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# Fisheries science and sustainability in international policy: a study of failure in the European Union's Common Fisheries Policy

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**Abstract**

Within the European Union, scientific fisheries research and advice is passed down a chain of central European institutions before being incorporated into policy. However, advice is often poorly or only partially implemented and the system has largely failed to achieve sustainable fisheries management.

This paper aims to explain why, by examining the use of fisheries science within the Common Fisheries Policy (CFP). The problem is examined with respect to both the political system and fisheries science, to show that the factors in both the supply, and the subsequent use, of scientific data inhibit effective fisheries management.


*Keywords:* Common Fisheries Policy; Policy formulation; Fisheries management

## 1. Introduction

With increasing awareness of the vulnerability of natural resources during the latter part of the 20th century, governments and intergovernmental organisations have introduced various measures aimed at improving the sustainability of our resource use. These measures should ideally be based on the best available understanding of the nature of these resources, as elucidated by scientific investigation. Unfortunately, however, the translation of scientific discovery into practical policies is often slow and incomplete, as many other political, social and economic factors come into play. We can see such a pattern in fisheries science and policy, where the lack of effective management has contributed to a crisis in world fisheries [1]. This paper examines the way in which scientific research has guided fisheries politics, and the factors which have prevented science from translating into effective policy, in the European Union (EU)'s Common Fisheries Policy (CFP). We first review the established routes for scientific advice to feed into the CFP and the extent to which it has been acted on. Then we examine the factors that have inhibited the translation of scientific advice into policy, from the perspective of both the intended end-users of that advice (decision-makers and fishers), and the suppliers of the advice (the scientists). Finally, we look to the future, considering recent developments in both the political and the science environments, which may improve fisheries management under the CFP.

## 2. How does scientific advice feed into the politics of the CFP?

The CFP uses two types of instruments to conserve fish stocks within its jurisdiction: total allowable catches (TACs) which set upper limits for the total amount of fish which can be landed from particular areas; and technical measures including gear regulations, closed seasons, closed areas, and minimum allowable sizes for individual species. In addition, the policy attempts to limit fishing effort by controlling the capacity of fleets (structural measures) and limiting time spent at sea.

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The establishment of these measures is based on scientific assessment of the status of stocks. Working groups of scientists within the International Council for the Exploration of the Seas (ICES) coordinate and report on research, which is then discussed by the ICES Advisory Committee on Fishery Management (ACFM) and used to produce scientific advice for the European Commission. The commission then forms a proposal in light of this evidence and discussions with various relevant departments and committees, including the Scientific, Technical and Economic Committee on Fisheries (STECF) and the European Parliament Fisheries Committee. Proposals are sent in turn to the Council of Ministers, made up of national ministers from member states, which has the final authority to negotiate and formulate fishery regulations [2] (Fig. 1).

This system is widely regarded as having failed to conserve the fisheries resources of the EU. Many of the important commercial stocks (e.g. North Sea cod) have suffered serious declines and are threatened with collapse; management measures have proven ineffective; and the European fleet has not successfully been downsized to an appropriate capacity to exploit the dwindling resources [3]. The fisheries of the North Sea are some of the best studied in the world, so how did the scientific expertise fail to translate into sustainable management of the stocks? There are three reasons why scientific advice has not been put into practice.

First, although there is an established structure for scientific advice to be passed along the chain of institutions into legislation, the advice of scientists is rarely adopted in full at the policy stage. Symes [4, p. 145] describes the phenomenon thus: "when scientific advice has been refracted through the political process, it may appear to shed little light on the final decisions." Karagiannakos [5] documents trends from 1980 until 1994 when TACs were frequently set higher than the levels recommended by scientists. This pattern appears to be continuing even since the 2002 review of the CFP. In 2002, ICES expressed serious concern over the status of North Sea cod and recommended a complete moratorium on all catching of cod whether targeted or as bycatch. The Commission's STECF accepted this advice but the Commission opted to propose an 80% reduction in the cod TAC. The Council of Ministers eventually agreed on only a 45% reduction in TAC in conjunction with effort limitations [6].

