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RAPPORT DES RECHERCHES COLLECTIVES

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History of the ICES Advisory Committee on Fishery Management, 1978–2007

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Editor

Kjartan Hoydal

We shall not cease from exploration

And the end of all our exploring

Will be to arrive where we started

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Contents

Foreword

The preparation of this history of the ICES Advisory Committee on Fishery Management (ACFM) has been a work in progress for several years. The initial step was a presentation by Fredric Serchuk (ACFM Chair, 1990–1993), co-authored by seven other previous ACFM Chairs, entitled "The ICES Advisory Committee on Fishery Management (ACFM), 1978–2000: a quarter century agrowing" given at the ICES symposium on "100 Years of Science under ICES" held in Helsinki, 1–4 August 2000. Unfortunately, the presentation was not submitted for publication in the proceedings of the symposium (Anderson, 2002).

During the 2008 ICES Annual Science Conference (ASC), the Editor (ACFM Secretary, 1985–1988; General Secretary, 1989–1993) of the *ICES Cooperative Research Report* (*CRR*) series consulted with and received encouragement from a number of people on the possibility of having a history of ACFM published as a *CRR*. He approached both Serchuk and Jean-Jacques Maguire (ACFM Chair, 1996–1999) before receiving agreement from Maguire in 2009 to pursue the preparation of a manuscript, building on the earlier work by Serchuk and his co-authors. However, in early 2010, due to work commitments, Maguire had to withdraw from the project. Shortly thereafter, Kjartan Hoydal (ACFM Chair, 1981–1982; Statistician and ACFM Secretary, 1982–1985) volunteered to take on the task. Publication of the history as a *CRR* was subsequently authorized (C. Res. 2010/1/ACOM05) at the 2010 ICES Annual Science Conference, with the expectation of completion in 2011.

Work on the history progressed gradually, but Hoydal became involved in a related project that commanded higher priority. In October 2010, the ICES Council commissioned an independent review of the ICES Advisory Services to be conducted from September 2011 to October 2012. The main objectives of that External Review Panel, which Hoydal was asked to chair, were to evaluate the quality and reliability of the scientific advice, the appropriateness of the process used to prepare it, its relevance, responsiveness, and scope , and to assess if the human and financial resources available to deliver the advice were appropriate to the workload. As a result, it became impossible for him to meet the 2011 deadline for completion of the ACFM history. Being involved in both projects, it became evident to Hoydal that it would be worthwhile for the Review Panel to take advantage of the ACFM history. An overlap between the drafting of the history and the performance review was, therefore, warranted. Both processes, to a large extent, drew on the same material. Consequently, the deadline for completion of the ACFM history was extended to November 2012 to allow its consideration and discussion in the Advisory Services review process.

The final draft of the Report of the External Panel, 2011–2012 to Review ICES Advisory Services (ICES, 2012a, 2012b, 2012c) was presented to the ICES Council on 25 October 2012. The portion of the ACFM history that is of particular relevance and support to a future ICES advisory framework is the chapter on the lessons learned during the ACFM years. This history of ACFM examines in greater detail some issues of general interest which the External Panel chose not to include in its review. Reading this report on the history of ACFM together with the Report of the Panel should,

therefore, provide a more complete overview of problems encountered by the ICES Advisory Services during the past four decades.

This report is, to a large extent, based on the work of hundreds of scientists who contributed to the advisory work of ICES during the ACFM years (1978–2007). Nearly all former Chairs and ACFM Secretaries have contributed in some way to this history, either with written material or with comments. Particularly helpful in this regard were David de G. Griffith (ACFM Chair, 1982–1984; President, 1991–1994; General Secretary, 2000–2005) and Jean-Jacques Maguire.

Emory D. Anderson

Series Editor

February 2013

First holistic era	1902–1909	**Overfishing concerns. Hydrographic conditions** in relation to fisheries. **Migration thinking** on fisheries fluctuations re-examined. **Innovative equipment** developed at **Central Laboratory**. **Standard Seawater** production commenced. **Knudsen's Tables** of physical constants of seawater.
	1910–1919	**Overfishing** concerns continue; various programmes. **Fisheries fluctuations:** paradigm shift from **migration** thinking to **population** thinking; **Johan Hjort's** paper in 1913.
Growth and specialization era	1920–1929	**Overfishing.** ICES continues to recommend conservation measures. Resolution of herring **scale reading** controversy. **Mesh selectivity** investigations intensify.
	1930–1939	**E. S. Russell, M. Graham** develop population thinking; **Fishing Theory.** **Johan Hjort** *et al.*: optimum fishing. First application of **echosounders** in fisheries science. Hardy's **Continuous Plankton Recorder**.
	1940–1949	**Comparative fishing**: the search for **equivalence**. Further **development of Fishing Theory**, principally by **Beverton and Holt**. **Cod, herring** shoals **monitored by echosounder** and **ASDIC**.
	1950–1959	Importance of **Comparative Fishing** continues (new Committee). **Beverton and Holt publish** "On the Dynamics of Exploited Fish Populations".
Quantification era	1960–1969	**Quantification** (hydrography, fish stocks). Virtual Population Analysis (VPA). Stock assessment Working Groups. Increasing use of **echosounders** for measuring fish stock abundance.
	1970–1979	The **environment**. Biological, physical, chemical **quantification** continues. **Mariculture** Committee. Code of Practice on **Introductions**.
Second holistic era	1980–1989	**Multispecies** approach; first Year of the Stomach. **Dialogue Meetings** start. **Theme Sessions** organized. **Environmental stock-taking** commences; Baltic assessment.
	1990–1999	Further **maturation** through holistic developments: • Study of **fisheries/environment** interactions, • **Precautionary** approach, **fisheries economics**. **Environmental stocktaking** continues: assessments, Quality Status Reports (QSRs), Harvest Control Rules (HCRs).

Adapted from the Stockholm 1999 Centenary lecture by Griffith (2003).

1 Introduction

As noted by Noam Chomsky, history does not come neatly packaged into distinct periods, but by imposing such a structure upon it, we can sometimes gain clarity, without doing too much violence to the facts.

> There is a theory which states that if ever anyone discovers exactly what an advisory system for fishery management is and why it is here, it will instantly disappear and be replaced by something even more bizarre and inexplicable.
>
> There is another theory which states that this has already happened.
>
> *(Paraphrased from Douglas Adams' "The Hitchhikers Guide to the Galaxy")*

When I took on the task of assembling the history of the ICES Advisory Committee on Fishery Management (ACFM), I had the rather naïve perception that it would be easy, with the help of the other former ACFM Chairs, to describe the development of ICES advice from the last year of the Liaison Committee (1977) to the arrival of the Advisory Committee (ACOM) in 2008.

Having studied material provided by other former Chairs and Secretaries of ACFM, together with other internal material from ICES, it became apparent that instead of giving a year-by-year description of what happened at ACFM, it would be more important to make use of the experiences gained during the 30 years that ACFM was responsible for advice on fisheries. This would contribute to the ever-ongoing discussions on the role of scientific advice in fishery management. These discussions are particularly vibrant at the present time. These 30 years cover a time wherein there were major developments in international law and instruments[1], and biodiversity protection came to the fore after the Rio Summit of 1992.

It was, therefore, decided to arrange the material more thematically in the main sections following:

Chapters 2–5 describe the context for the demand for scientific advice in the Northeast Atlantic and how it developed in the latter half of the 20th century up until 2007. This is trying to relate processes in ICES to international processes.

Chapter 6 describes the internal ACFM view of the developments in the Committee, especially the strong focus on improving scientific quality. This was the main problem for ACFM in its early years. It was an area where

[1] For example, relevant provisions of the United Nations Convention on the Law of the Sea of 10 December 1982; the Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks, 1995; the Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas, 1993, and taking into account the Code of Conduct for Responsible Fisheries adopted by the 28th Session of the Conference of the Food and Agriculture Organization of the United Nations in October 1995.

ACFM/ICES had full freedom to act and eventually moved quite rapidly forward. This chapter is based on internal ICES papers, noted from Chairs and Secretaries of ACFM, Dialogue Meetings, and papers summarizing developments over the years.

Chapter 8 attempts to describe external views. Several academic studies and projects have looked at ACFM and particularly the problems involved in getting the advice into a form that is useful and meets the demands of managers and the fishing industry. Two academic studies were chosen here to reflect these studies.

Chapter 9 continues from the experiences of ACFM to the debate today on the interface between science and management. What can we learn from the history of ACFM that can be used in the ongoing discussion of the role of scientific advice? Some of the recommendations of the External Panel, 2011–2012 to review ICES Advisory Services are given.

It is informative to compare engineering and fisheries advice. Engineering is about dimension: how much stress construction will withstand. Fisheries science deals with the same problem: how much fishing pressure can a fish stock withstand and still maintain sustainable or economically preferable levels?

Fisheries science needs to work with probabilities, particularly the probability that a certain stress (fishing mortality) will lead to a preferred stock situation, not make exact predictions, based on repeatable and reproducible experiments. Fisheries science is more complex, and the probabilities involved are not easily calculated or presented to recipients of the advice. This recalls the famous Burkenhard criticism of the fisheries science of his day (up to 1950) and his call for an inductive rather than a deductive approach, with controlled experiments with regulations. This call was, however, generally rejected as impractical.

2 Context

The changes in fisheries governance from the mid-20th century to 1977 were dramatic and completely changed the need for advice and the list of customers of ICES. This happened under the umbrella of international negotiations of international law and instruments stretching from the negotiations leading to the 1958 Conventions on the Territorial Sea and the Contiguous Zone, on the High Seas, Fishing and Conservation of the Living Resources of the High Seas and on the Continental Shelf, and the negotiations from 1972 to 1981 to the Third United Nations Conference on the Law of the Sea leading to the signing of the United Nations Convention on the Law of the Sea in 1982, which entered into force in 1994. The website of the UN Division of Ocean Affairs summarizes the historic background as follows:

> "The oceans had long been subject to the freedom of-the-seas doctrine – a principle put forth in the seventeenth century essentially limiting national rights and jurisdiction over the oceans to a narrow belt of sea surrounding a nation's coastline. The remainder of the seas was proclaimed to be free to all and belonging to none. While this situation prevailed into the twentieth century, by mid-century there was an impetus to extend national claims over offshore resources. There was growing concern over the toll taken on coastal fish stocks by long-distance fishing fleets and over the threat of pollution and wastes from transport ships and oil tankers carrying noxious cargoes that plied sea routes across the globe. The hazard of pollution was ever present, threatening coastal resorts and all forms of ocean life. The navies of the maritime powers were competing to maintain a presence across the globe on the surface waters and even under the sea.
>
> "A tangle of claims, spreading pollution, competing demands for lucrative fish stocks in coastal waters and adjacent seas, growing tension between coastal nations' rights to these resources and those of distant-water fishermen, the prospects of a rich harvest of resources on the sea floor, the increased presence of maritime powers and the pressures of long-distance navigation and a seemingly outdated, if not inherently conflicting, freedom-of-the-seas doctrine – all these were threatening to transform the oceans into another arena for conflict and instability.
>
> "In 1945, President Harry S Truman, responding in part to pressure from domestic oil interests, unilaterally extended United States jurisdiction over all natural resources on that nation's continental shelf – oil, gas, minerals, etc. This was the first major challenge to the freedom-of-the-seas doctrine. Other nations soon followed suit.
>
> "In October 1946, Argentina claimed its shelf and the epicontinental sea above it. In 1947, Chile and Peru, and in 1950, Ecuador, asserted sovereign rights over a 200-mile zone, hoping thereby to limit the access of distant-

> water fishing fleets and to control the depletion of fish stocks in their adjacent seas.
>
> "Soon after the Second World War, Egypt, Ethiopia, Saudi Arabia, Libya, Venezuela and some eastern European countries laid claim to a 12-mile territorial sea, thus clearly departing from the traditional three-mile limit.
>
> "And then there was fishing. Large fishing vessels were roaming the oceans far from their native shores, capable of staying away from port for months at a time. Fish stocks began to show signs of depletion as fleet after fleet swept distant coastlines. Nations were flooding the richest fishing waters with their fishing fleets virtually unrestrained: coastal States setting limits and fishing States contesting them. The so-called 'Cod War' between Iceland and the United Kingdom had brought about the spectacle of British Navy ships dispatched to rescue a fishing vessel seized by Iceland for violating its fishing rules."[2]

Although UNCLOS was not signed until 1982, the development moved ahead, and in 1977, there was a general move towards 200-mile fishing limits. In the Northeast Atlantic, this happened in 1977, seriously reducing the mandate of the NEAFC Convention of 1959, which entered into force in 1963. The North-East Atlantic Fisheries Commission, which was formed under that Convention, succeeded the Permanent Commission, founded in 1953.

