5 of this report.

Interviews with Canadian scientists have revealed that though many of them know that the SAGE principles and guidelines exist, few of them are familiar with their provisions. Those involved in providing scientific advice have not absorbed the

message. SAGE seems to have been a government initiative which influenced the design of the advisory process without reaching those providing scientific advice.

The Canadian system for managing fisheries

There is much which can be learned from the Canadian experience in dealing with issues of scientific advice and how it should be provided. The SAGE Report sets out general principles and guidelines for providing scientific advice, and represents the most detailed analysis of advisory issues currently available. The application of these principles to fisheries science has required extensive planning. DFO has put a great deal of effort into meeting its advisory responsibilities in ways that are predictable to all participants, and give all interested parties a clear understanding of their roles and responsibilities. The adoption of the Regional Advisory Process (RAP) ensures that advice is provided at the right level and that relevant parties can participate. The existence of CSAS ensures that common standards are applied to the devolved process, while the FRCC is available to involve a wider range of advisers in strategic support.

Under the SAGE guidelines science input has to be sought from a wide range of sources, due weight has to be given to the 'traditional knowledge' of local peoples; and advice has to balance the multiple viewpoints received. All advisory processes, including those involving traditional knowledge, must include rigorous review and quality control of all input, analyses, findings, and recommendations. Scientists now have a wider range of information available to them and can look at the conclusions and interpretations of other parties. The whole process is also subject to scrutiny.

Rice (2005) has commented upon the operation of the DFO system and compared it with the system operated by ICES. He believes that the SAGE and other associated principles and guidelines set a high bar for the Canadian science advisory processes. By having a single, inclusive RAP the problems within ICES of having separate Advisory Committees for fisheries, environmental, and ecosystem issues have been avoided. Inviting scientists from academia and other international laboratories to meetings has proved worthwhile. Including fishers and other stakeholders has proved more difficult, but members of the industries being managed, and people from the communities where fishers live now have a place in the process as active participants –not just as observers. They can contribute information, pose questions about working papers, and participate in the formulation of the conclusions and advice. Their presence has not compromised the objectivity of the advice. DFO has developed a process which meets the required standards for inclusiveness and transparency while maintaining objectivity. Rice (2005) has outlined those features of the RAP system which have ensured success in involving stakeholders. One of these is the participation of individuals, including fishers, as 'experts', rather than representatives of particular sectoral interests.

Much information on the principles adopted for participation in meetings, and the diversity and flexibility of the meetings has been documented on the CSAS website (www.dfo-mpo.gc.ca/csas).

A particular feature of the Canadian system is now the direct involvement of fishers in surveys and stock assessment. Fishers assist more directly in providing information to evaluate the fisheries. A series of joint industry / science surveys aimed at monitoring stock biomass were established as part of a support programme following the closure of the northern cod fishery in 1992, with the support of the Fisheries

Resource Conservation Council (FRCC). Much progress has since been made in developing the role of fishers in the provision of information on the fisheries and the state of stocks. The Fishermen and Scientists Research Society carries out research and monitoring of stocks and disseminates that information to its members. The Pelagics Research Council and the Herring Science Council carry out surveys by means of commercial fishing vessels and engage in major fish tagging experiments. The resultant improvement in the credibility of science with the fishing industry has led to increased compliance, which has contributed to some success in implementing conservation measures. Joint survey programmes have improved understanding between fishers and scientists. Working together has led a much better consensus as to the state of the fish stocks and fishers now have more confidence in the scientific assessments.

There is, however, a strong element of top-down management and the 'nanny state' about the Canadian system. Responsibility for the formulation of advice remains very firmly in the hands of DFO, especially now that the FRCC plays a smaller role in formulating annual advice on the fish stocks. DFO decides who can be a stakeholder, and who should be permitted to attend the RAP meetings. Moreover, there is only very limited funding for stakeholders to participate in meetings.

There is also concern that the RAP system, and indeed the whole fisheries management system is too strongly centralised. George Rose (2003) has argued that fisheries science in regions like Newfoundland and Labrador needs a new foundation and new direction. He points out that a broadly-based and continuity-rich scientific program is impossible without a strong local base, involving regional Universities. He also argues that the independence of science from management and the political processes of the day is vital not only to the quality of the science, but also to its credibility both to local industry and more broadly on the international scientific arena. He is doubtful whether the present configuration of the DFO can deliver the type of science required.

The world has much to learn from the Canadian system of fisheries management which developed following the catastrophic decline in the ground-fish stocks. The debate about different forms of management, the role of government and the role of stakeholders has probably been more thorough and well-informed in Canada than anywhere else. The system of management currently in place is elaborate, but well thought out and progressive. However, it is still criticised by many within Canada and may not have reached its final stage of development.

11. Stakeholders & scientists

Stakeholder participation in fisheries management

Despite the heavy involvement of scientists and other technical experts in fishery management, and the very strong control exerted by governments and international agencies on many fisheries, there have been many alarming instances of fish stock declines throughout the world. There are clearly difficulties when governments attempt to manage fisheries, even with the aid of a plethora of expert advisers. It now seems self-evident that the participation of fishers and other interest groups is important to the success of fisheries management. In section 6 we saw that there are strong philosophical, pragmatic and political reasons for involving the governed in their own governance. In addition, where control is exercised by unelected officials, or where there has been a failure of management, there are practical advantages to be gained from more participative governance; a system of management where the state plays a less intrusive role and elements of decision-taking are passed to stakeholders and other interests. Fisheries management is not just about conserving fish stocks. There are wider management objectives, and advice is required from a wide range of experts, including fishers themselves.