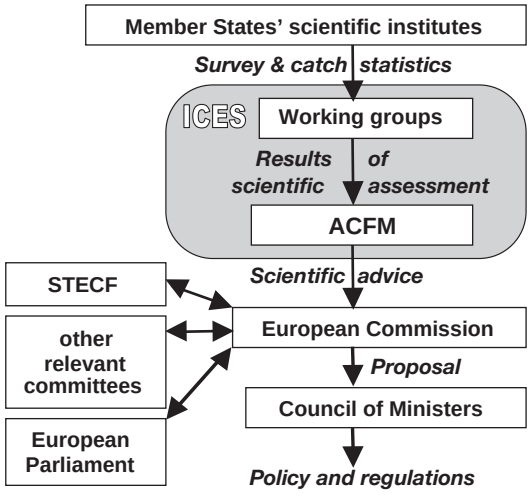


Fig. 1. Route for the implementation of scientific research into fisheries policy within the European Community.

Second, technical and structural measures have often been stalled. For example, during the 1980s, recommended mesh-size regulations were delayed at the Council stage by 6 years. Closed areas have rarely been implemented within the CFP [4] despite the fact that they have been regarded by many scientists as an effective and appropriate management strategy [7]. Moreover, fleet restructuring to reduce effort through the Multi-Annual Guidance Policies (MAGPs) has been slower and much less severe than advised by scientists. For the 1992–1996 period, the Gulland report recommended a 40% reduction in fishing mortality on all stocks, but the ensuing negotiations in the Council were unable to reach an agreement in time. Eventually a 2% reduction in capacity was agreed on by 1992 and reductions of 0–20% were planned for different sectors of the fleet by 1996 [4].

The third reason for the failure to convert scientific recommendations into practice is poor enforcement of CFP regulations. Discarding at sea, illegal landing of "black fish", and the mis-allocation of catches to fishing grounds leads to rates of fishing mortality above the levels that were initially recommended by scientists and to poor recording of catches. As Ritchie [8, p. 22] has pointed out, 'a study carried out on UK landings in 2002… found that there was a culture of rule breaking amongst fishers. There was a high reliance on illegal landings. Fishers were violating the output controls (set up by the EU and enforced by a number of local agencies) largely because of economic necessity. More than half of the fishers interviewed disagreed with the statement that quota requirements should be complied with because "they were the law" or because "they were a way of giving people their fair share". A high percentage of the sample felt that breaking the rules was in order because the system was flawed and inefficient'. A report from the European Commission in January 2003 stated that the number of serious offences against the fisheries regulations of the CFP rose by 12% between 2000 and 2001 (*Fishing News* 10/1/03, p. 6). Nearly 50% of these offences related to unlawful fishing, either without proper authorisation or in closed areas, and there was a large increase in landing offences and gear regulation violations.

Clearly then, advice from scientists, based on observations of the status of stocks, is not being

implemented, either officially in terms of regulations, or actually in terms of mortality on the fish, with serious consequences for the sustainability of the resource. Why has the best available scientific advice apparently been ignored in the regulation and implementation of the CFP? To answer this question, we look, first, at the deficiencies of the political system, and, second, at the deficiencies of fisheries science. But before doing so, we must draw attention to a fundamental tension between the politics and the science of fisheries. This tension arises from the two contrasting objectives of the political state and the fisheries scientific community. The state funds fisheries science in order to obtain data that will enable it to manage the fisheries sector successfully; it 'has no rational self-interest in supporting the academic pursuit of knowledge for its own sake' [9, p. 151]. As Weeks [10, p. 429] puts it, politicians use science as a 'legitimising frame for policy decisions through the translation of social issues into technical ones', and they achieve closure of policy debate by 'an appeal to objectivity in a contested and value laden domain'.

By contrast, the purpose of the fisheries scientific community is to engage in disinterested research; its 'sole *raison d'etre* is the epistemological authority derived from the assumed independence of its knowledge from political institutions and its allegiance to science' [9, p. 150]. Paradoxically, however, the state needs fisheries science to appear to be independent, in order to fulfil its own role of persuading the public that its fisheries policies are soundly based. Hence the tension: 'the state's fisheries policy derives its legitimacy by appearing to be in close association with science, but science derives its credibility by appearing to be disassociated from the state' [9, p. 151]. This tension lies behind many of the points made in the next two sections of this paper.

## 3. Deficiencies of the political system

The inability of the CFP to incorporate scientific advice could be viewed as a failure of the political system to make those who are responsible for policy and the fishing industry heed and act upon advice. There are three underlying causes of this failure: the psychology of individual fishers; the electoral politics of fisheries ministers; and the political devaluation of fisheries science.

