ICES Journal of Marine Science, 57: 766–770. 2000
doi:10.1006/jmsc.2000.0730, available online at http://www.idealibrary.com on IDEAL®

Viewpoint

Integrating environment and fisheries management objectives in the ICES Area: reflections of a past ACME chair

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Richardson, K. 2000. Integrating environment and fisheries management objectives in the ICES Area: reflections of a past ACME chair. – ICES Journal of Marine Science, 57: 766–770.

There is a common perception of a need to integrate fisheries and environmental considerations when giving management advice. I argue that the current two-committee advisory system adopted by ICES, in which fisheries and environment are considered independently, has not and will not lead to the desired integration in the delivery of advice. Integration can only be achieved when it is recognized that the goals of sustainable fisheries management are a subset of the goals of sustainable environmental management. I argue as well that the scientific community must take a more proactive role in identifying the important issues to be addressed when considering interactions between fisheries and the ecosystem. Currently, the research focus is directed primarily towards those direct interactions that appeal to the general public (e.g. by-catches of mammals and birds, habitat destruction, and discarding of undersized target and non-target organisms). Focusing on these visible interactions neglects the fact that there can be unexpected consequences of short-term mitigation efforts designed to offset these interactions. Furthermore, it is not given that the effects on the ecosystem that are most obvious to the human eye are also those that are potentially most threatening to the ecosystem.

Key words: ACFM, ACME, environmental management advice, fisheries management advice.

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Introduction

The organizers of the Symposium have asked me to address the topic of integration of fisheries and environmental management objectives in the ICES Area because my status as former Chair of the ICES Advisory Committee on the Marine Environment (ACME) should give me the appropriate background for the task. Progress on integrating fisheries and environmental management objectives in the advice produced by ICES has been slow and, in my opinion, is hampered by the two-committee advisory system that has evolved. The two committees and their approach to advice are perceived by many within ICES to be very different. Therefore, for the most part, they work in isolation from each other. In my opinion, however, the approaches used and the types of problems being faced by fisheries and environmental scientists are really very similar and much can be gained by closer collaboration between the two groups. Furthermore, true integration of fisheries and environmental management objectives cannot be achieved until it is recognized that these objectives are essentially the same, i.e. the goals of sustainable fisheries management are a subset of the goals of sustainable environmental management.

To make my case, I will briefly review the historical development in the use of the term ''environment'' within ICES as well as the evolution in thinking concerning the advice given by fisheries and environmental scientists. I will conclude by arguing that we, as scientists concerned with the marine ecosystem and its components, ought to be taking a more proactive role in identifying topics for research into ecosystem effects of fisheries.

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Historical perspectives

ICES started as a scientific organization with the broad goal of understanding the physical and biological processes and interactions leading to the development of commercial fish populations (the events and thought processes leading up to the establishment of ICES are reviewed by Mills, 1989). ICES identified itself as a source of fisheries management advice with the establishment of the Liaison Committee in 1965 as a link to the North-East Atlantic Fisheries Commission. The Liaison Committee was the precursor of the Advisory Committee on Fisheries Management (ACFM) established in 1977. However, by the time ICES adopted an advice-giving role with respect to fisheries management, fisheries scientists focused almost entirely on quantifying the size and structure of the stocks, giving little or no consideration in their advice to the underlying ecological mechanisms leading to the observed stock development.

At about the same time when ICES started to supply fisheries management advice, concern was surfacing in the general public about the environmental threats from chemical contamination. One obvious concern was whether the fish harvested for human consumption might present a health risk to the consumer. ICES responded by establishing the Advisory Committee on Marine Pollution (ACMP) in 1972. Thus, "environment" was first seriously considered in connection with fisheries management in the 1970s. At that time, environment was used almost exclusively to mean contaminant chemistry and biology.

In more recent years, the use of environment in connection with fisheries management has expanded so that it is now used as a popular synonym for ecosystem. In this case, however, it is usually not used in a strict scientific sense but, rather, to denote an appreciation of the existence of interactions between ecosystem components. It was in recognition of the fact that environment in relation to fisheries management was taking on a meaning broader than a simple referral to contaminants that ACMP was replaced with the Advisory Committee on the Marine Environment (ACME) in 1992.

Unfortunately, representation on ACME has not (at least here in its youth) been such that expertise on all components of the ecosystem has been represented. The tradition of having one advisory committee concerned with fisheries and one with "everything else" has been carried on after the establishment of ACME. This has left the advisory committee charged with the production of environmental (ecosystem) advice largely without expertise on fish and fisheries and ACFM largely without expertise on components of the ecosystem other than fish and fisheries. This was illustrated by asking the ACME members present at this meeting to identify themselves: a show of hands indicated that only one (alternate) member (DK) was present! This arrangement is an obvious handicap when trying to provide peer-reviewed advice on the ecosystem effects of fisheries and must be changed if a true integration of fisheries and environmental management objectives is to be achieved.