It is an important step to involve fishers and other stakeholders in fisheries management, and it is one for which little prescriptive guidance is available. There is no instruction manual for achieving participative fisheries governance. The Regional Fishery Management Councils in the USA provide a working example, but they are very closely tailored to the American system of government. The Councils exist within a political system where the rights of individuals are considered paramount, transparency is important and consideration of other countries is minimal. The Councils have their own unique advantages, but they do suffer from some difficulties. Their management decisions appear to be prone to legal challenge. There are problems in the way participants are selected. There is some conflict at the interface between state and federal government. Similarly, the Regional Advisory Process in Canada is seen as a great improvement, but it retains a strong degree of top-down management, with stakeholders only partially admitted to the process of fisheries management. There are, however two strengths in the American and Canadian systems which are worthy of emulation. The first is there their success in bringing scientists and stakeholders together. Specific mechanisms have been put in place for integrating scientific views with those of stakeholders. In both countries those mechanisms are still evolving, but they appear to have been successful. The second is that both countries have looked long and hard at actual processes for producing expert advice, and have set out guidance for establishing advisory committees.

The new Regional Advisory Councils (RACs) of the European Union have come into existence with their own structure. They are designed to bring together fishers and other interests from different Member States to provide advice to the fisheries managers. They allow the full involvement of stakeholders in the preparation of advice, with their decisions arrived at through consensus. However, they are purely advisory. The Commission and Council of Ministers are still firmly in charge. Unlike the Regional Fishery Management Councils in the USA their views carry no legal weight and the Commission is not obliged to accept their advice. It has been said that it would be difficult for the Commission to avoid following advice reached by consensus within a RAC. Certainly there is scope for the RACs advice being accepted by the Council of Ministers in preference to proposals coming from the

Commission. However, the RACs are too new for their full strengths and limitations yet to become fully apparent.

It is evident that even with the new RACs the process of integrating advice from stakeholders with the advice coming from scientists is still problematical. Unlike America and Canada, where advice is fully integrated, under the CFP there are parallel and separate channels for obtaining scientific advice on the one hand, and advice from stakeholders on the other. Scientific advice comes from ICES and from the Commission's own advisory body, STECF. Stakeholder advice comes from ACFA and from the RACs and is taken after the scientific advice has been incorporated into management proposals. The management structure is designed around the assumption that biological science is the main source of knowledge on the fish stocks. The main sources of that knowledge (ICES and STECF) are insulated against any influence from the fishing industry. Fishers and other stakeholders are entitled to ask the question *'why should the accumulated evidence on fisheries be mediated and interpreted only by scientists and civil servants whose contact with those fisheries is very limited?'*

Under the CFP, the system for providing scientific advice is self-contained, as indicated in figure 14. Although the RACs are now able to observe the scientific process they are not formally part of it.

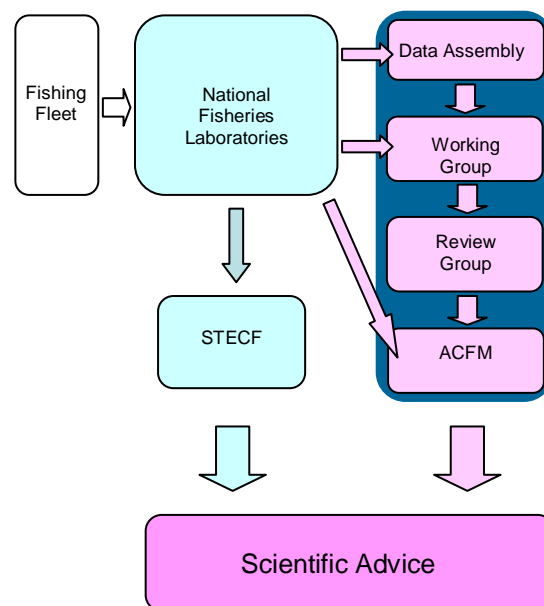


Figure 15. The two main streams of scientific advice under the Common Fisheries Policy.

Within the CFP, then, there remains a question over the extent to which scientific advice should remain isolated and independent of the views of lay persons or indeed from the political structures in which the advice is utilised. We have seen that in other countries scientific advice is no longer prepared in isolation, but depends on interaction with, and even the support of fishers, although it does not allow the wishes of fishers to dominate. How critical is it to involve stakeholders in the formulation of scientific advice?

The involvement of stakeholders in the preparation of advice

The United Nations Food and Agriculture Organisation's (FAO) Code of Conduct for Responsible Fisheries (1995) emphasises the need to listen to fishers, and evaluate the needs and aspirations of fishing communities rather than treat the management of fisheries as a purely scientific and technical problem. Stress is placed on a need for increasing involvement of fishers and their own knowledge in management.

One aspect in which the involvement of fishers is crucial is in the gathering of information on the fisheries and on the fish stocks. The North Sea Commission Fisheries Partnership (section 8) paid particular attention to the information required from fishing fleets. A joint Study Group with ICES examined the incorporation of additional information from the fishing industry into fish stock assessment. Amongst the recommendations from the study group was a suggestion that joint working groups of scientists and fishers should develop strategies for improving data quality. This could ultimately lead to quality assurance protocols for sampling. Regional and/or stock specific project groups, consisting of fishermen and scientists (and possibly including fishery economists or social scientists) might be established to develop a common perception of fish stocks in certain areas. These groups could provide additional information for the stock assessments, improve the transparency of the assessment process and promote mutual understanding. Joint abundance surveys could be designed to incorporate fishing vessels and the expertise of fishermen into the scientific surveys.

Finlayson (1994) points out that in Canada, in the events leading up to the collapse of the northern cod, the Department of Fisheries and Oceans respected the political power of fishers but made little attempt to use the information that fishers were willing to present. He acknowledges, however, that one of the problems is that fishers' knowledge often has a completely different format to the information collected by scientists. Much of the knowledge held by fishers is tacit (Pálsson 1995); that is, it is real knowledge but it is not readily articulated in words. Scientists find it difficult to evaluate tacit information. Even when the information can be written down it has often not been collected systematically, and it tends to be qualitative rather than quantitative. There is a reluctance to engage with fishers unless the information is provided in a format which scientists can recognise. In effect, scientists only value the knowledge of fishers if the fishers become proxy scientists or research assistants, presenting data in a scientific format. There is no recognition of the fact that knowledge can take a variety of forms and that fishers themselves are experts on their own terms. There is also a problem in that scientists may mistrust fishers. They may be concerned that fishers might seek to promote a rosy picture of the state of fish stocks, or to minimise the impact of the fishery.