### 3.1. Psychology of individual fishers

One basic problem lies in the fact that reducing catches, whether scientifically recommended or not, has an economic cost for fishers, fishery-related industries and national economies. Although fishers have a strong self-interest in ensuring the long-term sustainability of a resource, there are two reasons why it may be perfectly rational for them to continue fishing regardless of sustainability: the tragedy of the commons and economic discounting theory. Hardin [11] most famously suggested that when resources form a common pool, there is no incentive for any individual user to limit his/her exploitation and that only privatisation or regulation can prevent degradation of the resource. The theory is particularly pertinent to marine fisheries, over which it is virtually impossible to establish individual ownership and which are notoriously difficult to police. Thus even if fishers are concerned by warnings from scientists, they are trapped in the race to catch their share of the disappearing fish before someone else does.

Economic discount rate theory shows the economic advantage of exploiting a resource now, rather than in the future. The theory can be applied to fisheries to demonstrate that where the discount rate is higher than the natural growth rate of a fish population, the most economically efficient strategy would be to exploit the fishery as fast as possible and invest the profits.[1] Immediate financial concerns (e.g. mortgages on vessels) can effectively increase an individual's discount rate. Hence, even when fishers believe that levels of exploitation are unsustainable, they may still (quite rationally) prefer to continue fishing rather than incur the short-term cost of reductions in catches.

### 3.2. Electoral politics of fisheries ministers

In the CFP, proposed regulations are watered down most at the stage of the Council of Ministers where national politicians, each answerable to an electorate in their own member states, negotiate and decide to what extent they will accept the proposals of the Commission. Democratically elected ministers, by definition, are preoccupied with their likely popularity at home during the next election. They have little incentive to make unpalatable decisions to tackle the sustainability of stocks that may not pay-off until the term of future ministers [14]. As Pirzio-Biroli (Chef de Cabinet to Franz Fischler) put it, 'politicians…are faced with the fishing lobby and there are always elections taking place'. As a result, politics always 'gets in the way' of sustainable fisheries management (*Fishing News* 26/7/02, p. 4). Economic hardship and unemployment caused by cutbacks are high profile issues, eagerly reported by the press and easily blamed on the actions of a fisheries minister. In contrast, the blame for hardship borne of resource over-exploitation is unlikely to fall as directly at the feet of government when alternative scapegoats are available in the form of unsustainable practices of foreign fleets, mismanagement by previous governments, or climatic variability.

[1] See Clark [12] as cited by Hart and Reynolds [13].

The domestic circumstances of each member of the Council affect how severely they are constrained by the need to pander to short-term popularity. In 1997, the Conservative government in the UK pledged to stand up for British fishermen and resist effort limitation until action was taken to stop "quota-hopping" (other nations buying UK vessels in order to access UK quotas) [15]. This belligerent position was undoubtedly calculated to increase the government's popularity at home in the light of their precarious majority and the approaching general election. This is an example of international negotiations on fisheries measures being sidelined or overshadowed by other issues, with conservation measures used as a "political football" to apply pressure on other states. In the event, Labour won the election before the Council of Ministers met and adopted a more conciliatory (and unpopular in British fishing communities) stance. This was made possible by such a secure government enjoying the first few months of a comfortable majority.

Not surprisingly, therefore, it is difficult to get agreement between a large group of member states with different characteristics of geography, fishing and culture on conservation measures, as some states inevitably object to any adequate proposals on account of the "inequality of sacrifice" [16, p. 82]. Jealousy between states can obscure or upstage scientific opinions on resource security issues. This results in an international tragedy of the commons in which no state is willing to incur the cost of taking the lead on conservation if the benefit will be enjoyed by other states. This agrees with Krasner's realist view of international regimes as "zero-sum games" [17] in which any legislation is watered down to the lowest common denominator before being passed.

### 3.3. Political devaluation of fisheries science

In five respects, politics is responsible for devaluing fisheries science. First is the tendency of politicians to act apparently in spite of scientific advice. For example, in June 2002, the Fisheries Council decided to allocate TACs for deepwater species, although, according to Hamish Morrison (Chief Executive of the Scottish Fishermen's Federation (SFF)), this was contrary to all 'known scientific opinion' that only effort control can safeguard deepwater species (*Fishing News* 4/10/02, p. 15). This apparent disregard for scientific advice leads to apathy amongst fisheries biologists towards stock assessment. They are encouraged to focus on esoteric scientific questions, reducing the quality and quantity of immediately management-related research [18].