"NEAFC formed the framework for international cooperation in the area of fisheries regulation beyond national fishing limits. Its main purpose was to recommend measures to maintain the rational exploitation of fish stocks in the Convention area, taking scientific advice from ICES. In 1967, NEAFC established a Scheme of Joint Enforcement which contained rules for mutual inspection and control outside national fishery jurisdiction. Although all decisions regarding judicial processes were the responsibility of the flag state, this scheme was considered a significant achievement. In 1969, the Commission recommended a full ban on salmon fisheries outside national limits. It also agreed to enforce a closed season for the North Sea herring fishery from 1971. In 1975, a recommendation to ban the directed industrial fishery for North Sea herring was agreed.

"During this period, the Commission's powers increased as it was allowed to set total allowable catch limits (TACs) and effort limitations, including the allocation of quotas. The first quota recommendation was on North Sea herring in 1974, and the following year, NEAFC recommended total allowable catch and quota allocations for fifteen stocks. By the end of 1976, NEAFC was aware that developments taking place after the Third United Nations Conference on the Law of the Sea would result in the extension of fishing limits to 200 miles. In 1977, when the coastal states in the North

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[2] http://www.un.org/depts/los/convention_agreements/convention_historical_perspective.htm

Atlantic declared 200-mile jurisdictions off their coasts, areas of stocks regulated by NEAFC became national zones. The management of joint stocks became a matter of bilateral or multilateral responsibility, instead of NEAFC's responsibility" (Engesæter, 2000).

This change moved millions of square miles of fishing acreage from the jurisdiction of NEAFC to the new jurisdictions in the Northeast Atlantic, the EU, the Faroe Islands, Greenland, Iceland, Norway, and the Soviet Union. Under these new regimes, ICES advice had to be rearranged. The Liaison Committee, with its membership of Committee Chairs and co-opted experts, had to be replaced by a committee that reflected the new main customers, the new coastal states in the Northeast Atlantic. The Committee was named ACFM, the Advisory Committee on Fishery Management. In hindsight, this title is somewhat of a misnomer. ACFM became the main source for advice on stock status, but fishery management is far more than merely stock status.

2.1 Demand for scientific advice in the Northeast Atlantic

The ICES Area covers all EEZs and areas beyond national jurisdiction in the Northeast Atlantic, including the Baltic Sea and the Arctic Ocean. All coastal and fishing states in the area are members of ICES.

The implementation of the 200-mile fishery limits in the Northeast Atlantic in 1977 meant a transfer of jurisdiction to coastal states in the area, changing dramatically the competence of regulatory commissions. This called for a "review (of) the objectives, structure and methods of operation of the Council and to propose as necessary, relevant changes in the Rules of Procedure for consideration at the 65th Statutory Meeting."

Following internal procedures in the Bureau and the Council, it was agreed to replace the Liaison Committee with "**The Advisory Committee on Fishery Management" (ACFM),** (which) "shall be responsible for giving, on behalf of the Council, scientific information and advice to Fisheries Commissions and to the Council's Member Governments – or groups of Governments – on such matters on which they may request advice, or on such matters as the Council or the Committee may consider relevant.

"The Committee shall consist of a Chairman **nominated by the Consultative Committee** from among Delegates or Experts and appointed by the Council, and the Chairmen of such other Committees as the Council decides, and one scientist nominated by each delegation who so wish, and subsequently appointed by the Council.

"If the Chairman, when elected, is among the members nominated by the Delegations, he shall cease to serve in that capacity and the Delegates who nominated him shall have the right to nominate another scientist."

For 1977/1978, the Council decided that the following standing committee chairs should serve on ACFM: (i) Chair, Demersal Fish Committee; (ii) Chair, Pelagic Fish Committee; (iii) Chair, Baltic Fish Committee.

It was further agreed that ACFM "may as hitherto be free to call, with the consent of the President, on such expertise as may be necessary."

At the Delegates Meeting on 5 October 1977, the ICES President reported that the Consultative Committee had nominated Alan Saville (Marine Laboratory, Aberdeen, Scotland) as ACFM Chair. The Council thereafter unanimously agreed to appoint him to that office for a period of three years. The President asked for and received nominations of ACFM members from each of the Member Countries, and the Council then unanimously appointed the persons nominated.

"It was further agreed that in cases where there is a need during an intersessional period to appoint a substitute for a member, the name of the substitute shall be communicated to the General Secretary, who will seek the President's approval. The President's approval of the name has effect until the next Statutory Meeting. The Delegates will be informed about such approvals."

The first meeting of ACFM was held at the ICES Headquarters in Charlottenlund (Figure 2.1), 22–31 May 1978, under the chairmanship of Alan Saville. The participants in that meeting, as well as all subsequent meetings of ACFM, are listed in Annex 1.

Figure 2.1. Charlottenlund Castle, home of the ICES Secretariat from 1936 to 1980, was the venue for the ACFM meetings in 1978–1979.

This change from the Liaison Committee, which consisted of standing committee chairs and co-opted members with special expertise on the issues being considered, to the new Committee, still with standing committee chairs, but with a majority of representatives proposed by national authorities, reflected a change in responsibilities. Before 1977, most fisheries took place in waters beyond national jurisdiction and were regulated by the regional fishery management organization NEAFC. Most fisheries thereafter became the responsibility of competent national authorities, and this situation had to be reflected in the ICES advisory body. Discussions of the possible consequences of this change with respect to the impartiality of the advice are discussed in more detail in Section 2.7.

During the 1970s and 1980s, as other regional commissions became established, they too turned to ICES for scientific advice. The International Baltic Sea Fishery Commission (IBSFC) sought and obtained the ready agreement of ICES to provide scientific advice from its foundation in 1974, as did the North Atlantic Salmon Conservation Organization (NASCO) upon its establishment in 1983. The Commission of the European Communities (EC) first requested fishery management advice from ICES in the early 1980s, having assumed responsibility for the management of fisheries within EC waters in 1977. Since 1987, this arrangement has been formalized by an Exchange of Letters between ICES and the European Commission.

2.2 Clients and competent authorities in the ICES Area and their needs after 1977

The establishment of Exclusive Economic Zones (EEZs) in 1977 increased dramatically the area where coastal states acquired:

> sovereign rights for the purpose of exploring and exploiting, conserving and managing the natural resources, whether living or non-living, of the waters superjacent to the seabed and of the seabed and its subsoil, and with regard to other activities for the economic exploitation and exploration of the zone, such as the production of energy from the water, currents and winds;
>
> jurisdiction as provided for in the relevant provisions of this Convention with regard to:
>
> (i) establishment and use of artificial islands, installations and structures;
>
> (ii) marine scientific research;
>
> (iii) protection and preservation of the marine environment;
>
> other rights and duties provided for in this Convention.[3]

The United Nations Convention on the Law of the Sea was opened for signature in December 1982 and entered into force in November 1994. However, the texts had been negotiated for several years, so coastal states were aware what was in store already in 1977. It should be noted here that the protection and preservation of the marine environment was already discussed as one of the areas over which coastal states acquired jurisdiction. Nevertheless, the discussion in ICES on how to adapt to the new regime only dealt with fisheries.

2.3 EEZs, ABNJ, and stocks advised on

The new jurisdictions and the competent management authorities in the Northeast Atlantic and the EEZs after 1977 are shown in Figure 2.2.

The areas beyond national jurisdiction (ABNJ) within the ICES Area include:

> North-East Atlantic Fisheries Commission (NEAFC): 1980 Convention in force 1982, amended 2004 and 2006.

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[3] United Nations Convention on the Law of the Sea, UNCLOS Article 56.

Baltic Sea: The International Baltic Sea Fishery Commission (IBSFC) up to 2005.

Salmon: North Atlantic Salmon Conservation Organisation (NASCO).

ICES rearranged its advisory system in order to provide advice to these competent authorities.

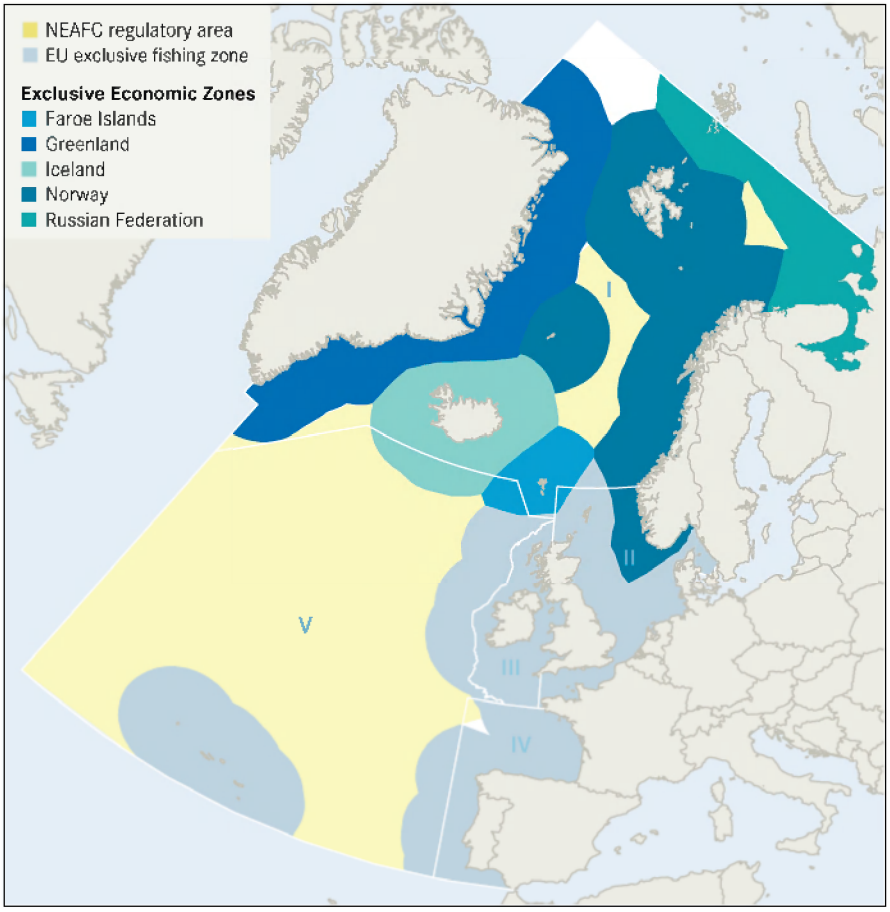


Figure 2.2. Fisheries management zones in the OSPAR area. Ice-bound areas beyond national jurisdiction are shown in white and high seas waters in yellow (OSPAR, 2010).

Groups of coastal states then had to take care of shared, transboundary, and straddling stocks. Some examples are:

Exclusive stocks: The EU has a number of exclusive stocks, but these have to be negotiated annually between member states, which renders them exclusively EU EEZ functionally transboundary stocks. The Faroe Islands and Iceland are in the unique position that most demersal and some pelagic stocks are exclusive stocks, only found inside their own EEZs. Norwegian coastal cod and Northeast Arctic saithe are exclusive stocks for Norway.

Shared stocks: Norway and Russia share the stocks of cod, haddock, and capelin in the Barents Sea. Cooperation with Russia in the north takes place in the Joint Norwegian–Russian Fisheries Commission, which sets total allowable catches (TACs) for shared stocks. Norway cooperates with the EU on the management of joint stocks in the North Sea, which involves more shared

stocks than between Russia and Norway. Norway and the EU agree on the management on cod, haddock, saithe, whiting, plaice, and North Sea herring.[4]

Straddling stocks: Over time, the following coastal state groups have been formed to agree on TACs and the management of straddling stocks:

(i) Blue whiting: EU, Faroe Islands, Iceland, and Norway.

(ii) Mackerel: EU, Faroe Islands, Iceland, and Norway.

(iii) Norwegian spring-spawning (Atlanto-Scandian) herring: EU, Faroe Islands, Iceland, Norway and the Russian Federation

(iv) Pelagic redfish in the Irminger Sea: Greenland, Faroe Islands, and Iceland.

Discussions on Rockall haddock and deep-sea fisheries in ANBJ mainly take place at NEAFC.