There is also a problem from a fishers' standpoint over the free and unrestricted exchange of information. Fishers' knowledge is important for their livelihood. They do not want to release information which will help competing fishers. Nor do they wish to provide information which will result in their being penalised by fishery managers. Fishers have already experienced the problems which can arise when they cooperate with scientists in the monitoring of by-catches. Those fleets which provide information may subsequently be subject to regulation while others which withhold information may escape. There is an ethical problem here. Scientists and managers may wish to emphasise to fishers the long term value of their providing further information for use in management, without mentioning to them that the information may result in their fishing activities being curtailed. Moreover, those

fishers who remain secretive about matters such as discarding may benefit from withholding information.

The solution is to create a process or institution which can promote trust between fishers and scientists in order to facilitate exchange of information under conditions which instil confidence in both parties. It cannot be disputed that local, detailed information from fishers, even if it is not expressed in a scientific format, can supplement research-based knowledge and result in better scientific advice. Furthermore, it must be acknowledged that the acceptance and use of knowledge provided by fishers will result in advice which is more likely to be recognised and accepted by them.

Fishers' knowledge is not only useful for extending the range of data available on the fish stocks. Fishers are also able to assist by validating scientists' assumptions about the way the fisheries operate, and in some cases even to validate the data being used. Fishers can improve scientists' view of reality.

The North Sea Commission Fisheries Partnership has made significant progress in persuading the Secretariat of ICES to involve fishers and other stakeholders in ICES' activities. As a first step, fishers met ICES assessment scientists to examine the fish stock assessments and comment upon them. Beginning in 2002, North Sea fishing industry representatives, together with an international team of scientists recruited by the Partnership, met ICES assessment scientists at the end of their working group meeting, but in advance of ACFM, to review the emerging fish stock assessments. A format for future consultation meetings was established. Thus fishers and external experts were provided in advance with extracts from the Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak. The external experts were able to examine the stock assessments independently. Then, at the consultation meeting itself, ICES scientists described the process of assessing fish stocks and reported their preliminary findings on the state of selected fish stocks in the North Sea. They answered questions from the invited experts and fishers, and then took part in an open discussion of the assessments.

The results of those consultation meetings between fishers, outside experts and ICES scientists were remarkable. A series of recommendations on the presentation of the assessments, the use of alternative models and the provision of additional data emerged. Fishers gave their opinions on both the assessments and the process which had led up to them. For the first time, assessments were made open to fishers, and fishers themselves were encouraged to identify additional data that might improve the assessments. The presence of invited experts reassured fishers of the quality of the assessments and enabled all aspects to be explained and explored. At the very first consultation meeting serious errors were found in the catch per unit effort analyses, which were traced back to flaws in the collection of data. Fishers were able to correct errors in the perceptions of scientists about the way particular fisheries operated. Fishers also pointed to the valuable information held in their log books, and urged that it be used more effectively in support of the stock assessments. The result was that fishers and scientists recognised the advantages of joint discussions at an early stage in the preparation of the scientific advice. Both parties also recognised the value of their subsequently engaging with one another in the joint collection of data and in cooperative research programmes.

The Partnership attempted to take the process of engagement further by asking ICES to open up ACFM, the committee which prepares the final advice for the Commission. Initially, the ICES Management Committee on the Advisory Process (MCAP) decided that there was no political mandate to open up the meetings.

Indeed, the Fisheries Commissions and Member States which paid for the advice from ICES announced that in their view the advisory meetings should be open only to 'paying' observers. ACFM meetings therefore remained closed to the Partnership, although observers were allowed from the client Commissions. This decision was later ratified by ICES Delegates, representing member countries of ICES. The outcome was disappointing to the Partnership but pressure continued. In 2005 and 2006 fishers and other stakeholders were allowed to attend parts of the ACFM meetings as observers.

A schematic diagram of the informal process which was adopted is shown in figure 16.

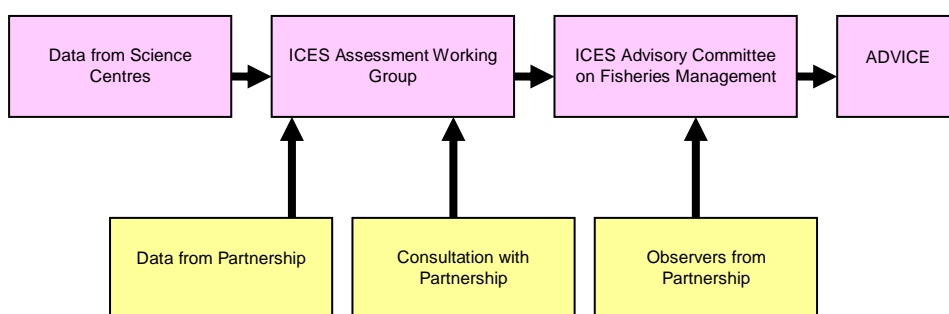


Figure 16. Participation by the North Sea Commission Fisheries Partnership in the ICES stock assessment process

Several clear conclusions on the merits of fishers meeting with scientists can be drawn from the collaboration between the Partnership and ICES.

Firstly, the Partnership's participation in the assessments resulted in additional information being made available to scientists. Amongst the new data now made available are the results of the North Sea Fishers' Survey, carried out every year since 2001, and used by ICES working groups in preparing stock assessments and now used by ACFM in presenting advice to the Commission on the state of North Sea fish and shellfish stocks.

Secondly, it became evident that open discussion of the state of fish stocks with fishers revealed flaws in the fisheries data resulting in changes to the assessments and pointing to the need for stronger peer review of the science. The discovery that scientists' knowledge of the way a particular fishery operated was incomplete underlined the need for scientists to consult on issues of fact.

Thirdly, the consultation meetings with the Partnership improved transparency. Fishers' representatives were able to report back to their members with new information.

Finally, fears that fishers would use the partnership to lobby or exert pressure on scientists to change their assessments proved greatly exaggerated.

The consultation meetings, together with pressures from other quarters, have subsequently led ICES to introduce their own changes to the process of stock assessment. Thus, ICES has now interposed Review Meetings between the

Assessment Working Groups and ACFM in an attempt to distil down the information required and also introduce an element of quality control and peer review. These changes have not yet gone as far as many fishers and some scientists would wish, however.