Second, for public relations purposes, politicians and civil servants over-simplify the advice given to them by fisheries scientists. As Finlayson [9, p. 138–139] explains: 'Ambiguity and uncertainty from sources of specialized expertise is not seen as useful by the executive structure of a rational bureaucracy. It is then easy to understand why all the caveats that the scientists routinely attached to their projections and advice were routinely stripped away and discarded by the consumers of scientific knowledge'.

Third, politicians may use science to disguise their political objectives. Morrison claimed that EU officials were 'hiding behind the scientists' on the 2002 cod recovery plan (*Fishing News* 17/1/03, p. 3). Similarly, Roddy McColl (Secretary of the Fishermen's Association Ltd. (FAL)) wrote that 'The draconian measures now being imposed have nothing whatever to do with conservation. They are part of a European 'federalist' agenda to hand over the bulk of European fishing to Spain. The Commission has exploited and will continue to exploit scientific recommendations to close down the British whitefish sector' (*Fishing News* 17/1 03, p. 4). Even if such conspiracy theories are unconvincing, it seems incontrovertible that, as George MacRae (Secretary of the South West Fish Producers' Association (SWFPA)) put it, 'fisheries dealings in Brussels are always political' (*Fishing News* 17/1/03, p. 3).

Fourth, scientists, seeing their advice repeatedly watered down, may try to pre-empt political compromise by recommending overly conservative catch levels. Or they may become so disaffected with criticism of their stock assessments from the industry, that they refuse to offer any advice to regulators. As Sissenwine and Mace point out [19, p. 23], 'because scientific advice is increasingly being subjected to criticism…there are strong disincentives to being responsive to fisheries management needs'. This could have serious consequences, because it could 'lead scientists to play it safe by not giving advice…if this happens, will managers close down fisheries in the face of uncertainty…or will they presume that fisheries management is not needed, since there is no scientific advice indicating that there is a problem?' In other words, politicians may react to this over-cautiousness by scientists by not taking warnings seriously [20].

Fifth, the political environment may cause biases within scientific work leading to errors. Finlayson [9] uses the perspective of science as a social construct, rather than a purely objective process, to explain how pressures imposed by their socio-political environment led Canadian government scientists to vastly overestimate the abundance of cod stocks on the Grand Banks in the 1980s. For example, he quotes Jake Rice (then Head of the Groundfish Division of the Canadian Department of Fisheries and Oceans) saying that 'I, and no other scientist in the Department that I know of, have never been asked to lie. But we certainly have…been discouraged from revealing the whole truth. Every government has to do that to its civil servants.

You cannot have everything that is going on in the halls of government ending up in the newspapers the next day' [9, p. 115].

This suggests a distinction between 'academic' and 'regulatory' science. As Weeks [10, p. 434] explains, 'academic' science is 'the idealised notion of good science that is value free and peer reviewed...a science not enveloped by powerful interests'. By contrast, 'regulatory' science is unable to 'attain the idealised measure of purity (disinterestedness) of basic science. Regulatory science is by its nature interested…forced to act within the constraints of…legislative and bureaucratic mandates'. Regulatory scientists 'are not free to pursue whatever intellectual and/or management goals they choose'. Of course, many fisheries scientists would not be happy with the term 'regulatory' science, because they regard their research as academically pure and independent. Perhaps, however, they would accept a distinction made by Sissenwine and Mace [19, p. 20–21] between 'budget' control (which does not compromise the academic integrity of fisheries scientists) and 'supervisory' control (which could threaten the objectivity of fisheries science): 'budget control clearly influences priorities, but it is less likely to lead to the perception of an influence over results (i.e. the advice) than from supervisory control'. But he who pays the piper calls the tune… .

Clearly, then, various features of the political system predispose decision-makers and fishers to dispute, dilute or ignore advice from fisheries scientists. However, should the blame for non-implementation of scientific recommendations lie solely with these parties, or could scientists improve the quality and relevance of their advice? Let us now turn to the deficiencies of fisheries science.

## 4. Deficiencies of fisheries science

Not all of the blame for ineffective conservation policies can be attributed to the politicians and fishers who receive the advice. Some of the reasons may be found in the nature of fisheries science, specifically: its lack of certainty; its limited scope; and its remoteness from fishers.