In Table 2.1, the stocks on which ICES gave advice in 2007 are grouped according to EEZ, ABNJ, and status as exclusive, transboundary, or straddling stocks.

Table 2.1. Stocks on which ICES gave advice in 2007: exclusive, shared, transboundary, and straddling stocks by EEZ, Baltic, and ANBJ. All EU stocks not shared are listed under transboundary because quotas have to be negotiated between member states.

Coastal state or ABNJ	Exclusive	Shared	Transboundary	Straddling
EU	Horse mackerel	North Sea cod, haddock, saithe, whiting, plaice, sole	Cod, haddock, saithe, whiting, plaice, sole, anchovy, hake, Baltic herring and cod, sprat, horse mackerel	Blue whiting, Atlanto-Scandian herring, mackerel
Greenland				Oceanic redfish
Faroe Islands	Cod, haddock, saithe		Tusk, ling, blue ling	Blue whiting, Atlanto-Scandian herring, mackerel
Iceland	Cod, haddock, saithe, summer-spawning herring		Tusk, ling, blue ling	Blue whiting, Atlanto-Scandian herring, mackerel
Norway	Saithe, coastal cod	North Sea cod, haddock, saithe, whiting, plaice, Northeast Arctic cod, haddock, capelin		Blue whiting, Atlanto-Scandian herring, mackerel, *Sebastes mentella*
Russian Federation		Northeast Arctic cod, haddock, capelin, redfish, Baltic cod, herring, sprat, salmon		Atlanto-Scandian herring, *S. mentella*
ABNJ NEAFC south of Iceland				Blue whiting, Atlanto-Scandian herring, mackerel, deep-sea species

[4] Norwegian fisheries management, Fiskeridepartementet 2012.

ABNJ NEAFC Norwegian Sea			Blue whiting, Atlanto-Scandian herring, mackerel, *S. mentella*
ABNJ NEAFC Barents Sea			Prawns
Baltic	Sprat, herring, cod, salmon	Sprat, herring, cod, salmon	

The number of coastal states involved in management has potential implications for the form and the delivery of the advice.

2.4 Fishing fleet approach or fish stock approach

Since the mid-1970s, many fishery biologists associated with ICES had been feeding what has been called "the TAC machine" (Holm and Nielsen, 2004; Schwach *et al.*, 2007). Managers had requested one product from the advisory bodies: TACs, which were supposed to control fishing mortality and keep it at levels deemed sustainable.

> That TAC work is a very respectable view widely held by right-thinking people, who are largely recognizable as being right-thinking people by the mere fact that they hold this view.
>
> It is very easy to be blinded to the essential uselessness of TACs by the sense of achievement you get from getting them to work at all.
>
> *Paraphrasing Douglas Adams in "So long, and thanks for all the fish".*

In the late 1960s and early 1970s, it was by no means evident that this was what would be required. In the 1950s and most of the 1960s, the focus had been on fishing fleets and fisheries (Gulland, 1956; Clayden, 1972), and managers spent a lot of time discussing how to protect juveniles (landing-size limits and mesh sizes). Gezelius and Raakjær (2008) describe the lively debate between scientists and managers about how to control fishing mortality. A summary of Chapter 2.3 of their book, "TACs emerge as the dominant management form" is given below.

It was discussions in the North Atlantic fishery commissions, ICNAF and NEAFC, which focused the attention of administrators and scientists on the need to restrict fishing mortality. NEAFC was influenced by discussions at ICNAF. This was to be expected, because several European countries were contracting parties of both commissions. Both commissions had strong links to ICES and FAO.

The increase in fishing effort in the late 1950s and early 1960s in the Northwest Atlantic forced scientists at ICES and ICNAF to draw the attention of managers to the fact that a technical measures regime was insufficient to protect fish stocks against overfishing. Following discussions at ICNAF, Wilfred Templeman and John Gulland produced a paper (Templeman and Gulland, 1965) in which they arrived at the same conclusion and suggested that fishing had to be restricted, either by limiting effort or by setting catch quotas. The question of which management form to choose was addressed at the 1966 annual meetings of the two commissions. ICNAF established the Working Group on Joint Biological and Economic Assessments of Conservation Actions (WGBEAC), which was tasked to evaluate the two management alternatives. WGBEAC was equally divided between biologists and economists, with 16 people from FAO, OECD, and national fisheries administrations, science, and industry.

A system based on regulating effort directly was seen as the most rational approach from an economic perspective, but it was extremely difficult to find a reliable standardized and agreed measure for the relationship between fishing effort and fishing mortality. Catch limitations were not seen to carry similar problems, but it was realized that catch quotas could not include discards. The main problem, however, was perceived to be the need to adjust catch quotas annually in order to keep fishing mor-

tality constant, requiring the update of scientific data and the willingness of states and industry to adjust. The outcome of the discussions was what came to be the system in the North Atlantic: TACs to protect fish stocks, supplemented by national limited entry licensing schemes to support economic efficiency (Hoydal, 2011).

Sidney Holt had the following to say in a commentary: "Graham insisted, I think rightly, that controlling fishing effort was the better way to go than setting physical catch limits, and in his last writing, published posthumously, I think my old colleague Ray Beverton clinched that argument" (Holt, 2006).

It is not difficult to understand that it is easier to allocate total allowable catches (TACs) than total allowable effort (TAE) among states. The focus on TACs has meant that fishing fleets and other management measures, like technical measures and closed areas, were put on the "back burner".

2.5 Fishery systems

ICES has considered the fishery systems approach. The Working Group on Fishery Systems was established in 2000 to, *inter alia*, "develop a framework and methodology for the analysis of fishery system performance" and "propose ... interdisciplinary research which will advance ICES future capability in fishery systems analysis". In 2005, the Study Group on Management Strategies (SGMAS) was established. It concentrated on evaluating management strategies and their inherent harvest control rules (HCRs), and looked at the specific subset of HCR recovery plans for depleted fish stocks in reports from 2005 (ICES, 2005a) and 2006 (ICES, 2006a; NEAFC, 2007).

In the 2006 report (ICES, 2006a), there was a focus on fishery systems as a prerequisite for developing management plans and HCRs. SGMAS offered the following descriptions of fishery systems (the whole section beneath, from the heading "Conceptual issues" to Figure 2.5 is lifted from ICES, 2006a):

> Conceptual issues
>
> ICES is increasingly being asked to evaluate harvest control rules or management plans as a step to move from away from short-term crisis management towards long-term management.
>
> A harvest control rule is a component in a wider management strategy "

A decision (explicit or implicit) on longer term management objectives and performance criteria

A decision on the relevant knowledge base for tactical management decisions

Tactical management decisions regarding the fisheries in the current or coming fishing season (including harvest control rules)

A decision on implementation measures (mainly input or output control etc.)

> A management strategy thus includes what is called a knowledge system, a decision-making system and an implementation system (Figure 2.3). The fleet

adaptation system and the underlying resource system represent the objects of management and are thus external to the management strategy itself. This external system should be incorporated in any management strategy evaluation in terms of achievements of objectives, robustness and risk relative to external factors.

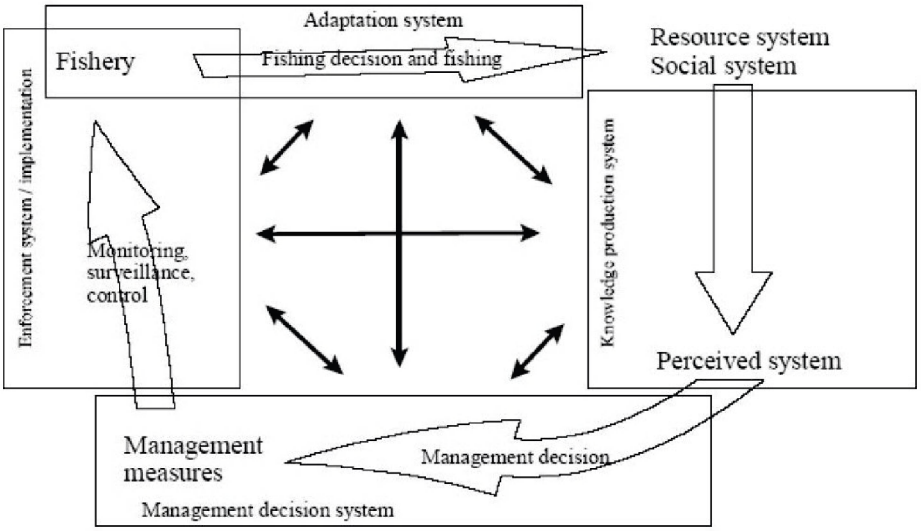


Figure 2.3. The fisheries system. The management strategy identifies the knowledge production system, the management decision system, and the implementation system. The adaptation of the fleets and the natural changes in the resource system are external constraints (from ICES, 2000a).

The fishery system can also be conceptualized in the form of an onion where each outer layer encompasses one of more inner layers. This onion model can be applied to the (rational) contents of a fishery system (Figure 2.4) or to the processes of a fishery system (Figure 2.5).

The rationality-based version of the fishery system consists of (from inside to outside):

A harvest control rule (HCR) is the lowest level in a hierarchy within the fishery system. There is always an implicit harvest control rule, but it is in most cases in the NE Atlantic area not stated explicitly. The present implicit harvest control rule in Europe is to decide an annual TAC on basis of a two year catch forecast based on the population one year prior to the fishing season. This rule is associated with a B_{lim} reference point and two trigger points (B_{pa} and F_{pa}).

Tactical management decisions can include a critical evaluation of the outcome of a harvest control rule and can be subject to requests for flexibility when politically sensitive issues are at stake. However, the long-term benefits of harvest control rules can be undermined by such tactical management decisions.

A management plan includes the decision-making processes (harvest control rules, tactical decision-making) and the sanctions on implementation and the requirements for monitoring and reporting. Management plans may also exist in the form of rebuilding plans or recovery plans. While management plans can include

decision rules that aim at recovery in the case decision parameters fall outside trigger points, recovery plans are only temporary until recovery has been achieved.

Management strategies include decisions on objectives with associated performance criteria, on the implementation measures (e.g. input or output control) and on what is considered a relevant knowledge base for decisions. The knowledge production system should reflect the management strategy. Analytic stock assessments with annual catch forecasts is just one particular approach to produce the knowledge base for tactical management decisions within a management strategy based on annual TACs. Other approaches are direct use of survey indices prior to or in the fishing season or catch rates from the early part of the fishing season. In an effort based management strategy other types of knowledge and other frequencies of updates are required and annual catch forecasts may be irrelevant.

The external constraints include the future state of nature and the future behaviour of the fishing fleet, which includes adaptations to the management. These external constraints cannot be predicted but management strategies can be evaluated by their robustness to changes in these constraints.

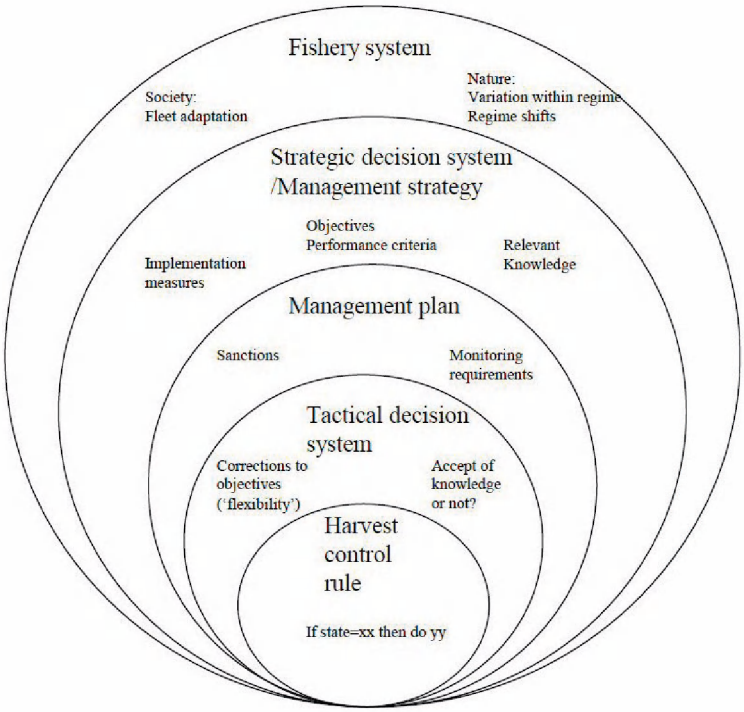


Figure 2.4. The management strategy onion: contents-oriented version (from ICES, 2006a).