Cooperation between North Sea fishers and ICES has now been taken further under the auspices of the North Sea Regional Advisory Council. Currently, RAC representatives, and representatives of other stakeholder groups are invited to engage with selected assessment working groups, and to attend ACFM as observers. The informal system which is currently in operation is shown in figure 17.

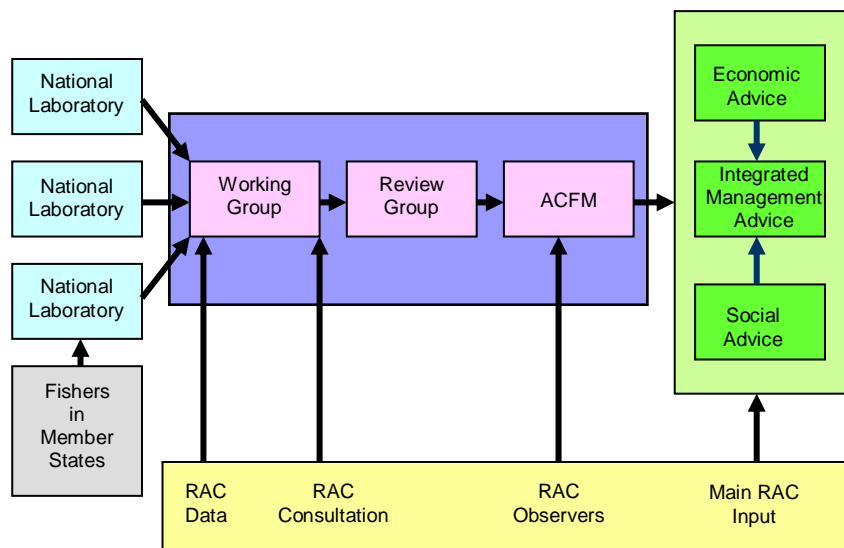


Figure 17. Current system which integrates the RACs with the system for providing scientific advice

There is little doubt that mutual partnerships formed between stakeholders and scientists can greatly facilitate the integration of stakeholders into the process of providing scientific advice and that it can improve both the quality and acceptability of that advice. Within such partnerships the expertise and professionalism of trained scientists earns respect from fishers. Scientists also gain a better appreciation of the way the fishery is conducted. Together, both sides can promote information gathering and produce subsequent advice which has greater utility and acceptance.

ICES reforms

An on-going debate within ICES has identified a number of problems with the current advisory system. It is seen as inflexible, providing poor quality assurance, with difficulties in integrating advice on the ecosystem, having a complex appearance to the outside world, inefficient in its discussions with clients, competing for experts drawn from a limited pool, with ineffective links to new science, expensive to operate and generating poor morale amongst participants. Quality assurance and the need

for peer review are seen as high priorities. Particular attention has been paid to the need to integrate the work of the three parallel lines for providing advice; that is, advice on fisheries management (from ACFM), advice on the marine environment (from ACME) and advice on ecosystems (from ACE).

The main proposal to emerge from a number of alternatives is that ACFM, ACME and ACE should be merged into a unified Advisory Group, which would also assume the role of another ICES Committee, MCAP (the Management Committee on the Advisory Process). It is thought that advice coming from a new single Advisory Committee would be more timely, integrated and reliable. A single Advisory Group would effectively bring together advice on fisheries with advice on ecosystems and the environment. It would also secure closer links with the ICES science programme. An Advisory Management Group, composed of members of the Advisory Group, could report annually to the ICES Council. It is proposed that member countries would have national representation on the Advisory Council.

Under the new arrangements, the main work of stock assessment would be carried out by Expert Groups. Review Groups would then bring together the work of several Expert Groups, perform technical peer review, develop draft advice and assure that the advice was in accordance with ICES principles. The Review Groups would draw on the expertise of the ICES Science Committees, in particular their Chairs, and also involve external experts. The Review Groups would forward their advice to the new Advisory Committee (figure 18).

The ICES Council has instructed MCAP to develop an Implementation Plan during 2007 for consideration at the 2007 Council. The Plan is to assume that implementation will be from 2008.

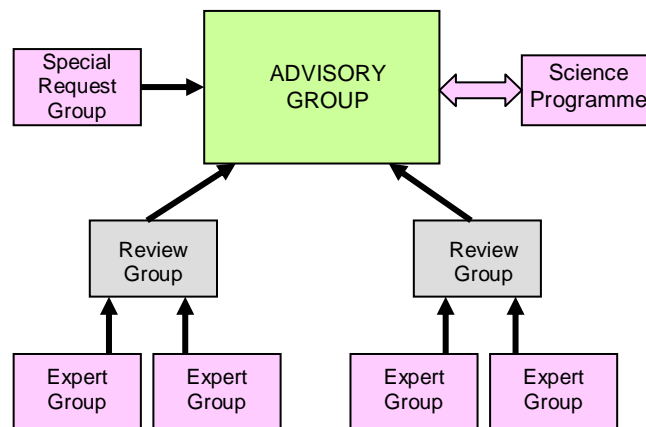


Figure 18. The proposed new ICES advisory process

There is little recognition in these reform proposals for the need to integrate stakeholder views with the science. Indeed, the proposals seek to separate the scientific advice from any benefits gained through the participation of stakeholders. It appears that ICES wishes to maintain a remote and elitist attitude towards fishers and other stakeholders. It will continue to keep them at arms' length. The more collaborative relationships between fish stock assessment scientists and the fishing industry which have developed within the Partnership have not been formally recognised. The existence of the RACs is not acknowledged in the documents outlining the reforms. The progress made in the USA and Canada in absorbing

fishers into the process for providing scientific advice has not been taken into account although these countries are themselves members of ICES. Representatives from the USA and Canada will participate in the ICES Advisory Group, but those countries do not seek to involve ICES within their own systems for seeking scientific advice on fisheries. They have their own, much more participative arrangements.