### 4.1. Lack of certainty

Despite its long history of development, fisheries science still suffers from very high levels of uncertainty. Hart and Reynolds [13] identify three types of uncertainty inherent in fisheries science: apparently random fluctuations in fishery characteristics; uncertainty in the parameters that describe the behaviour of the fishery; and the lack of scientific understanding of interactions within ecosystems that control their behaviour. For example, fisheries biologists have long struggled to understand the seemingly stochastic variations in ''recruitment'' of young fish to the stock [21]; stock assessments may typically have error margins of up to 50% [22]; and the complex interactions of different target species with each other and their biological environment are relatively scarcely studied and poorly understood. Complex systems, like the marine ecosystems from which fisheries are derived, are characterised by nonlinear or even chaotic behaviour in which small changes in initial conditions can be exaggerated through time and lead to major shifts in the system [23]. The ability of fisheries scientists to predict the biological effects of different levels of fishing mortality is therefore very limited. While uncertainty is an inherent feature of complex systems like fisheries, and so hardly the fault of scientists, it can be argued that trying to prescribe maximum exploitation levels does not sensibly take account of this uncertainty [22].

Moreover, fisheries scientists are not known for their public acknowledgement of the uncertainties of their results. As a result, when their results are challenged by vested interests, the public may form the impression that the scientists' work lacks credibility [24]. In such circumstances, the highly vocalised opposition of the fishing industry to scientific advice can neutralise any public conviction of the need for action. Even worse, when disputes arise within the scientists' own ranks, and deviations from scientifically accepted consensus are publicised (views that are contradictory to the norm generally attract greater press coverage than those which embody accepted knowledge), the public's confidence in science may be further undermined.

### 4.2. Limited scope

The scope of traditional fisheries science is limited in that it is generally confined to single species assessments, and therefore includes neither multi-species nor ecosystem analyses. Although it may be possible to model maximum sustainable yield (MSY) for an individual stock, many co-existing fisheries interact through predation or bycatch, so that MSY cannot be attained in all fisheries simultaneously [25]. Moreover, even accurate and sophisticated multi-species models cannot tell us how to manage fisheries; they can only predict the various ecological states that will be obtained under different levels of exploitation. For example, industrial fishing by Danish vessels in the North Sea can potentially affect cod and haddock fisheries through the bycatch of juveniles and the removal of prey species, leading UK cod fishers and conservation organisations to call for restrictions on the industrial fishery. Denmark claims that severe measures are not needed. Both sides cite ICES research to support their respective arguments, but the scientists can, at best, only make

predictions of how various levels of one fishery would affect the catch of the other [16], so the question of how to balance the trade-off between the fisheries has to be resolved politically.

With regard to ecosystem analysis, a common criticism of traditional fisheries science is that it fails to take account of factors other than fishing effort in reducing fish stock levels—factors such as the impact of seals, birds, whales and climate change. For instance, Hugh Allen (Secretary of Mallaig and North Western Fishermen's Association) argued that 'By trying to cut the fleet they are aiming at the factor that least affects stock sizes. We have seen closed areas becoming barren, so that they have to consider that seals take as much as fishermen, birds take twice as much as fishermen, whales four times as much and other fish take 200 times as much fish as fishermen. They take no account of climatic change which affects successful spawning rates. By attacking fishermen, they are just scratching the surface, but causing huge economic and social hardship. The EC should be ignored because their recommendations are not based on good science' (*Fishing News* 4/10/02, p. 3).

Furthermore, fisheries science is traditionally confined to natural science, and does not take into account socio-economic factors. Not surprisingly, therefore, the poor predictive ability of contemporary fisheries science is most acute in relation to human aspects of fishery management. Fisheries scientists until very recently have focused almost exclusively on the biological aspects of fishery management, when it is, in fact, humans, not fish, who are ultimately managed by conservation policies. Hart and Reynolds [13] point out that fisheries research all too often stops at stock assessment, or, sometimes, reporting ecosystem status. Social scientists have rarely been brought into the powerhouses of fisheries science, and so the ability of fisheries science to produce useful recommendations is even further limited. Recommendations based solely on biology are unlikely to be suitable for the "real world" in which fishers' behaviour (and therefore fishing mortality) is affected by economics and external societal issues as well as the personal experience, circumstances, traditions, perceptions, beliefs and preferences of individual fishers. It is true that bio-economic analysis is beginning to be applied to fisheries systems, but, as stated by Hart and Reynolds [13], it "is so often the case, [that] economic analysis leaves out the intangibles that motivate people."