Comparison of contaminant and fisheries scientists

The two-committee advisory system has meant that environmental and fisheries scientists within ICES have had only limited interaction through the last two decades (this also seems to apply outside the ICES community). As a result, many individuals have the (mis)perception that the strategies developed and approaches taken for giving management advice by the two groups of scientists diverge greatly. In fact, the development of advice delivery by the original environmental scientists (those concerned with contaminants) and fisheries biologists was very similar.

Both committees provide advice that can be applied in the management of the use of the sea. Fisheries advice is needed to regulate commercial fisheries. Contaminant advice is needed to regulate the use of the sea as a recipient of waste. In both cases, the traditional scientific approach has been to focus on a single contaminant or a single fish species. Regulation of contaminant levels has been based on the assumption that it was possible to define a safe concentration limit for individual contaminants below which no unacceptable effects will occur. Provision of fisheries management advice has been based on the assumption that it is possible to define safe biological limits for the size of a harvestable stock.

Over the last decade, there has been a growing appreciation that antagonistic and synergistic effects among different contaminants (and naturally occurring chemicals) make the identification of a single safe limit for the concentration of a contaminant impossible. Likewise, in preparing fisheries management advice, the recognition of multispecies interactions as well as the poorly understood and, as yet, largely unpredictable effects of climate on recruitment have challenged the concept of identifying safe biological limits for harvesting of individual stocks.

In both fields, the more visionary scientists are now searching for indicators that can be used to describe the integrated effect of all stressors on individuals, populations, or on the ecosystem. It is this search for indicators of the state of populations or ecosystems that, ultimately, unites management advice by fisheries and environmental scientists and, in my opinion, necessitates a single advice-giving function within ICES.

The fire-fighting approach

Public and scientific interest in ecosystem effects of fisheries is relatively recent and first seriously surfaced in

the ICES area in connection with the preparation of the *North Sea Quality Status Report 1993* (North Sea Task Force, 1993). For some time, however, there has been focus on the potential ecosystem effects of other ocean users than fishers. Shipping, for example, has been identified as an environmental threat for several decades. It may, therefore, be worth our while to examine the evolution in our understanding of interactions between shipping and the ecosystem as a model for our understanding of interactions between fisheries and the ecosystem.

The most obvious ecosystem effect of shipping, and the one that first received attention, is oil and contaminant release. Leakage of oil to the environment is not unique to the shipping industry, but the public often associates it with shipping, and I want to use this as an example of how the public's eye focuses on what is most visible and not necessarily on what is most insidious. Oil spills can be either accidental (i.e. the well-known and dramatic events resulting from ship break-up) or intentional. Intentional release largely comprises illegal discharges but there is a small legal component as well. This type of release is much less obvious to the public eye than the accidental oil spills, and therefore receives less media attention. Nevertheless, routine and intentional releases actually account for the greatest quantity of oil that enters most marine ecosystems.

I believe this example is relevant when considering ecosystem effects of fisheries, because most of the current focus in research into these effects is on the activities that immediately catch the eye of the general public: by-catches of mammals and birds, discards, destruction of bottom habitat, release or escape of fish from aquaculture, or sea-ranching programmes. Yet, it is not necessarily so that these interactions are the most important for the marine environment and, therefore, the most interesting from an advisory point of view. It is noteworthy that, in most cases, it has not been the scientific community but rather NGOs that have raised public interest and debate (and ultimately funding) for the study of ecosystem effects of fisheries.

Of course, the public does have a role in identifying important research issues. However, the ideal research programme should be designed with input from both the public and the scientific community. I am not convinced that the scientific community is actively and constructively joining in the public debate in identifying important research issues. So far, the design of our research effort into the ecosystem effects of fisheries can only be described as "fire-fighting". The public identifies a fire and we rush to try and put it out by reducing the visible effects of the interaction. For example, in the case of by-catch of mammals in the gillnet fishery, we develop acoustic pingers to frighten the animals away from the nets. We have "solved" the problem when the by-catch is reduced to acceptable levels. The fishers' activities have not been reduced appreciably and, thus, any other effects these may have. However, relatively little research is directed towards less visible effects of the solution, such as long-term effects of noise introduction on animal behaviour.

The fire-fighting approach has also been used to reduce other visible effects of shipping. For example, ballast water has been cleaned up in an effort to prevent it from introducing contaminants in ports of call. However, clean ballast water presents another ecosystem threat as a vehicle for the introduction of alien species, sometimes with disastrous consequences – e.g. the releases of zebra mussel (*Dreissena polymorpha*) in the Great Lakes, of toxic-phytoplankton cysts into regions previously free of toxic blooms, and of *Mnemiopsis* spp. in the Black Sea, leading to a collapse of the local fishery.

The potential ecosystem effect of the "solution" to the ballast water problem was foreseeable from the knowledge available when the new practice was introduced. However, I am not aware of any serious attempt by the scientific community to consider the potential effects of removing contaminants from ballast water. This is just one example of where fire-fighting has created a new and unacceptable problem due to interactions with the ecosystem. Armed with such examples, we should focus much more on examining proposed solutions for alleviating ecosystem effects of fisheries.