Obstacles in the way of closer stakeholder engagement

It is evident that there are differences of opinion, especially amongst scientists, but also between scientists and stakeholders, about the degree to which stakeholders should be brought into the scientific advisory process. A number of meetings of scientists and fishers have discussed this issue, and have revealed the differences in attitude which exist and which act against closer integration. These meetings have included those of the North Sea Commission Fisheries Partnership; the Thirteenth ICES Dialogue Meeting on Advancing Scientific Advice for an Ecosystem Approach to Management held in Dublin in 2004; An Interactive Forum with the Fishing Industry – held at the ICES Annual Science Conference in Aberdeen in 2005; and the October 2006 Meeting of ACFM. Below, some of the views from different sectors are presented, with all their inconsistencies.

Scientists' views

Fishers are seen as part of the problem associated with fisheries management. Current problems in fisheries management do not lie with the science, but are, rather, the result of short term approaches to management.

The fishing industry is not yet united, and working with fishers could be problematical, although the RACs could help to create a more unified industry and stakeholder view. There might also be problems with too much 'talk', and stakeholders should also learn to listen. Can stakeholders be relied upon to give reliable and honest advice?

There are potential problems with involving the industry in scientific institutions like ICES; which could become too political. The accepted role of ICES is to provide independent advice, so that it can work outside national and political interests. ICES is a credible institution and the process is credible only if the system is allowed to operate without any contamination from those who wish to discuss policy issues or lobby for particular outcomes.

There are dangers if fishers are allowed to participate. The 'greens' will also wish to take part and that will pose problems, especially for those ICES countries engaged in whaling.

Fishers' participation in science assessment and advice is essential, because it builds trust and transparency. Poor relations between fishers and scientists have led to a lack of progress on sustainability.

There is a general problem in making use of the vast knowledge fishermen have, both at the national and regional level.

The work of scientists should not be free from comment and criticism. The present limited system of peer review of ICES advice is unsatisfactory. The system

introduced by the North Sea Partnership, which brings in experts from outside the ICES system, should be extended. It is costly but it must become a regular feature in ICES and member countries will have to meet the cost. ICES cannot be blind to change and introducing proper peer review is important.

When the data which underpin fisheries advice are incorrect; the fishing industry turns against the advice. Better relations are necessary between the different sectors to identify weaknesses and knowledge gaps and close them. Fishers need to be involved in the early stage of preparing advice as experts on fishing, improving the basis for recommending subsequent management options, and also at the later stage where they would have an opportunity to influence the actual management decisions to be taken.

A distinction should be drawn between issues of collaboration involving fishers and scientists in stock assessment work and representation of stakeholders in the wider policy process. Science should produce options. Management itself must identify goals and reach decisions after consulting stakeholders. Science must be kept separate from policy. We have to separate the bringing of information and technical assistance to support scientific advice from the very different process of selecting between different management options. Fishers need to be involved in the early (scientific) stage of the system to provide better data and improve the basis for advice, and also at the later stage where they would have an opportunity to influence the management decisions to be taken.

With increasing involvement of stakeholders there are concerns over equity, for instance some stakeholders might have more power and resources than others. There might be a lack of transparency, and the game might become increasingly political, with governments retaining control over the final decisions. There is scope for too many compromises, with appeasement and weak decision making.

Fishers' views

The most effective way to achieve sustainability is through applying the best possible science but this can only be achieved by greater involvement of fishers in the science. The fishing industry does not see ICES as credible. The data used by scientists is often flawed and fishers can assist in correcting this. Fishers can be particularly useful in giving advice on technical issues, for they have unparalleled knowledge of fishing gear and how fleets operate. They can also give up-to-date advice on fish behaviour

Stakeholders might find it difficult to give unbiased advice. Stakeholders always bring their own interests to any forum.

Relations between fishers and scientists have been problematic in the past, and fishers are at least partly responsible. However, this could be explained by fishers' feelings of vulnerability. For instance they are worried that their knowledge might be used against them in the context of a harsh quota regime and mounting criticisms from the green lobby. Fishers want to resist what they perceive as increasing bureaucracy and form-filling. However, relations between fishers, scientists and managers are improving.

Views of others

All people have a basic right to participate in political structures, and fisheries management is no exception. No stakeholder should have a monopoly on knowledge. Participation by fishers in the preparation of advice gives fishers some ownership over that advice, improving compliance on their part.

There is of course a major role for 'specialists' in fisheries management, but because scientific advice is fallible scientists should not be the only ones to give advice. We should be continually asking when it is legitimate to involve lay people in science. There already has been significant interaction between scientists and industry and it has brought benefits. The question is not *whether* fishers should be involved, but *how*. Stakeholder involvement is important, but it has to be spelled out at what level and with what input.

There have been moves away from management systems that facilitate *information exchange*, e.g. the North Sea Commission Fisheries Partnership, to models where fishers could give actual *policy guidance*, for example in the new EU Regional Advisory Councils (RACs). This trend could eventually include a genuinely devolved management system that allows fishers to become involved in *policy formation*.

Genuine participation of fishers in management has yet to be seen. We need to reflect on how much the views of fishers are reflected in actual decisions. Some potential problems arise from greater participation. As we move away from centralised, top-down, exclusionary management towards a more devolved and participatory model, the system could become more complex. The so-called 'scientific and technological' approach to management, involving information exchange with a limited number of stakeholders, is relatively simple: however, the new ecosystem-based approach, involving a broader range of stakeholders, could become increasingly complicated.

Synthesis

What has emerging from the work of the Partnership and from discussions centred on North Sea fisheries, is that fishers and other stakeholders can play an important role in fisheries assessment and management. But there are still reservations on the part of scientists and fishery managers about the closer integration of stakeholders into the science. There is also a clear wish to separate the participation of stakeholders in the provision of information on the fishery from their role in management and policy.

The RACs are seen by the Commission as an interesting experiment in involving stakeholders in management itself, and in decisions on management policy and the management measures to be adopted. On the whole, scientists appear to have no objections to this. Many European scientists have participated in deliberations of the American Councils and are aware of the benefits to be gained from involving stakeholders in management. There is some scepticism on whether all stakeholders, with their different perspectives and objectives, can work together successfully, but there is considerable support for taking forward the experiment. Indeed, many see it as a necessary and important initiative.