The **process-oriented** version of the fishery system (Figure 2.5) is based on Ostrom's model of commons decision rules (Ostrom, 1990) which distinguishes the fishery system into:

constitutional choice rules: who gets to participate

collective choice rules: how they get to participate

operational rules: what they have agreed, e.g. the 'HCRs'.

> An example of the process-oriented aspects of fishery systems is the establishment of Regional Advisory Councils (RACs) in the EU. The RACs have been set up within the context of the new Common Fishery Policy ('the management strategy')."

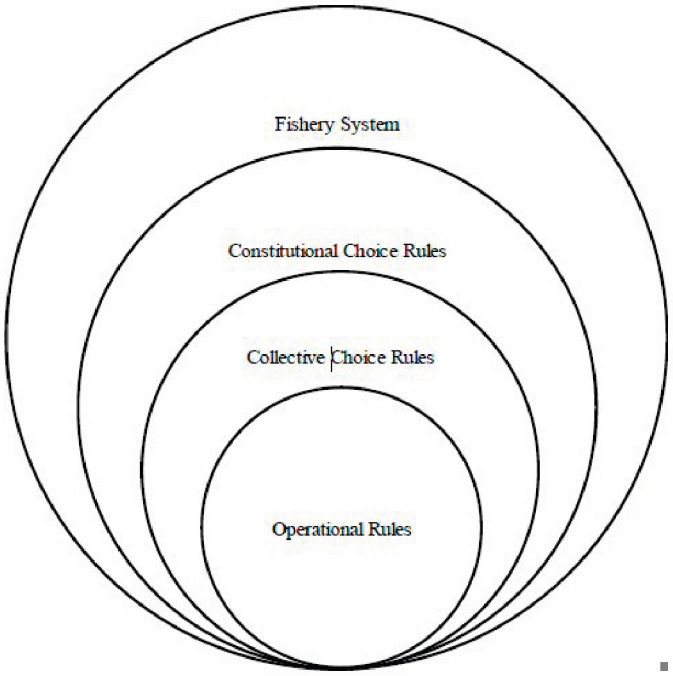


Figure 2.5. The fishery system onion: process-oriented version (from ICES, 2006a).

Garcia and Charles (2006) also describe fishery systems. Below are excerpts of their representation of fishery systems focusing on the ecosystem approach:

> "In order to meet these needs, fishery research constructs simplified representations (models) of the natural and resource use systems. Many such representations can be found in the scientific literature of the last 50 years. As described in section 1, their scope and complexity has increased with time, reflecting changes in social demand and the specific questions raised by policy and decision-makers……. The representations used as a framework for the Ecosystem Approach to Fisheries are among the most comprehensive ones, incorporating the biotic, abiotic, fishing and institutional components, as well as connections with the global market, climate, other ecosystems, public policies, societal values, etc. [Figure 2.6]. Variants of that representation have been proposed, for instance by Charles (2005) recomposing the representation in two subcomponents: a natural system including the biotic, abiotic and climate factors, and a human system including the fishing and related economic activities and the institutional and governance components.

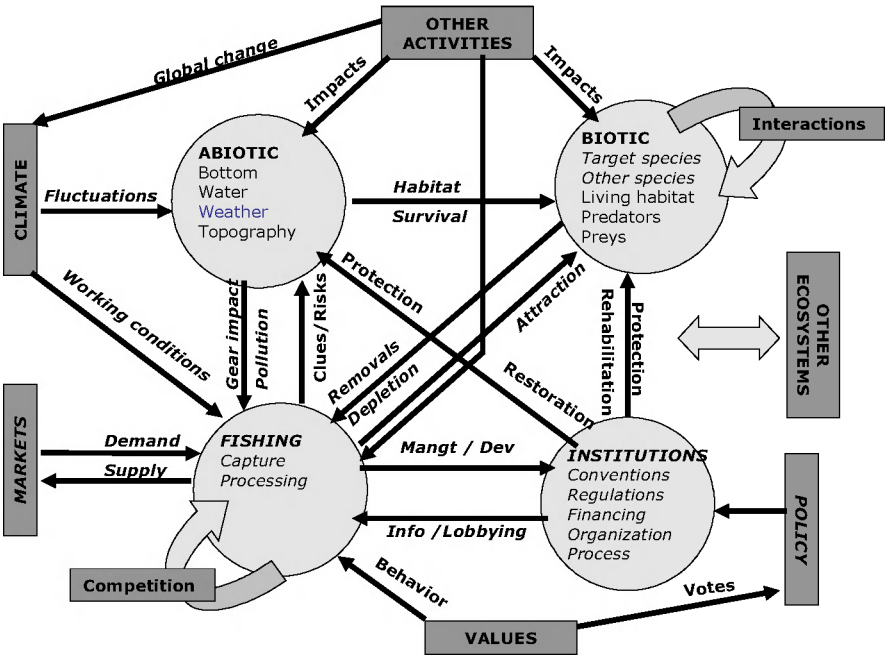


Figure 2.6. Holistic representation of the fishery system (from Garcia *et al.*, 2003). The elements in italics represent the extension from a conventional to an EAF representation.

"A system representation requires decisions regarding its external and internal boundaries (scope); components (structure), scales (grain), and linkages (functions) between components and with the outside environment. Boundaries, scales, components and linkages interact to determine the level of detail or aggregation (compression) of a system representation. In selecting them, and in the process of increasing the scope and detail of the model, care will be taken to improve the balance between the amount of hard information taken into consideration and assumptions necessary to cover uncertainties.

"Boundaries are fundamental for any fishery system analysis and, indeed, figure in the definition of the ecosystem approach to fisheries (EAF). They materialize the scope of the system, both in terms of its geographical and functional extension. The external boundaries of the system separate the 'core' of the system – the object of detailed representation – from the external components and influences, of environmental, political, economic, social, and ethical nature, that affect its functioning. The internal boundaries identify the various components and therefore the degree of detail or aggregation of the representation. The boundaries selected for the natural and human subsystems are essentially human artefacts, necessary to reduce complexity to intellectually manageable levels and their drawing depends essentially on the purpose and focus of the system representation as well as on available information. A trade-off must be faced between holism and tractability.

"When the purpose of a fishery system representation is to assist in governance, it is important to match system and jurisdictional boundaries to the ex-

tent possible. This is a major dilemma, since such a matching with jurisdictional boundaries must be balanced by the desirability, within an ecosystem approach, of managing on the basis of sensible ecosystem boundaries. In practice, it will depend on the specifics of a particular case whether the fishery system is easier determined on the basis of ecological boundaries or jurisdictional ones, or some intermediate approach. The matching boundaries requirement is too often 'forgotten' by scientists, e.g. in a number of LME systems, bounded entirely on the basis of natural considerations, with little or no explicit regard to institutional boundaries in the same region. This can create an institutional gap that complicates or interrupts the two-way flow of information between research and management.

"The decision on boundaries and scales determine the elements that constitute the system, sub-systems or components, and the degree of detail in their description. If the fishery system would be conceived as a series of concentric rings, the centre ring would contain the core elements of the fishery sector while the peripheral ring would contain elements with a greater conceptual "distance" from the core but not automatically with the least influence on it. Examples are given below:

1. "System core: resource complex (e.g. stocks; target, dependent, associated, and endangered species); fleets (e.g. commercial, artisanal, industrial, recreational, foreign, pirate); processors (e.g. at sea, on land); fishers (e.g. native, migrants, part-time, full-time, owners, employees, fishing households); fishery management agency (including MCS systems); post-harvest (e.g. processors, distribution, marketing, etc.); traders and markets (e.g. local, regional, global).

2. "Intermediate ring: Ecosystems (e.g. inshore, offshore, deep sea; lagoons, estuaries, rivers, lakes, shelves, coral reefs, seagrass beds, seamounts, etc.), with their habitats (vulnerable, critical), and environment (productivity, climate, variability); fishery research (e.g. for improved technology and management advice); administration (public and private; professional associations and unions; statistical systems); government (e.g. Parliament; Ministries and in particular the Ministries of environment, Commerce, Finance and Justice; development banks; and a hoist of other economic sectors which impact on the socio-economic environment immediately around the fishery sector, such as: the rural and urban sectors (e.g. providing market and manpower); agriculture (complementary or alternative livelihood); aquaculture (e.g. competing for space, seeds, and markets; polluting); tourism (providing alternative jobs and markets); defence (e.g. providing high-tech for localization and detection as well as enforcement); navigation and ports (e.g. providing security and shelter; boosting capacity); boat building (shipyards); public works (e.g. that provide feeder roads and infrastructures and access to markets); as well as the cables, pipes, mining, oil and gas sectors.

3. "Outer ring: A number of sectors that interact with fisheries (albeit less directly), that potentially create operational opportunities or problems for fisheries such as: academia (producing a range of fishery research as well as staff for fishery agencies); consumers (with demands to satisfy); voters (who affect policy-makers' choices); the public at large (which has a range of views, e.g. ethical considerations) and the non-governmental organizations and foundations as well as the media which are very active in the environmental and industry arenas."

The advice customers requested when ACFM was established only covers a small corner of the fishery systems in the Northeast Atlantic. Since then, there has been an increasing acceptance of the need to consider more than just the state of individual stocks in isolation. This was manifested by the gradual inclusion in assessments and advice of technical (multispecies fishing gear) and biological (predator–prey) interactions, and then, following the termination of ACFM, further broadening the context through the ecosystem approach.

2.6 Modelling of commercially important fish stocks and their environment

At the outset, ACFM and its expert groups had access to the numerical methods developed in stock assessment by Ray Beverton and Sidney Holt in the 1940s and 1950s, and John Gulland and others in the 1960s. [The first exposition of the mainstay of fish stock assessment methodology, the virtual population analysis (VPA), is tucked away as an annex, written by John Gulland, attached to the 1965 report of the Arctic Fisheries Working Group.] These developments enabled ICES, during the 1960s, to set up the first fully analytical fish stock assessment working groups (Griffith, 2002).

By 1974, several ICES working groups performing basic stock assessments were established.

Garcia and Charles (2006) give the following graphic summary of the development in assessment technology (Figure 2.7).

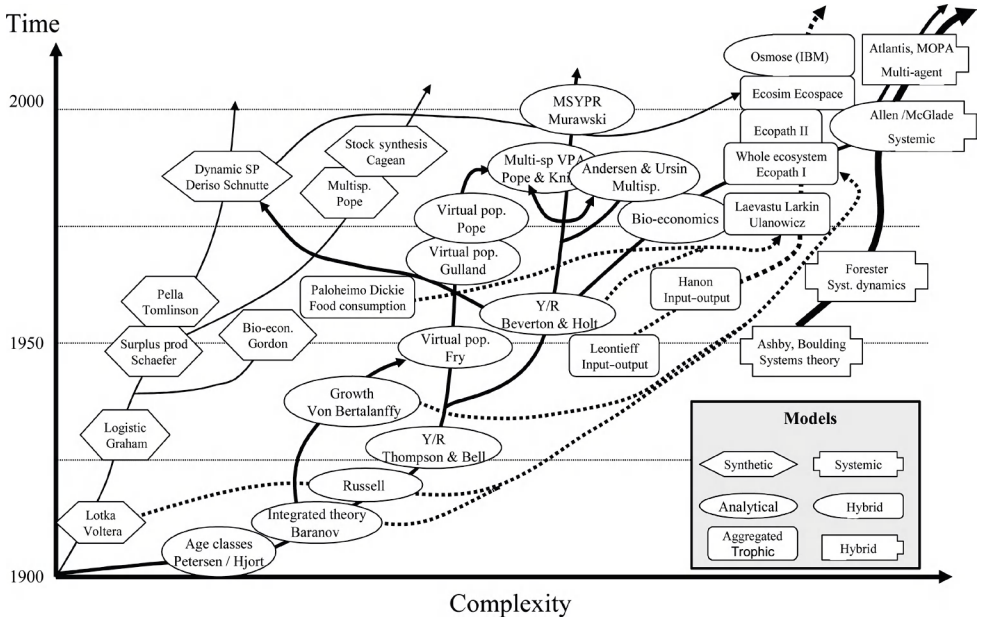


Figure 2.7. Evolution of fisheries modelling, 1900–2005 (from Garcia and Charles, 2006).