The current research effort to solve the discard problem by developing more selective fishing gear is another example. Development of truly selective gear would give us the ability to cleanly and effectively remove trophic niches or even entire trophic levels from marine ecosystems. Already, there is some evidence that the relatively non-selective fisheries practised today may influence trophic structure (Pauly *et al*., 1998). Surely, considerations of the potential impact of truly selective gears on energy flow in marine systems should be an important component of the current gear development effort.

Another noticeable effect of fisheries in the ICES Area has been the reduction in many different fish stocks. One response has been to establish culture and release programmes (sea-ranching) for some species. While this activity is usually defended as being a manner of "helping" the environment, so far it has only been practised for commercially important species. Sea-ranching has probably been practised longest in European waters for Baltic salmon, after human activities along spawning rivers altered the natural habitat and prevented salmon from reaching their spawning grounds. About 85% of the salmon in the Baltic are released through restocking programmes (ACFM, 1999) and only very recently has concern been raised about the potential consequences of restocking for the genetic integrity of wild stocks. However, a thorough consideration of the potential

ecological consequences of sea-ranching at the time of its inception could surely have identified this threat.

Energy conversion and transfer in marine ecosystems

I have argued that we need to consider proposed solutions for alleviating fisheries effects in an ecosystem context. In particular, since the primary function of marine ecosystems is conversion and transfer of solar energy, it is disappointing that the scientific community has not been more proactive in identifying the need to quantify potential effects of large-scale fishing activities on the energy flow through marine ecosystems. Although cascading effects through the food chain have been addressed in various contributions to the Symposium (e.g. Reid *et al*., this volume), our knowledge about the influence of fisheries on energy flow and community structure (especially at the level of the plankton) in marine systems is still limited.

Obviously, this is not an easy topic to study but it can be tackled and there is a good case to be made for funding appropriate research. While existing evidence for an influence of fisheries on energy flow in marine ecosystems is equivocal, it does not seem unreasonable to assume that an influence exists in at least some regions. Indeed, one reason why the few studies that have been conducted yield conflicting evidence for cascading effects may be that such effects are restricted to some types of systems. It is time for scientists to define which systems are most susceptible to effects of fisheries in this respect.

Such knowledge is also crucial for the environmental manager. Billions of dollars have lately been spent in the ICES Areas in an effort to reduce phytoplankton biomass in marine coastal regions by reducing nutrient run-off originating from waste water and agricultural activities. Operating on the assumption that oxygen-depletion events were entirely the result of land-based activities, the Kattegat fishermen have even demanded (unsuccessfully) compensation for losses resulting from extended periods of hypoxia that are ultimately caused by high phytoplankton biomass. For areas where tensions between different ocean users can be intense, it is critical for the manager and legislator to know whether the fishing industry has contributed to the observed increase in phytoplankton biomass by changing grazing profiles in the ecosystem, and whether a change in fisheries management strategy might be a cost-effective mechanism of reducing phytoplankton biomass.

Integration of management objectives and sustainable fisheries management

We refer generally to fisheries and environmental management objectives as if they are distinct. In reality, however, fisheries management can be considered part of a comprehensive environmental management programme. The ultimate goal of environmental management is to optimize all ocean users' benefits from the sea in such a manner that the effects on the ecosystem are considered acceptable by society. Fishing is only one of the many ways in which the ocean is used. Thus, the goals of fisheries management must ultimately contribute to the goals of environmental management. Although ICES has responded to the public appreciation of the ocean as an ecosystem by establishing ACME, the advisory committees continue to operate as if environmental and fisheries management objectives are distinct from one another.

The evolution of the two-committee advisory system is historically justified as the Commissions requesting scientific advice from ICES have in the past tended to focus on either fisheries-related or environment-related (i.e., contaminant) advice. Increasingly, however, the types of information being requested by all customers for ICES scientific advice require the input of both fisheries and ecosystem experts. Requests for integrated advice reflect the fact that fisheries are increasingly considered as an integrated part of the marine ecosystem by non-scientists, an indication that the time has come to unite the two advisory functions within ICES.

Politicians have identified a societal goal of exercising sustainable fisheries management. As a result, elucidation of the ecosystem effects of fishing has become a major goal of fisheries scientists. So far, however, we scientists in the ICES Area and elsewhere have failed to identify what sustainable fisheries management means in an ecosystem context. We have allowed the research agenda to be set by non-scientists and have directed our energies into fire-fighting, i.e., quantifying and mitigating those ecosystem interactions that are immediately obvious to the general public. This approach will not readily result in truly sustainable fisheries. This is not to say that it is wrong for scientists to spend part of their efforts on problems that concern the public. However, that is not enough. There is also an urgent need for fisheries scientists to be proactive in defining the research agenda if truly sustainable fisheries management in an ecosystem context is to be achieved.

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