We are left, however, with the task of resolving the role of stakeholders with respect to the scientific advice. There is strong emphasis by both stakeholders and scientists

on the need for better information from the fishing fleet to improve the assessments. In the case of some stocks the information available to scientists is so poor that they are unable to perform analytical assessments, and their advice is therefore weak and uncertain. The collaboration of fishers is urgently required to rectify this problem. However, some scientists see this collaboration as entirely one way. Fishers must yield up their information, in a format accessible to scientists, but then play no further part in the process. Those scientists see the problem is solely one of improving data collection. Fishers cannot be trusted to be objective and should play no further part in the assessment process.

Others see the participation of stakeholders, and especially fishers, as crucial in improving the methodology for assessing fish stocks. As well as collecting additional data fishers may also play a role in validating the data being used, the assumptions made and the analyses being performed. At the very least they should be present as observers to ensure that they are content with the way the advice has been produced. However, they can also bring a healthy dose of reality-checking into the process. They know how, where and under what conditions the fleets operate; they observe changes in the behaviour and distribution of fish; they know how fishing gears work, and they are often more familiar with the current application of management measures. Their engagement in the process would improve trust and confidence in the process. It may be true that they may have their own agenda, and they may seek to further their own interests, but it is not inconceivable that a process could be designed to reduce that bias.

The seriousness of this problem over the lack of opportunity for fishers to really engage with and influence the scientific process is well illustrated by a discussion in October 2006 at a meeting of the NSRAC Demersal Working Group. ICES scientists had completed a presentation on the ICES advice, during which fishers and scientists themselves had lamented the poor availability of key data for important stocks. The chair of the Working Group pointed out that every year the NSRAC commented on the ACFM advice, and every year it had identified flaws in the advice and had called for improvements. The NSRAC might come up with ways of improving both the landings and discard data through stronger collaboration with the fishing industry. Such initiatives would be a very significant step towards improving the assessments, which all parties wanted to see. It was no longer satisfactory to have to draw attention to obvious flaws in the assessments from one year to the next – without any action to improve matters.

Attendance at ACFM has revealed that there is great inertia in the process, and especially there is a lack of progress and delay by working groups in taking up and dealing with problems identified at ACFM itself. Communication between the different stages of the advice process received much criticism. As the ICES Working Groups only meet once per year the speed at which communication takes place between them, the Review Groups and ACFM is very slow. Requests or recommendations to Working Groups are made by ACFM in October and are not implemented until the Working Group meeting in the following September. ACFM then checks what has been done in the October meeting and has another opportunity to make recommendations for the following year. This slow cycle of information results in very slow adaptation to changing demands. Where new science is required the process of adaptation is even longer, as communication then has to take place with ICES science committees and with scientists in individual institutes before the science can be embarked upon. This contrasts with the position within Regional Fishery Councils in the USA, where the need for new work, or changes to procedures is immediately apparent to NMFS, which funds and directs the science.

There is a concern over the existing ICES process and the proposals for reform. There is still a political element to the work of ICES, illustrated by the insistence that all member countries are represented on advisory committees. The committees do not simply bring together the most knowledgeable and able scientists. National representatives are perhaps present to ensure that the process is fair and equitable. Should not key stakeholders be afforded the same privilege? In addition, the current ICES process does not really incorporate peer review; that is, thorough re-examination of the assessments by a diversity of experts. Peer review is seen as a fundamental part of the Regional Advisory Process in Canada, following on from the SAGE principles. The Department of Fisheries and Oceans (DFO) has provided its own justification for peer review:

'It is difficult to ensure that a consistently high standard of technical evaluation is applied to all science data and analyses, and experiential knowledge is evaluated with similar objectivity and rigour through methods appropriate to the type and sources of information. It is also difficult to maintain the objectivity and lack of bias in interpreting results and assessing the weight of evidence with regard consequences and options. All these tasks benefit from an inclusive process, where the diversity of experts and perspective examine all the material with rigour and with open minds. That is the essence of peer review.'

It is clear that to DFO, peer review does not simply involve inviting independent experts to inspect the assessments. There must be a range of experts, representing different perspectives, engaged in the review. This is also the procedure in the SEDAR process in the South Eastern USA.

Experience in Canada has been that fishers can play an important role in the Regional Advisory Process. Their participation is mandated by the SAGE principles, which stress that advice must be drawn from a variety of scientific sources and from experts in many disciplines, and that openness and transparency must prevail. In the USA, the SEDAR process has shown how a wide range of interests can be brought into stock assessment. SEDAR begins with a data workshop taking information from a wide range of sources, including independent laboratories and university researchers as well as individual fishers. An assessment workshop follows, which includes federal and state scientists, representatives of environmental groups, university and other independent scientists, and fishers. Again, stakeholders play a full role and are free to comment on the assessments and suggest alternatives. Finally, there is a review workshop, where peer review of the assessments takes place by an independent panel of experts. All the workshops are open to the public.

It is conceivable that the current process for assessing the state of fish stocks within the EU could be modified to include some of the features of SEDAR. A model for further discussion and development is presented below (figure 19). Further discussion is required to develop an appropriate and inclusive process. However, one major obstacle to change is the institutional distance which exists between the RACs and ICES. SEDAR has developed within a system where scientific advice comes mainly from within the fisheries management agency.

In the future, it may be better to consider ICES simply as a unique analytical resource which brings together experts who are versed in the methodologies of fish stock assessment. Those engaged in management can use this resource to further their own knowledge, and to assist with management of fishery resources. With this scenario, ICES would not be the source of management advice but would provide an open and transparent scientific service to the managers and stakeholders engaged in the formulation of fisheries management proposals.