### 4.3. Distance from fishers

Fisheries research (especially within ICES) is often conducted in relative isolation from the fishing industry [18], which is unfortunate for two main reasons. First, fishers are more likely to be sceptical of scientific proclamations in which they have little involvement or understanding. Second, the quality of scientific advice itself would benefit from interaction with fishers, including their feedback on the utility of previous scientific assessments.

On the first point, it was shown amongst Finnish fishers that those who were more familiar with the scientific process were more supportive of science-based management policy [26]. Other fishers, removed from the process, are likely to dispute findings and develop suspicions of partiality to explain the seemingly inexplicable scientific conclusions. In the North Sea cod dispute, for example, fishers pointed to EU funding of ICES, and Mike Park, the chairman of the Scottish White fish producers association (SWFPA) claimed darkly, that, "We are engaged in a greater plan of politics here which has the potential to completely ruin the Scottish industry" [27]. It is common for fishers to dispute the findings of science. For instance, during 2002, in contrast to ICES scientists' assertion that North Sea cod were showing "a classic symptom of a stock close to collapse" [28], Alex Smith, 'the Scottish Fishermen's Federation chairman stated, "The reality is that the stocks have never been so abundant in the last 5 years" [27]. These widely disparate views are not necessarily because of fishers' vested interests in avoiding restrictions; fishers may gain an unrepresentative view of fish abundance due to "hyper-aggregation" of the remaining stocks [29]. For example, before the 1990 collapse of the Newfoundland cod stock, offshore fishers were unaware of the precipitous condition of the resource. Their catch rates were maintained by targeting cod which had aggregated in spawning grounds [30]. One fisher was quoted as saying "I tell you there are more fish there now than there were 8 years ago" [9, p. 162]. This suspicion and lack of understanding is aggravated by the detachment of fisheries science from fishers.

Not surprisingly, therefore, one of the six objectives of the recently formed European Fishing Action Group (EFAG), comprising fishers from Denmark, France, Ireland, Italy, the Netherlands and the UK, is 'to reject the scientific assessments for cod, hake, haddock and whiting stocks which is based on incorrect and old information geared to scientific models that are out of date, inflexible and at variance with the experience of professional fishermen at sea' (*Fishing News* 20/12/02, p. 4).

On the second point, catch statistics are important data for the scientific assessment of stock levels, but are subject to unknown inaccuracies when large quantities of fish are landed illegally without any official records, caught as bycatch in industrial fisheries, or discarded at sea. For example, estimated discards of North Sea haddock in 1991 amounted to 40,000t, nearly equal to the officially reported catches of 44,000t [5]. Cooperation with fishers is the only way that realistic

assessments of this unaccounted fishing mortality can be obtained. Corten [18] admits that fisheries scientists did not foresee the problems of TACs leading to "black fish" and excessive discards of consumable fish. This reveals a stark lack of appreciation of the practicalities of fishers' existence by scientists, something that could be alleviated by closer consultation between the two groups. In another example, the UK had to withdraw legislation enforcing the use of square-mesh panels in trawl nets because they created technical problems during hauling [31]. Meaningful consultation with fishers could have foreseen these problems.

Moreover, scientists attempting to make assessment of stocks with limited resources and opportunities for research cruises could benefit from the extensive knowledge which fishers accrue through observations and experiences on fishing grounds. The experience of fishers can serve as a check on the uncertain results of scientific assessment. The *inshore* fishers of Newfoundland, for example, were the first to question erroneous government estimates of cod abundance in the 1980s before the collapse of the stock and imposition of the moratorium in 1992 [9]. Some attempts to address the distance between science and fishers [32,33] have found that fishers, who are in possession of novel and useful information, are willing, and even grateful to be involved, while Joel Fuertes (Director-General of the Vigo Fishing Vessel Owners' Co-operative) stressed the need for 'collaboration between scientists and the sector within a permanent framework. Just as a doctor cannot make a reliable diagnosis if he is unaware of the conditions, the fisheries researcher has to work side-by-side with the fishermen to ensure that his predictions are right' (*Fishing News* 4/10/02, p. 6).

Clearly, then, fisheries scientists must accept some of the responsibility for the failure of management policies; the blame cannot wholly be laid at the door of the politicians. The question that remains is: 'how can we improve the situation for the future'?