ACFM led the way in improving methods and making software accessible to the working groups. Much of the fundamental theory and many of the concepts were already established by 1970, and the advisory expert of 1978—when ACFM was established—would have had little problem understanding the fishery advice of today; nor would the environmental advice present any real problem.

Although the basic concepts were understood, there were major theoretical achievements during that period, perhaps most noticeably the multispecies models and the fish stock VPA models. Another step forward was the introduction of computer-based data analysis packages. Also, data collection technology developed significantly (e.g. trawl control systems, hydroacoustics, and genetic stock identification). On the data collection side, the establishment of standardized abundance surveys, whether hydroacoustics, trawl, or egg/larva surveys, present major achievements (Lassen, 2010).

2.7 Origins and development of ICES fishery advisory process

From the time of the first ICES planning conference in Stockholm in 1899, the aim was to establish a scientific organization that would bring tangible benefits to commercial marine fisheries (Griffith, 2003). ICES began to provide scientific advice to the governments of its member countries during its earliest years, and international management action resulting from this began to appear in 1907. Later, ICES included recommendations to protect whale stocks and undertook to assist and advise the League of Nations on general issues of marine science.

Continuing work by ICES on fishery biology and gear technology in relation to conservation led to regional conventions covering the Baltic (parts of) and the Skagerrak (1928 and 1930, respectively), and the International Convention for the Regulation of the Meshes of Fishing Nets and Size Limits for Fish, which was adopted in London in

1937. The latter never came into effect, however, because the onset of hostilities in 1939 prevented the completion of the ratification procedures, and in 1946, it was replaced by the more comprehensive International Fisheries Convention, also signed in London.

The Permanent Commission established under the terms of the 1946 Convention held its first meeting in 1953, ICES being designated as its source of scientific advice. This was provided by the Liaison Committee, which ICES established in the same year and convened for the first time in 1954.

The Liaison Committee continued to provide scientific advice on behalf of ICES to the North-East Atlantic Fisheries Commission (NEAFC) when NEAFC replaced the 1946 "Permanent" Commission in 1963. In turn, the 1963 NEAFC Convention had to be renegotiated following the widespread extension of national fishery limits to 200 miles in the 1970s; the "new" NEAFC came into effect in 1982 following the ratification of its 1980 Convention. This 1980 Convention established, for the first time, the regulatory capability to set catch limits (total allowable catches, TACs) to limit exploitation rates rather than technical measures alone (e.g. minimum mesh sizes, closed areas). The enabling clause of the Convention (Article 7e), however, was not ratified until 1974; it was implemented the following year, in setting an ICES-recommended TAC for North Sea herring.

During its working lifetime (1954–1977), the Liaison Committee consisted of the chairs of what were deemed to be the most relevant of the ICES science committees – those covering the fields of fish and shellfish biology and, in later years, fishing gear technology and catch statistics. As expertise in the later-developing techniques of fish stock assessment was not widespread among fishery biologists in the late 1950s and early 1960s, three (subsequently four) experts in mathematics and statistics were co-opted to the Liaison Committee, which, in its final year of existence, therefore consisted of 14 people: nine science committee chairs, four co-opted experts, and a chair elected by the ICES Delegates. To ensure demonstrable scientific objectivity, the Liaison Committee was responsible only to ICES, not to any member government or any of the client commissions.

As noted in Section 2.1, following the creation of 200-mile fishery limits in the North Atlantic, ICES member countries insisted on the right to full participation in all stages of the scientific advisory process. As the old Liaison Committee structure could not provide this, ICES replaced it with an Advisory Committee on Fishery Management (ACFM) consisting of one representative from each ICES member country plus the chairs of the three fish committees (Pelagic, Demersal, and Baltic). ACFM met for the first time in 1978; like its predecessor, ACFM continued to be responsible directly to the Council.

Through a diplomatic nicety intended to allay fears that an advisory committee consisting of nationally appointed members might follow national instructions rather than the dictates of scientific objectivity, it was agreed that the members of ACFM

would be nominated by their respective countries, but appointed by the Council. To reinforce that concept, it was also agreed that ICES would pay the Committee members' travel and *per diem* expenses incurred in participating in ACFM meetings.

3 Development (1978–2007)

3.1 Transition and first years

Despite a long history of providing scientific advice on the management of fisheries, it was not until 1976 that formalized scientific principles and objectives for developing such advice were adopted by the Liaison Committee of ICES. These included:

The simple MSY (maximum sustainable yield) concept (e.g. yield associated with F_{max}) does not incorporate all the vital processes particular to fish resources (i.e. stock–recruitment relationships).

A new integrated management objective that establishes the exploitation level at a slightly lower level than F_{max} (i.e. $F_{0.1}$) would avoid some of the inherent risks in a MSY-based strategy and would generate other benefits. This approach should also take into account the exploitation pattern (which should, as far as practicable, be optimized), the spawning stock (which should be maintained within the range that would produce the most desirable level of recruitment), a buffer stock (which implies that the stock size should be maintained at a sufficiently high level so that its recruitment-sourced variation is reduced), and catch per unit of effort (which implies that fishable stock densities should be maintained at high enough levels to ensure harvesting without excessive financial costs).

The application of this new approach would require that, for each stock, there would be a need to:

(i) define an optimal range of spawning–stock size. This should be assessed either on the basis of a stock–recruitment analysis or chosen more arbitrarily on the basis of historical reviews of periods of "normal" recruitment;

(ii) define an agreed minimum fishable biomass level. This may, or may not, differ from the minimum spawning–stock level;

(iii) assess the characteristics of the fishing pattern in relation to an optimized pattern.

A TAC based on yields corresponding to $F_{0.1}$ will often be found to meet the objectives of maintaining the spawning stock at the desired level, if used with a reasonably favourable exploitation pattern. This TAC should then be modified against the objectives for "optimum fishing", i.e. (i) maintain the spawning–stock size within the defined range, and (ii) keep the fishable biomass above the agreed minimum level. Objective (i) must be considered more important than (ii).

A statement concerning the exploitation pattern should be prepared with assessments of the effects of possible improvements for single stocks, or groups of stocks for multispecies fisheries. These assessments should consider not only changes in mesh size and minimum landing size, but possibly also seasonal and area closures. Where applicable, changes in mesh size should be accompanied by an appropriate change in minimum landing size. The assessments should evaluate the effects of changes in exploitation pattern on yield, stock biomass, and spawning–stock biomass.

Where the spawning–stock biomass is substantially lower than the acceptable range, or the fishable biomass lower than the agreed minimum level, a

scheme of rebuilding the stock in annual steps should be designed. Use should be made in such schemes of recruitment variations when strong year classes enter the stock.

The advantages for management in adopting the new approach outlined above will include: (i) reduced fluctuations in TACs from year to year; (ii) increased catch rates; (iii) reduced risks of stock depletion; and (iv) increased reliability of the scientific advice.

These principles remained unchanged when ACFM replaced the Liaison Committee in 1978, but ACFM took things a bit further by adopting a policy of recommending gradual reductions in fishing mortality to address what ACFM identified as the widespread overexploitation of fish stocks. ACFM preferred such an approach in order to avoid what it interpreted as major short-term economic and social hardship to fishing industries. Furthermore, ACFM noted that there would be biological and ecological justifications for this.

In its report for 1981 (ICES, 1982a), ACFM explained:

"Ideally managerial authorities would define their objectives for the different stocks or fisheries and ACFM would thereafter evaluate the consequences of these management strategies and define the biological constraints for the attainment of these objectives. Without clear objectives at hand from managerial bodies, ICES has had to develop certain management objectives which are mainly based on purely biological considerations. These are $F_{0.1}$ and F_{max}, which define a certain level of fishing mortality associated with the optimal use of the growth potential for the existing pattern of exploitation."

In a move towards "exploratory" advice and away from the "normative" advice (Hoydal, 1983) which had characterized ACFM's statements since 1978, the 1981 ACFM report also defined five categories of stocks for the purposes of providing management advice:

1. "Stocks which are depleted and suffering from recruitment failure. In these cases, ACFM shall not calculate options, but shall recommend a single figure.

2. "Stocks which are fished at levels largely in excess of the levels indicated by biological reference points. In these cases, ACFM shall give options inside safe biological limits, and shall recommend one of these options, according to the general principles of aiming at more stable levels.

3. "Stocks which are fished at levels not very different from the biological reference points. In these cases, ACFM shall give options inside safe biological limits, but shall not recommend any particular one of these. It shall only indicate a preference, which is in line with the general principles mentioned above.

4. "Stocks where, at present, it is not possible to carry out any analytical assessment with an acceptable reliability. In these cases, ACFM shall indicate precautionary TACs to reduce the danger of excessive effort being exerted on these stocks.

5. "In cases where fisheries on a stock are not subject to TAC regulation, there may be a danger of catches taken from stocks of the same species in adjacent areas being misreported as having been taken in areas of unregulated fisheries. To reduce the risk of this happening, ACFM, on occasion at the request of management bodies, has advised the implementation of TACs, and their levels on this basis. As in the majority of cases, the data on these stocks are inadequate for analytical assessment, they too will generally be recommended as precautionary TACs based on historical catch levels."

In the following year (1982), ACFM amended its terms for Category 2 stocks (underlined text below), and also recommended that its biological advice should not be considered entirely separately from economic considerations (ICES, 1983a):

"In order to allow more flexibility to the management authorities, the type of recommendation for a Category 2 stock is that fishing mortality should be reduced to one of the biological reference points ($F_{0.1}$ or F_{max}) as quickly as possible, or (in some cases) towards one of these points.

"The ACFM considers that biological advice on fisheries management should not be considered entirely in isolation from economic considerations. Economic analyses would more clearly illustrate optimal management strategies within biological constraints. ACFM would welcome a continuing dialogue with the other parties in the management process, in order to tailor the biological advice to best suit the needs of subsequent stages in the process of achieving viable management. It must be stressed, however, that it will be necessary for management to improve both the quality and the detail of much of the information available to ACFM and the ICES Working Groups, which at present is not adequate to carry out any kind of analytical biological assessment on several stocks and seriously impairs the precision of some of the assessments carried out on others."

3.2 Developments after 1987

The next development came in 1987 when ACFM introduced two additional biological reference points (F_{med} and F_{high}) which were intended to provide guidelines for levels of fishing mortality at which long-term recruitment would probably (in the case of F_{med}) and unlikely (in the case of F_{high}) be sufficient to sustain a stable stock (ICES, 1988a). ACFM stressed that biological reference points were intended to provide guidance for fishery managers, not targets, and that no single reference point can serve as a universal target for management. ACFM advice, the Committee said, takes into account as many relevant factors as possible (e.g. fishing mortality in rela-

tion to biological reference points, spawning–stock size in relation to historic levels, trends and recent levels of recruitment, and the precision of the assessments).

The years 1986 and 1987 saw the further development of the concept of "safe biological limits" by ACFM, when all assessment working groups were asked to "try to define safe biological limits for the stocks which they assess and to indicate whether sufficient data exist on which to base a definition". ACFM adopted the approach taken by the Irish Sea and Bristol Channel Working Group (ICES, 1987b):

> "Biologically safe limits should be based on the historical experience of recruitment, stock size, and fishing mortality for each stock. Precise 'safe limits' cannot be defined but indications of the current stock situation in relation to safe limits can be obtained by addressing the following questions:
>
> 1) "Is there any evidence from the stock/recruit data that recruitment is reduced at the lowest levels of spawning stock which have been observed in the historic series?
>
> 2) "Is the spawning stock currently at a level which is lower than any previously observed?
>
> 3) "Does spawning biomass show a declining trend which, taken with available evidence on recruitment, might indicate that a historically low level will be reached in 1987 [the current year] or 1988 [next year]?
>
> 4) "What level of F in 1988 [next year] would be needed to reduce the spawning-stock biomass to a historically low level in 1989 [the following year] and what would the corresponding catch be in 1988?"

The basis and form of ACFM advice throughout the period 1981–1990 were, generally speaking, accepted without serious reservations by the client commissions of ICES, except for criticisms that the selection of management objectives and the time-scales at which objectives should be reached should be left to the management bodies, not ACFM, and that discussions of socio-economic issues did not properly lie within the responsibilities of ICES (Serchuk and Grainger, 1992).