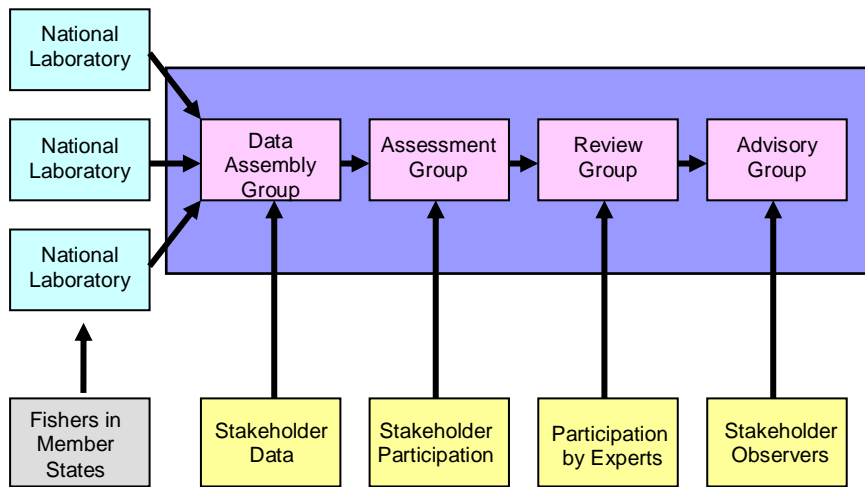


Figure 18. A model structure to promote integration of stakeholder advice with scientific advice

The internal requirements of the RACs for technical expertise

One of the requirements for the RACs is that they should provide advice on behalf of stakeholders on the management of fisheries; advice which is evidence-based, adopts an ecosystem based approach and incorporates the precautionary principle. It was originally intended that the RACs would make wide use of existing sources of scientific, technical and economic information. As a representative of the Commission said:

There is a need for a significant amount of scientific expertise in the RACs to provide an opportunity for presentation of the scientific advice and allow comment on the advice, as well as to provide some input to policymakers on the impact of following the advice.

Scientists and other experts are not members of the RACs. Most fishery scientists are employed by Member States and it would be inappropriate for them to be treated as stakeholders; they may only be present as observers. The original intention was that scientists and other experts would be represented on working groups set up to advise the RACs. However, no financial provision was made by the Commission to allow scientists and other experts to advise the RACs. In particular, no funding was allowed to enable the RACs to pay for advice from independent scientists. The RACs are therefore dependent upon experts who volunteer their time or upon Member States being prepared to fund participation by their own scientists from the national fisheries research institutes. The result has been that scientists have tended to participate only when a subject of particular national interest is being discussed; where Member States are prepared to fund the participation of their own scientists to ensure that their national interests are catered to. Individual scientists and fishery economists have occasionally attended because of interest in a particular topic – but this has been rare.

The Commission has repeatedly emphasised that scientific advice for the RACs must come from existing sources. It has been prepared to refer questions from the RACs to STECF and to ICES. ICES itself met with the RACs in February 2006 to identify and clarify the demands and expectations that RACs may have from ICES in the coming years. ICES representatives pointed out ICES scientific and advisory work is carried out by the scientific community drawn from its member countries. It does not control this resource and any increase in demand on ICES from the RACs would require commitment of additional resources.

From an ICES standpoint, one of the principal problems is that there is only a limited pool of scientists involved in the advisory process and they are already overloaded. A key element of co-operation with the RACs would be to use this limited resource in an efficient and effective manner. Some ICES scientists believed it is important to improve the coordination between the work done by STECF and ICES, so that the role of each party becomes clear and overlap is avoided. In general, STECF might concentrate on economic advice and short-term biological issues.

RAC representatives have expressed their wish to have scientists regularly participating in their working group meetings. They do not wish scientists to be members of the RACs, contributing directly to decision-taking. However, they do want to have their advice '*on tap*'. They would like a point of contact with the scientific community; a one stop shop for obtaining independent scientific advice. The fishing industry has very positive experiences of working with the scientists through the North Sea Fisheries Partnership, and wish cooperation to continue with the new RACs. Previous interaction with scientists has helped stakeholders to understand ICES advice. Such understanding will be important when the RACs draw upon scientific knowledge in formulating their advice to the Commission. Contacts with scientists have also been important in the transfer of knowledge in the opposite direction; that is, in conveying fishers' knowledge to the scientists.

The RACs have made it clear that their primary requirements are for:

Regular dialogue with scientists, economists and other technical experts at RAC meetings & working groups;

Assistance with questions on the stock assessments – including assurances that the assessments take account of all the available information;

Reality checking of RAC proposals (so far some checks have been carried out by STECF through the EC);

Expert advice on the social & economic consequences of management proposals (although it is recognised that ICES cannot provide this).

ICES wishes to be positive towards receiving requests from RACs on scientific issues within their field of interest. With respect to RACs, ICES accepts that participation of stakeholders is part of the ecosystem approach. However, ICES emphasises that stakeholder participation must not be at the expense of the quality and independence of the advice it provides. It is willing in the future to present the results of its assessments to the RACs, and would like to engage with the RACs to help it to improve the quality of data for the assessments. The main problems are funding and the availability of key scientists. ICES is dependent on national laboratories providing scientists for its work. Funding is also required to cover ICES

Secretariat work, travel and per diem costs associated with answering any request. ICES recognises that RACs do not have their own funding to pay for requests to ICES.

It has been agreed that requests to ICES, STECF and Member State Institutes have to be presented in an orderly and timely way if they are to be catered to. Although RACs do not currently have resources to pay for scientists to attend their meetings, some Institute Directors have been very cooperative. It has been agreed that ICES will interact with the RACs over the stock assessments. RACs may be invited to present their own data to ICES Working Groups, and may be invited to assist ICES Working Groups with the provision of additional data. Parts of the ACFM Meeting will be open to observers, and the RACs will be among those considered for observer status. RACs will be able to forward specific requests to ICES via a contact point in the Commission. They will also be able to refer any of their proposals to ICES for comment and evaluation (again, via the Commission).

If RAC questions cannot be answered by ICES scientists then the Commission is willing to discuss new research needs. Indeed, the Commission has mentioned that with respect to data collection and research the EC has funds which might be available also for RACs to apply for, either alone or as joint ventures with ICES or Member States. The Commission has a Memorandum of Understanding (MOU) with ICES for recurrent work on stock assessments and the MOU also provides for 'Special Requests'. The Commission hopes that the needs of RACs can be accommodated within the MOU. It accepts that the more routine requirement of the RACs for dialogue with scientists in their meetings and working groups cannot be provided directly by ICES. It also accepts that ICES cannot provide the social and economic advice that RACs need. However, the Commission will be revising the MOU with ICES and may consider adjusting it to meet new requirements.