## 5. The future—a new relationship between politics and fisheries science?

There are some signs that the relationship between politics and fisheries science is evolving in a way that may address some of the shortcomings described above. First, the political climate is changing, and, second, fisheries science is changing.

On the first point, there are signs that public interest in fisheries management and issues of marine conservation has grown as a result of high profile fishery disputes and stock collapses and the increasing involvement of influential non-governmental organisations (NGOs) in fisheries, including WWF and Greenpeace [34]. This means that those who are responsible for researching and managing fisheries are now held to account not only by the industry but also by the general public and environmentalists. Fishers may object to the intrusion of perceived outsiders on to the political stage of fisheries, but if fish and the marine environment are viewed as a public resource, the general public is entitled to influence fisheries policy [22,35]. NGOs have succeeded in directly affecting single-issue policies like the banning of drift-net fishing within the CFP [36], and the adoption of the precautionary and ecosystem principles within the non-mandatory North Sea Conference [37].

However, whether NGOs will be able to mobilise enough public support to bring about broader changes in EU CFP policy, remains to be seen. Todd and Ritchie [36] believe that they will struggle to have direct influence on the radical policy changes which are required within the CFP. As long as the Council of Ministers has the final vote on policy, the attitude of the European electorate will determine the direction of the CFP; NGOs will only be able to effect change through raising public awareness of marine environmental issues. The crucial test, then, is whether the public will gain an interest and a voice on fisheries issues fast enough to instigate a political environment in which effective (but economically harmful) legislation can be agreed in the EU. Despite the indisputable need and widespread calls for change, the politics of so many vested interests gives the CFP an inertia, which has prevented major reform in the past [38] and may hinder new attempts to conserve EU stocks.

There are also signs that fisheries science is responding to calls for change. For example, prompted by numerous stock collapses, fisheries scientists now widely accept that the conventional approach to management has failed, and they are engaging in much self-analysis to reinvent the discipline.[2] This has led to pressure for ICES to incorporate the work of social scientists (www.ices.dk), and for North Sea scientists to engage in discussions on stock assessment with fishers [33]. Dr. Franz Fischler (EU Fisheries Commissioner) has added his voice to support these moves: 'Greater co-operation between fisheries and scientists will…strengthen the reliability of scientific data. Fishermen are not only at the receiving end of scientific advice but at its source. It is crucial therefore that data coming from the fisheries sector are reliable since good advice cannot be built up on defective bases' (*Fishing News* 12/7/02, p. 15). The European Commission is looking to the proposed Regional Advisory Councils (RACs) to promote such links, referring to the need 'for strengthening co-operation between the fishing industry and scientists in data-collection and monitoring activity, particularly in the context of Regional Advisory Councils' [40].

[2] For example, see Pitcher [39].

Meanwhile, many prominent scientists advocate fundamentally changing the goals of fisheries science and management [41–43]. They argue that aiming for a maximum sustainable or economic yield (MSY or MEY) will ultimately lead to overexploitation, given the uncertainties described above, and they cite successive fishery collapses as evidence. Scientists and conservation organisations now maintain that a more appropriate and achievable goal of management would be to maintain (and restore in some cases) the integrity of whole ecosystems [42,43]. For their part, fishers' organisations insist that any move towards ecosystem management must involve fishers. For example, the Scottish Fishermen's Federation [44, p. 4] stated that 'there is a real danger that the ecosystem approach will result in a raft of ill-conceived controls on fishing…therefore it is essential that fishermen become directly involved in the development of any ecosystem policy. Those driving such policies forward should bear in mind that fishermen live and work in the marine ecosystem and have more practical experience of the sea and its fauna than any other group'.

## 6. Conclusion

Various elements of the political and scientific framework of the CFP inhibit the efficient incorporation of scientific advice into policy and practice. Although the policy is widely recognised as a failure, change is resisted by EU Member States who benefit from the status quo represented by politicians interested in short term popularity with their electorates. Meanwhile, the detachment of the scientific community from fishers hampers beneficial co-operation to improve assessments and breeds scepticism in their uncertain, and sometimes inappropriate, recommendations. Closer co-operation between policy makers, scientist and fishers; the integration of social and fisheries sciences; and the realignment of research objectives towards usable management goals, would greatly improve the relationship between the politics and science of fisheries management.

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