3.3 1991 and onwards

A new form of advice was adopted by ACFM in autumn 1991, following its two-year review of the bases and criteria that the Committee had been using since 1981. In this new departure, which, it maintained, was "a significant improvement over its previous approach and [would] result in more objective, consistent and credible management advice" (Serchuk and Grainger, 1992), ACFM defined its own objective:

> "to provide the advice necessary to maintain viable fisheries within sustainable ecosystems."
>
> Furthermore –

"responsibility for specifying management objectives was recognised as resting with management bodies, not ACFM;

"ACFM, however, would 'present options as to how management objectives can be reached and [would] clearly describe the implications and consequences of these options, and their associated risks'.

"recommendations would only be made where exploited stocks are outside safe biological limits, which the Committee defined as being below a 'minimum biologically acceptable level' – MBAL – or expected to fall below MBAL in the near future at present rates of exploitation;

"when stocks are exploited within safe biological limits, ACFM would provide options without indicating a preference, but would indicate the biological consequences and risks associated with each option; in this situation, the choice of option would be left to managers;

"for stocks for which an analytical assessment was not yet possible or where the state of exploitation could not be assessed precisely, ACFM would present information on recent landings trends and might be able to advise on likely changes in yield resulting from changes in fishing effort and/or exploitation patterns;

"ACFM would normally identify a number of biological reference points (BRPs, for example levels of fishing mortality on the yield-per-recruit curve, or levels of fishing mortality that effect the sustainability of recruitment), to enable scientists and managers to judge the state of exploitation of the stocks; BRPs, ACFM pointed out, are not the same as management objectives – they simply serve as a guide to aid managers in choosing from the range of available options."

3.4 Multispecies considerations and fishery systems

As pointed out by Serchuk and Grainger (1992), the need to provide multispecies advice has been long recognized by ICES, and when formulating advice, ACFM has always tried hard to take account of technical and biological interactions among fisheries and fish stocks to the greatest extent possible within the constraints of available scientific knowledge.

Recognizing the need to move towards the provision of advice on integrated fisheries systems, rather than just on single stocks or single fisheries, ACFM, in 1988, had initiated a restructuring towards area-based assessment working groups. A Long-Term Management Measures Working Group was established in 1993, and multispecies tasks were added to the terms of reference for several other working groups. Meanwhile, managers were urged – yet again – to meet the challenging task of developing "objectives for the management of fisheries systems so that any scientific scenario analyses performed within a multispecies/mixed species framework will be relevant", a subject which received attention during the Eighth Dialogue Meeting in 1991 (ICES, 1993).

By 1992, predation mortalities derived from assessments based on multispecies VPAs were already being used routinely for several fish stocks, whereas for others such as Barents Sea capelin and Northeast Arctic cod, predator–prey relationships were also being taken into account.

3.5 Broadening the dialogue in Dialogue Meetings

Perhaps the most telling legacy of the Dialogue Meetings, which were initiated in 1980 following an initiative from assessment scientists, but accompanied by some apparent uncertainty on the part of "official" ICES, has been the broadening of the dialogue to the point where stakeholders were invited to be observers at meetings of ACFM from 2004. Management observers had already been taking part in ACFM meetings from 1987 in the case of the European Commission, followed in 1988 by representatives of the Faroe Islands and Greenland Home Governments.

Simultaneously, fishers were invited to provide information that might help assessment working groups and ACFM carry out their work. It was not always possible to incorporate such information in the formal stock assessments and advice, but it was a development that boosted the knowledge of fishery scientists and earned significant goodwill.

4 Quality of ACFM advice — search for technical perfection

4.1 1978–1991: making full use of VPA and effort data, safe biological limits, and development of reference points

From the start of ACFM in 1978 and as the management of fishery resources tightened within national administrations, the need to get the TAC advice correct was fully realized by the scientific community. It became "abundantly clear that virtual population analysis itself contains no information whatever on fishing mortalities in the most recent years" (Pope and Shepherd, 1985). In that paper, the authors summarized the period 1978–1985 as follows:

> "Substantial efforts have been made recently to make better use of effort data for the determination of fishing mortality in recent years. This is sometimes referred to as 'tuning VPAs', since the data are often used for that purpose, and it is now abundantly clear that virtual population analysis itself contains no information whatever on fishing mortality rates in the most recent year (Pope and Shepherd, 1982). A discussion of the problems and an account of various methods are given in the report of the ICES *ad hoc* Working Group on the Use of Effort Data in Assessments (ICES, 198lc).
>
> "Since then, one of the methods discussed (the Gamma method) has been applied in practice by the ICES North Sea Roundfish Working Group (ICES, 1981e) and found wanting (ICES, 1981a). Various *ad hoc* methods have also been used, notably that proposed by Saville (1981a), and a modification due to Hoydal and Jones (ICES, 1981c). The relationship between these, and the conditions under which they should be valid, have been elucidated by Laurec and Shepherd (1983). Finally, the North Sea Roundfish Working Group made use of the Rho method in 1982, which allows for changing catchability, and attempts to make use of methods based on partial exploited biomass have encountered some difficulties (R. G. Houghton, personal communication)."

In July 1988, a Workshop on Methods of Fish Stock Assessment was held in Reykjavík (ICES, 1988b) to test and compare VPA tuning methods. Out of that comparison, the XSA (extended survivors analysis) was recommended as a preferred method.

The North Sea Roundfish Working Group (responsible for North Sea demersal fisheries) tried hard to make use of effort data, including a heroic attempt to create a database of total effort and catch by species by fleet segments by statistical rectangle for 1989 . That work was never standardized, and the basis for continuing disappeared.

At two meetings in 1989 and 1991, ACFM concluded that the main problem was data, especially effort data. The compilation of effort data consistent with FAO standards (STATLANT 27B) became very incomplete in the late 1970s and was abandoned. Methods were benchmarked at the meeting, but interest in discussing improvements in assessment methods slowly dwindled, and interest turned towards the precautionary approach (H. Lassen, pers. comm.).

Multispecies considerations escalated after publication of the Andersen and Ursin (1977) model and were addressed initially by large sampling programmes of stomach contents in 1981 and 1991.

Technical interaction had also been taken up by several working groups. However, the advances in the two important aspects, the impact of other species on fish stocks, and the impact of various and diverse fishing fleets on stocks, did not enter into practical advice to any significant extent. Single-species assessments and advice, which did not take account of any externalities, persisted in the ACFM advice during all the years it was in existence. Nevertheless, ACFM increasingly tried to make its advice more consistent among stocks exploited in mixed-species fisheries. A striking example of this was in 1989 when ACFM, in its report for North Sea roundfish, described the problems of regulating fishing mortality in mixed fisheries through the application of TACs, and for the first time, recommended that fishing mortality should be reduced by the same amount (–20%) for cod, haddock, and whiting. (The problem of controlling fishing mortality through TACs is discussed further in Chapter 7.)

In 1987, ACFM introduced the additional biological reference points F_{med} and F_{high} into its advice and noted that they were intended to provide guidelines for levels of fishing mortality at which it is probable (in the case of F_{med}) and doubtful (in the case of F_{high}) that recruitment will, in the long term, be sufficient to sustain a stable stock. It was furthermore noted (ICES, 1988a) that:

> "ACFM found F_{med} in particular to be a useful quantity in providing guidance in preparing management options, and reference to it will be found in this report where appropriate. ACFM also stresses that biological reference points are intended to provide guidance concerning management options, and that no single reference point can possibly serve as a universal target for management. ACFM advice is, however, based on the evaluation of as many relevant factors as possible, including levels of F in relation to biological reference points, spawning stock size in relation to historic levels, trends and recent levels of recruitment, and the precision of the assessments. Different factors dominate in different situations."

The issue of "safe biological limits" was addressed by ACFM in both 1986 and 1987. ACFM requested that all ICES assessment working groups "try to define safe biological limits for the stocks which they assess and to indicate whether sufficient data exist on which to base a definition". Although working group responses varied, "target" or "minimum acceptable" spawning stock levels were identified for many stocks. ACFM informally adopted the approach taken by the Irish Sea and Bristol Channel Working Group in addressing "safe biological limits" (ICES, 1987b):

> "Biologically safe limits should be based on the historical experience of recruitment, stock size, and fishing mortality for each stock. Precise 'safe limits' cannot be defined but indications of the current stock situation in relation to safe limits can be obtained by addressing the following questions:

1) "Is there any evidence from the stock/recruit data that recruitment is reduced at the lowest levels of spawning stock which have been observed in the historic series?

2) "Is the spawning stock currently at a level which is lower than any previously observed?

3) "Does spawning biomass show a declining trend which, taken with available evidence on recruitment, might indicate that a historically low level will be reached in 1987 [the current year] or 1988 [next year]?

4) "What level of F in 1988 [next year] would be needed to reduce the spawning-stock biomass to a historically low level in 1989 [the following year] and what would the corresponding catch be in 1988?"

In general, the basis and form of advice used by ACFM during the years 1981–1990 was accepted without major reservation by the various fishery commissions requesting information and scientific guidance from ICES. On more than one occasion, however, ACFM was criticized for assuming responsibilities for the selection of management objectives and for the time-scales (rates) at which objectives should be reached (Serchuk and Grainger, 1992). Such responsibilities were deemed more appropriate (or solely appropriate) to management bodies. Also, dissatisfaction was expressed that the ACFM advice had occasionally made reference to socio-economic considerations, which were felt to be outside the purview of ACFM. At various times too, ACFM was also criticized for not providing sufficient detail or justification for its recommendations (Serchuk and Grainger, 1992).

In the late 1980s, ACFM made strenuous efforts to try to standardize assessment methodology as much as possible and to have working groups monitor the quality and consistency of their assessments and forecasts. Written instructions were provided to all assessment working groups on recommended procedures, and working groups were required to complete quality control tables that showed the degree of consistency of assessments and forecasts in successive years, as indicated by estimated fishing mortality, biomass, and recruitment for the same years. Those tables often were a damning indictment of the reliability of forecasts (an issue explored further in Section 7.4), not to mention also demoralizing for the working group participants!

4.2 Advice 1988–2002

During this period, ACFM launched new efforts to improve its own efficiency and that of the various working groups responsible for performing the annual scientific analysis of stock status. For example, the following two-page stock assessment review checklist was developed and initially presented at the November 1988 ACFM meeting to standardize input from working groups:

STOCK ASSESSMENT REVIEW CHECKLIST

Stock _____

Source of information: _____

	OK	Problems	Specify
1. Basic Data			
1.1 All landings			
1.2 Complete effort data			
1.3 Complete CPUE data			
1.4 Adequate age composition data			
1.5 Adequate length distribution data			
1.6 Adequate weight-at-age data			
1.7 Consistency in weight/length at age			
2. Tuning or other estimation of F			
2.1 Tuning diagnostics			
2.2 Assumptions of methods used met by data			
2.3 Separable VPA (age and year range, residuals)			
2.4 Exploitation pattern			
3. VPA			
3.1 F at age, average F (Quality control diagram)			
3.2 SSB (Quality control diagram)			
3.3 Perception of F and stock dynamics relative to previous assessment			
4. Recruitment			
4.1 Data for recruitment estimation			
4.2 Methods for recruitment estimation			
4.3 Perception of trend in R			
5. Y/R			
5.1 Exploitation pattern			
5.2 Growth pattern			

	OK	Problems	Specify
6. Forecast			
6.1 Consistency of weight at age			
6.2 Exploitation pattern			
6.3 Assumption on catch for current year			
6.4 Recruitment			
6.5 Consistency with history of stock and exploitation			
7. Reference points			
7.1 Perception of exploitation with respect to reference points relative to previous assessment			
8. Miscellaneous			
8.1 Other information on recent changes in fishery and consistency with assessment			
9. Advice/recommendation			
9.1 Options range			
9.2 Present TAC versus previous			
9.3 Efficiency of previous TACs			
9.4 Justification for change of TAC			
9.5 Consistency with other stocks of same species or in same area			
10. Need for special comments on:			

Overall evaluation: Accepted Rejected

Assessment should be .....

Justification for rejection:

In 1991, ACFM issued the following proposal for the re-arrangement of the ICES assessment working groups (ICES, 1991a):

"During the last year, a discussion has been initiated within ACFM about possibilities to improve the efficiency of the system that ultimately results in the provision of management advice. The basis for consistent advice is clearly formed by the assessment carried out by the permanent Assessment Working Groups. These have evolved over the years as more requests for advice arrived at ICES and the terms of reference were often expanded on a rather *ad hoc* basis. A summary of some Working Group statistics is given in Table 1 [not provided here].