A changing system

We are now entering a period where the provision of advice for the operation of the CFP must change. Reforms have already taken place in the CFP to allow greater participation of stakeholders. Further changes are necessary to make better provision for the supply of expert advice and to overcome the serious flaws in the current process.

Structure of the advisory process

Attendance by a SAFMAM representative at the October 2006 ACFM Meeting as an observer has revealed some of the weaknesses in the current procedures. The system for providing advice on the state of fish stocks is overwhelmed by the quantity of information. Yet paradoxically much of the basic data is of poor quality, and often important information on catches and discards of fish are lacking. Working Groups are attempting to take account of multi-species interactions and provide advice for ecosystem-based approach, but have very little time to digest relevant reports and absorb any new science. Attempts have been made to reduce the workload of stock assessment scientists by simply updating some stock assessments in a given year, concentrating on fewer, more detailed, benchmark, assessments, but the workload is still very heavy and there will be ramifications from reducing scrutiny of the stocks.

The new ICES Review Groups have little opportunity to distil down the information for ACFM while at the same time fulfilling their role of peer review. Scientists serving on the Review Groups from outside the area to provide independence face difficulties familiarizing themselves with the fisheries and with the stock assessment methodology in the short time available. There is also inconsistency in the advice coming from the Review Groups.

Communication between the different stages in the process is slow. As Working Groups meet only once a year, comments made by the Review Groups or ACFM are not implemented until the following year. The process is full of inertia, and can adapt only slowly to changes in circumstance.

The conduct of the assessments

There has been a major change in the culture surrounding the assessments in recent years. Much closer scrutiny is directed at the quality of the data and the assessments, both because of the existence of the Review Groups and the presence of stakeholders as observers. The system now seems more inclined to acknowledge faulty data or a poor basis for making the assessments. There is closer scrutiny of the quality of the input data.

Assessment scientists are often faced with conflicting information. Survey indices may disagree with the stock assessments, and one survey index may disagree with another. A range of potential explanations exist to explain the discrepancies. There is therefore much uncertainty surrounding the actual assessments, accompanied by awareness that the final assessments may automatically trigger harvest control rules or result in major changes to the management regime with drastic implications for fishers. Although strenuous efforts may be made to make the assessments objective and free from political influence, those participating are aware that the assessments may be used as the basis for far-reaching management action. ACFM members, drawn from the member countries, inevitably have to consider the implications of the advice that ACFM will give.

The presence of observers

Where observers have participated their presence seems to have been welcomed. In general, the industry representatives have not exceeded their mandate by dismissing the science. Rather, they have attempted to clarify the operation of the fisheries and provide relevant factual information when asked to do so. It is also evident that informal links with the fishing industry play an important role, and that some issues which are raised have originating in discussions within member countries. Estimates of discarding and estimates of unreported landings do find their way into the system. Stakeholder observers can play an important part in the process.

Conclusions

We can now look forward to a period when there will be further intensive debate over future relationships between scientists and stakeholders in the field of fisheries management. Successful examples of integration from elsewhere will have an impact even within very conservative organisations like ICES. Participation of

stakeholders as observers may overcome some of the misconceptions about the role they will play. It seems likely that the RACs themselves will play an increasingly important role within the CFP, creating demand for more participation in all aspects of fisheries management.

Much work is now being done within the European Union to examine those institutions which are especially successful at promoting sound, policy-related, scientific advice (see Stirling, 2005, for an account of a seminar held under the EU Science and Society initiative). Work is being done to examine different professional practices, and to consider questions of institutional design especially in relation to environmental issues (see section 6). Wilson (2007) has drawn attention to the importance of boundary organisations in promoting communication across the boundary between science and policy. He also emphasises the concept of boundary objects, where scientists, policy makers and stakeholders work together on common projects.

An important issue for the CFP is for all those concerned to decide where the links between science and policy will lie in the future. The RACs are bringing together stakeholders and policy makers and they have some of the characteristics of boundary organisations. Scientists have not become key players within the RACs, however, although they do play an important and essential supporting role through the RAC working groups.

If working together on joint projects, or boundary objects, is a characteristic of a boundary organisation then the RAC working groups are developing in that direction. Joint projects are being established by the RAC working groups involving scientists and other experts – including economists and social scientists. The process of working together on issues of spatial planning, improvements in biological data collection and the collection of social and economic data from fishing communities is already creating a level of mutual understanding and communication which bodes well for the future. Currently, the Commission and member states are only involved peripherally in those working groups but that may change. There are indications that the Commission is taking note of the outputs from the working groups.

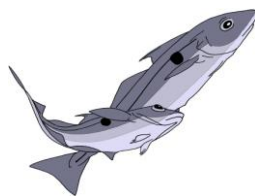
Very heavy responsibilities have been placed by the European Union upon ICES. While major changes have been taking place within the EU system of fisheries management ICES itself has been slow to change. It is notable that member countries outside the EU no longer rely heavily upon ICES for the provision of scientific advice. They have their own boundary organisations for integrating science and stakeholder advice into fisheries management. It has been ICES' steadfast decision to remain independent. It has engaged in only a limited way with stakeholders and policy makers. It values its independence and status as a purely scientific organisation. That may make ICES less valuable to the CFP in the future and may result in some of its responsibilities shifting to other, more adaptable organisations. ICES may end up as a specialist organisation, simply providing limited scientific facilities for fishery management bodies.

In contrast STECF has engaged both with stakeholders and policy makers. Its work is commissioned and guided by policy makers, but it is increasingly involving stakeholders in the work of its sub-groups. Although stakeholders are attending the meetings as observers they are in reality playing a more active role which is valued by all the participants. There may be scope for STECF taking on a wider role as a boundary organisation in the future.

The North Sea Commission Fisheries Partnership, now in abeyance, has performed as a true boundary organisation in the past and has contributed much to the development of the RACs. Should it continue into the future, or can its role now be fulfilled by the RAC working groups and by STECF? It will be interesting to see what happens.

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