"Although the machinery has worked to great satisfaction, a closer look at the present set-up revealed that there may be scope for further improvements by changing the traditional species-oriented system to an area-oriented system of Assessment Working Groups. This would allow Working Groups to take multispecies effects into account, both in respect to biological and technical interactions. The consequences of a re-arrangement of the Working Groups were discussed during the ACFM Theme Session at the 1990 ICES Statutory Meeting, and the general response to area-oriented Working Groups was favourable. At the same time, there is a growing demand within ICES to reduce the number of Study Groups and Working Groups, because of ICES and national expenses related to the meetings of these Groups. A possible reduction of Assessment Working Groups might therefore be taken into account, when trying to streamline the system.

"However, changing a system that has worked to great satisfaction should not be done lightly, because there are a large number of logistical factors which ultimately determine whether a Working Group can finish its tasks within a reasonable time span. In order to allow for feedback from the Working Groups to any proposals made by ACFM, a recommendation has been passed by ACFM (and adopted by the Council; C. Res. 1990/2:5:31) to invite Chairmen of Assessment Working Groups or their designees to participate in the ACFM Consultations at the 1991 Statutory Meeting to discuss possible rearrangement of Assessment Working Groups. In order to facilitate this dialogue, ACFM has proposed various changes in the responsibilities of individual Working Groups with respect to stock responsibilities and terms of reference.

"In drawing up the proposal, the following starting points have been taken into account:

"For species which are largely exploited by directed fisheries (e.g. herring, salmon) or are assessed by different methods because of their biology (e.g. *Pandalus* and *Nephrops*) species-oriented Working Groups seem appropriate, at least for the time being;

"An area-oriented Working Group is particularly appropriate for demersal stocks which are generally caught in mixed fisheries, because management measures for a single stock cannot effectively be evaluated in isolation. In

addition, stocks showing strong biological interactions should preferably be assessed by the same Working Group if at all possible;"

During this period, ACFM's goals and objectives, workload issues, future directions, and longevity formula were discussed, stated, or referenced in various reports and meeting minutes. They were synthesized and summarized (see Annex 2) by Fredric Serchuk in his presentation entitled "The ICES Advisory Committee on Fishery Management (ACFM), 1978–2000: a quarter century agrowing" given at the 2000 ICES symposium on "100 Years of Science under ICES" (Anderson, 2002).

5 Introducing the precautionary approach

Much energy was invested in the late 1999s and early 2000s in introducing the precautionary approach (PA). The discussions started in FAO's Committee on Fisheries (COFI).

Based on the legal texts in the FAO Code of Conduct of Responsible Fisheries and in Annex II of the UN Agreement on Straddling and Highly Migratory Fish Stocks drafted by the Technical Consultation on the Precautionary Approach to Capture Fisheries (Including Species Introductions) organized by the Government of Sweden in cooperation with FAO which met in the Fisheries Laboratory, Lysekil, Sweden, 6–13 June 1995, FAO took a significant step towards making the PA operational. ICES formulated guidelines on how to provide advice for fish stocks in reports of the Study Group on Precautionary Approach to Fisheries Management (ICES, 1997, 1998). The result is found in the Introduction section of the 1999 ACFM Report (ICES, 2000b).

This framework was based on a set of limit and PA points for spawning–stock biomass (B_{pa} and B_{lim}) and fishing mortality (F_{pa} and F_{lim}). By May 2000, ACFM had defined PA points for 63 stocks or about half of the stocks addressed in the ACFM report, and the advice was based on a PA. The result for non-depleted stocks, for which the advice previously was based on a *status quo* fishing mortality, was that the new reference points overall suggested a TAC of about 80% of the *status quo* fishery. While ICES managed to develop PA reference points for many stocks, there was no prescriptive advice for fish stocks that lacked reference point estimates for the precautionary framework.

This result came as a surprise to fishery managers, and there was strong criticism of ICES that, without proper discussions, they had introduced this new principle (ICES, 1999). Obviously, the process within management was behind the science process. As a manager put it at the 1999 Dialogue Meeting "We are committed to a precautionary approach, but not necessarily to the ICES interpretation". ICES was heavily criticized for "springing the PA on management", which, within the ICES community, was felt to be unfair. The process had taken about three years from the adoption of the precautionary approach in the Straddling Fish Stocks and Highly Migratory Fish Stocks Agreement in 1995 until the release of the advice in 1998. The ICES science community, as part of the larger marine science community, considered that Rio de Janeiro (the Biodiversity Convention of 1992) and Cancun (the Fish Stocks Agreement 1995) had established a societal expectation on a precautionary approach of the nature that ICES developed. Further, it was a widely held conviction that the science community had a political mandate to advance as fast as possible; "society expects the implementation of a precautionary approach". Finally, many centrally placed scientists held discussions with industry and management on an informal basis and believed that the ICES process was also well known outside scientific circles (Hoydal and Lassen, 2008).

At a meeting of the Study Group on Management Strategies (SGMAS) in 2007 (ICES, 2007), it was accepted that the precautionary approach had led to more normative advice. The pendulum had swung back again.

6 Internal points of view

This chapter contains statements and comments on the challenges and problems facing ACFM during the tenures of the 11 ACFM Chairs (Table 6.1) and the Secretariat staff members who served as ACFM Secretaries (Table 6.2).

Table 6.1. Terms of the ACFM Chairs and their respective Member Country and affiliation.

Chair	Term	Member country	Affiliation
Alan Saville	1978–1980	UK	Marine Laboratory, Aberdeen
Kjartan Hoydal	1981–1982	Denmark	Faroese Fisheries Research Laboratory, Torshavn, Faroe Islands
David de G. Griffith	1982–1984	Ireland	Fisheries Research Centre, Abbotstown
Øyvind Ulltang	1984–1987	Norway	Institute of Marine Research, Bergen
Bernhard Vaske	1987–1990	German Democratic Republic	Institute for Sea Fishing and Fish Processing, Rostock
Fredric M. Serchuk	1990–1993	USA	Northeast Fisheries Science Center, Woods Hole
Eskild Kirkegaard	1993–1996	Denmark	Danish Institute for Fisheries and Marine Research, Charlottenlund
Jean-Jacques Maguire	1996–1999	Canada	Independent fisheries consultant, Québec
Tore Jakobsen	2000–2003	Norway	Institute of Marine Research, Bergen
Poul Degnbol	2004–2005	Denmark	Institute for Fisheries Management and Coastal Community Development, Hirtshals
Martin Pastoors	2006–2007	The Netherlands	Netherlands Institute for Fisheries Research, IJmuiden

Table 6.2. ICES Secretariat professional officers who served as ACFM Secretaries, as well as their home country and prior affiliation.

Secretary	Term	Home country	Prior affiliation
Vadim Nikolaev	1978–1981	USSR	Ministry of Fisheries, Moscow
Kjartan Hoydal	1982–1985	Denmark	Faroese Fisheries Research Laboratory, Torshavn, Faroe Islands
Emory D. Anderson	1985–1989	USA	Northeast Fisheries Science Center, Woods Hole
Richard J. R. Grainger	1989–1992	Ireland	Fisheries Research Centre, Abbotstown
Roger S. Bailey	1992–1997	UK	Marine Laboratory, Aberdeen
Henrik Sparholt	1992–2007	Denmark	Danish Institute for Fisheries and Marine Research, Charlottenlund
Hans Lassen	1999–2007	Denmark	Danish Institute for Fisheries and Marine Research, Charlottenlund
Mette Bertelsen	2003–2007	Denmark	Danish Institute for Fisheries and Marine Research, Charlottenlund
Barbara Schoute	2007	The Netherlands	Ministry of Agriculture, Nature and Food Quality, The Hague

6.1 Alan Saville (1978–1980)

The following text is a statement (with some slight editing) by Saville (1981b) at the May 1980 Dialogue Meeting.

6.1.1 Introduction

It is clear that, from the outset, the major objective of the founding members in setting up ICES was to provide a body that could coordinate international research programmes on marine fish and supply advice on their management. At the first formal conference in Stockholm in 1899 to discuss setting up such an international organization, this aim is clearly stated in the report where it is said:

> ".....it be recognized as a primary object to estimate the quantity of fish available for the use of man, to record the variations in its amount from place to place and from time to time, to ascribe natural variations to their natural causes, and to determine whether or how far variations in the available stock are caused by the operations of man, and, if so whether, when or how, measures of restrictions and protection should be applied".

Although many things may have changed in the intervening period, most particularly in the geographic range of ICES activities and in our greater understanding of the complexity of the systems these early workers were proposing to investigate, one suspects that, as a brief lucid description of ICES objectives, this statement could not be bettered today.

Of course, over the period of almost 80 years since ICES was first founded, its procedures and machinery for providing advice on fishery management have undergone a good deal of change, partly at the Council's own volition, in an attempt to cope more efficiently with the demands being made on it, and partly to meet changing circumstances in the regulation of fisheries, which were external both to the Council and to the science with which it was involved. But ICES aim, and one would hope that you, as recipient of this advice, would agree, has been achieved with considerable success, and has always been to supply the most objective scientific advice possible, founded only on considerations of the optimal utilization of the seas' living resources. This is not the place to trace the history of ICES procedures in supplying advice to bodies concerned with fishery management. It should be pointed out, however, that events in the past decade, most particularly the extension of national fisheries jurisdiction and the resulting changes in the powers of regional fishery commissions, combined with major changes in the intensity of fishing on an ever-widening range of stocks, have resulted in a major growth in demands for advice on fish stock management and greater complexity in the channels from which these demands come, and to which the final product must be fed back. If, as we would hope, you would agree that ICES has coped with this major increase in the workload with some success, it might be salutary to consider how this has been achieved, with little if any increase in the resources available. I might suggest that, to a very large extent, it has been done by

concentrating an ever-increasing proportion of the available resources on solving, or attempting to solve, short-term problems, at the expense of the more fundamental work of really understanding the systems we are dealing with. If I am right in this, then the longer-term prospects for more rational management of fishery resources do not look very attractive.

6.1.2 ICES structures and procedures for providing advice on fish stock management

Before considering the ICES machinery for producing advice on management, it might be appropriate to consider where the impetus comes from to provide advice at all. ICES was recognized as the source of scientific advice on fish stock management problems by the Permanent Commission of the 1946 International Fisheries Convention, and its successor, the North-East Atlantic Fisheries Commission, from their inception. The Council was given a similar role by the International Baltic Sea Fishery Commission. Most of the requests for advice on specific problems have, therefore, in the past, emanated from those bodies. In recent years, with the reduction of the role of NEAFC in fishery management in the Northeast Atlantic, and the greater responsibilities of coastal states, or groups of coastal states, there has been a greater incidence of requests for advice directly from member countries of ICES, or from a body representing their interests in fisheries. This has worked reasonably well, but could lead to inefficiency and some conflict, without the opportunity, which NEAFC formerly provided, for an open debate between all interested parties on what advice was required and the exact formulation of the requests for it. In addition, ICES has always availed itself of the opportunity to provide advice gratuitously where this has seemed necessary in the interests of stock and fishery conservation. Scientific papers presented at the Council's Statutory Meetings, for example, sometimes draw attention to undesirable developments in a stock, or in the fishery on it, which make it expedient for ICES to investigate the matter further and to provide advice on remedial action without awaiting a formal request to do so from a commission or a member government. In practice, with the advent of a total allowable catch system as the main method of controlling the rate of exploitation, many of the requests for advice have become of a somewhat routine nature. Once one embarks on a TAC regime, specification of the total allowable catch for the ensuing year becomes a continuing requirement, at least until some better method of controlling exploitation is devised and accepted by the management bodies concerned.

The keystone of the ICES system for providing advice on fish stock management is its Advisory Committee on Fishery Management. This Committee was set up in 1977 as a replacement for the Liaison Committee, which had been established by the Council in 1953 to provide advice to the Permanent Commission. The major difference in constitution between the Liaison Committee and ACFM is that, whereas the former was composed of members who owed their position on it to being chairmen of relevant standing committees of the Council, plus a small number of members co-opted because of their special expertise, ACFM consists of one member nominated by each member country, the chairmen of the standing fish committees, plus a chair appoint-

ed by the Council. This change in membership was made as a response to the changed conditions for fishery management arising from the extension of fisheries jurisdiction of coastal states, and the resulting desire of those states to be more directly involved in the formulation of the advice provided. In an attempt to maintain the objectivity of the scientific advice provided, the Council appoints members on the receipt of national nominations, and the Rules of Procedure make it quite clear that the Committee is acting on behalf of ICES in providing its advice; but in practice, these distinctions are perhaps rather fine ones.

In the Rules of Procedure of the Council, the role of ACFM is defined as: " ---- shall be responsible for giving, on behalf of the Council, scientific information and advice to Fisheries Commissions and to the Council's Member Governments – or groups of Governments – on such matters on which they may request advice, or on such matters as the Council or the Committee may consider relevant".

ACFM, therefore, like the Liaison Committee before it, has been granted a great deal of authority by the Council in matters of giving advice, in that the advice does not need to be first approved by the Council before transmission to the relevant management bodies.

In practice, of course, it simply is not practicable for ACFM itself to carry out all of the wide range of assessments required annually to provide the basis of the advice provided. It therefore meets during each Statutory Meeting of the Council, considers what advice will be required in the following year, and recommends that working groups should meet at specified times to carry out the necessary assessments. The times of these meetings and the terms of reference of the working groups, as defined by ACFM, are then confirmed by the Council before the end of the Statutory Meeting. In exceptional circumstances, additional meetings of working groups can be arranged by the General Secretary with the agreement of the President, but this procedure is not advisable, except in circumstances of great urgency.

Meetings of assessment working groups are, therefore, set up by a resolution of the Council based on recommendations by ACFM, and their purpose is solely to carry out the specified assessments as a first step in formulating the advice to be provided by ACFM. Working groups are not empowered to provide advice on behalf of ICES, and their reports cannot be taken as necessarily being indicative of what that advice is likely to be. ACFM can, and frequently has, modified the assessments carried out by its working groups, or come to rather different conclusions based on those assessments. When a new working group is set up, the General Secretary invites all member governments to nominate members to it. There are no restrictions on the number of members which can be nominated by each country, and they can change their nominated members at will. Moreover, all working group members are solely national representatives. Under the new timetable for the provision of advice, agreed with the fishery commissions and other management bodies, ACFM now meets in the first fortnight of July to consider working group reports, formulate its advice, and write its report. To allow adequate time for working group reports to be finalized,

typed, printed, and circulated to ACFM members in advance of this meeting, working group meetings have to be completed by about mid-May. As the majority of working groups cannot carry out their assessments without the catch statistics for the preceding year and the results of biological sampling of catches taken in that year, the annual round of working group meetings cannot normally start before March. There are currently 23 assessment working groups, so, although all of them may not meet every year, fitting them into a period of 10–11 weeks leaves very little room for manoeuvre and places the Council's Secretariat under considerable pressure during the first six months of each year in servicing them and doing other preparatory work necessary for the main ACFM meeting. I feel it may be important to point out the logistic problems involved in providing the range of advice ICES currently has to provide, as it would seem that there has been some criticism that the ICES system is not sufficiently flexible in providing advice quickly in situations of urgency. It might also be considered fair comment that requests for urgent advice would be less frequent if management bodies accepted advice more fully and implemented it more quickly once it was received, and above all, accepted the fact that, at the current levels of exploitation, any relatively small underestimation of the TAC in the current year will be recouped, with interest, in the following year(s).

6.1.3 Principles governing advice on management

So much for the machinery and procedures underlying the provision of advice; but like any machinery, however good, a much more important factor governing the output is how it is used by the operators. In the previous contribution, Basil Parrish has spoken about the scientific basis for fish stock management, on which, of course, ICES advice must be based.

In broad terms, the objectives of scientific resource management are correcting:

the exploitation pattern;
the exploitation rate to optimize the yield-per-recruit; and
ensuring that these do not result in a fishery-induced decline in the recruitment level.

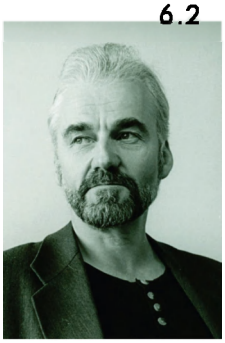
It will be appreciated, however, that within these broad general principles, there is, given the constraint placed on action by the established operational practices of the fisheries and the fact that conflicts can and frequently do arise between the requirements for optimizing yields from individual interacting components of them, a great deal of room for manoeuvre in the policy adopted in formulating management advice. It would also seem highly desirable that ICES adopts, as far as possible, a consistent management policy between stocks, and a consistent long-term policy in achieving its ultimate goal, when to do so immediately would result in major disruption and hardship for the established structure and infrastructure of a fishery. It was largely through an appreciation of these factors that ICES, in 1976, set up an *ad hoc* group to define more clearly the Council's long-term aims in fishery resource management, and how these should be achieved. The report produced by this group has been circulated to you, as Cooperative Research Report No. 62 (ICES, 1977), and I would advise any

of you who have not already done so, to read it, as it is a valuable document which still forms the basis for ICES advice on resource management. In particular, I would recommend that you look carefully at pages 3–6, which deal with the concept of the maximum sustainable yield as an objective of fishery management and explain why, in its usually implemented form of fishing at F_{max}, one can be pursuing a "will of the wisp". As a more acceptable objective, this report advocates fishing at $F_{0.1}$ with a more optimal exploitation pattern and with an overriding concern for what such a policy will do, in the short term, to the size of the spawning stock. At present, for the vast majority of stocks, we are so far from $F_{0.1}$, or from an optimal exploitation pattern, however, that to attempt to reach these goals in one step would result in major short-term disruption and considerable hardship in the fishing industries. ACFM has, accordingly, since 1977, adopted for these stocks a policy of a gradual reduction in the fishing mortality rate by about 10% per year, and a gradual attempt to achieve an improvement in the exploitation pattern. It is a great pity that management bodies have shown such reluctance to accept advice aimed at achieving the latter, because for the majority of stocks, it is likely to achieve the greatest gains, both in yield and in increasing the parent stock.

Quite apart from the disruption which would arise from an immediate acceptance of $F_{0.1}$ as the management objective, ACFM also considers that, in biological terms, it would be advisable to approach this goal cautiously. This is because sustained fishing at this level would, for the majority of stocks, result in a major increase in stock biomass, to a level above that for which we have any sound information on the effects on growth rate, natural mortality rate, and recruitment level. Moreover, the effects of reducing the fishing mortality rates to this level are assessed on a single-species basis—that is, the assessments assume that there is no interaction resulting from an increase in stock size of one species on other species living in the same area. Inherently, it seems highly unlikely that this is true, and in recent years, ICES member countries have been devoting more time to considering this problem. As a result, there are now a number of reasonably satisfactory models available that can cope with assessments that take account of species interactions. But the output from a model is only as good as the parameters one puts into it, and the real deficiency, at this point in time, is the inadequacy of our knowledge of what eats what, in quantitative terms, and under a range of population sizes of both prey and predator. ICES has now taken steps to collect the data required for what are likely to be the most important predator species. But at this point in time, in most areas, predator/prey relationships are too inadequately known to allow them to be incorporated into management advice with any confidence. It should also be appreciated that advice based on interactive assessments is likely to be of the form: "if you adopt this management policy, you can take more cod, but the resulting yield of sprat and herring will be less". Advice of this nature is going to place a greater onus on management bodies, and is likely to result in even greater problems in reaching consensus views on what action should be taken. With a strong possibility that such assessments will be in operation fairly soon, it might be advisable for those involved in implementing management advice to be considering how they can react to it in this form.

For the moment, however, because of the doubts outlined above about the realism of the single-species assessments, when one extrapolates them to stock sizes considerably larger than we have experience of, my own feeling, and not necessarily that of ACFM as a whole, is that one ought to gradually reduce the rate of fishing mortality on heavily exploited stocks to a more acceptable level, perhaps half way between the current level and F_{max}, and then hold it there for a few years until one has a chance to monitor the effects of the increased stock size on its own vital parameters, and on associated stocks, rather than aim progressively at attaining $F_{0.1}$. Such a policy would inevitably be a rather long-term one in attaining the ultimate objective, if this proved to be a realistic one; but would reduce, to a large extent, the danger of rushing into a largely uncharted area, and provide more time for the industry to adapt to the changed circumstances of its operations. There is one other aspect of policy on which it might be appropriate to comment at this meeting. The view has been expressed, with some frequency in recent years, that it is not the role of ICES to make firm recommendations on management action, but that it should give a wide range of options and spell out the likely effects of each of them. In part, the latter has been done in recent years, where there seemed to be realistic options available. In the ACFM report, which will be produced later this year, it is intended to carry this a stage further by giving predicted catches for 1981 over a wide range of fishing mortality rates, and with the resulting effects on spawning–stock biomass. However, it is my opinion that ACFM should continue to recommend the option which it considers most likely to safeguard the stock, provide greater stability in the long-term yield, and give a realistic approach to eventually optimizing the long-term yield. It is not incumbent on any management body to accept ICES recommendations, and they have done so all too infrequently in the past. The Council has, however, a responsibility to make its views known on what management action is required in the best long-term interests of the stocks and the fisheries which depend on these stocks, and is perhaps the only body in the Northeast Atlantic which can take an objective long-term view of this topic.

6.2 Kjartan Hoydal (1981–1982)



In 1981, ACFM debated its role and place in the system of providing advice on management of the fish stocks in the ICES Area. It had to find its way in the new system of customers introduced by the extension of fisheries zones in 1977, and the changed and still uncertain role of the regional fishery commissions.

ACFM had, since its inception in 1978, taken on a normative role. ACFM passed decisions on what should be taken for a fish stock in a given year to reach a certain level of fishing mortality. This advice was often a percentage reduction towards a level considered desirable for biological reasons. The two first Dialogue Meetings in 1980 (ICES, 1981b) had not made clear what the customers really wanted, and opinion was divided among scientists and among customers. Some customers felt that the scientific advice should not be a point of dispute, and a sizeable fraction of ACFM shared that perspective.

The reasons for going from normative to exploratory advice were rather compelling. It was realized that management could not be based only on biological considerations. Socio-economics as a subject was as legitimate as stock dynamics. It was further realized that the quality of many of the stock assessments did not allow a precise relationship to be established between TACs and fishing mortality levels in the year of advice. The advice could not, in many cases, be given with the precision implied by a single figure.

Figure 6.1. Palægade 2–4, home of the ICES Secretariat from 1980 to 2004, was the venue for ACFM meetings from 1980 through May/June 2004.

There was a third—rather sinister—consequence of the normative role. The scientists, for all practical purposes, took on the role of decision-makers, relieving administrative and political levels of the responsibility of managing the stocks on a wider basis. Moving into the political sphere made scientists from different countries accountable for advising on quotas with sometimes harsh consequences for their home fisheries. This presented a real danger of bringing a political element into the discussions of ACFM on advice and of the working groups on the assessments.

The answer to these problems was to categorize stocks and allow exploratory advice—advice with options—for some categories. Only in some stocks, those depleted or suffering from recruitment failure and those where an analytical assessment was not possible, did ACFM retain the normative role. The basis of advice from 1981 was:

1. Stocks that are depleted and suffering from recruitment failure. In such cases, ACFM shall not calculate options, but shall recommend a single figure.

2. Stocks fished at levels largely in excess of the levels indicated by biological reference points. In those cases, ACFM shall give options inside safe

biological limits, and shall recommend one of these options, according to the general principles of aiming at more stable levels.

3. Stocks fished at levels not very different from the biological reference points. In those cases, ACFM shall give options inside safe biological limits, but shall not recommend any particular one of these. It should, however, follow the general principles mentioned above.

4. Stocks where at present it is not possible to carry out any analytical assessment with an acceptable reliability. In such cases, ACFM shall indicate precautionary TACs to reduce the danger of excessive effort being exerted on these stocks.

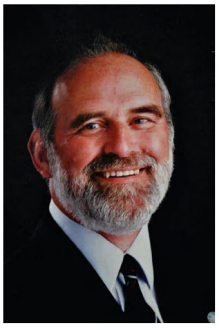
5. In cases where fisheries on a stock are not subject to TAC regulation, there may be a danger of catches taken from stocks of the same species in adjacent areas being misreported as having been taken in areas of unregulated fisheries. To reduce the risk of this happening, ACFM, on occasion at the request of management bodies, has advised the implementation of TACs and their levels on this basis. As in the majority of cases the data on these stocks are inadequate for analytical assessment, they too will generally be recommended as precautionary TACs based on historical catch levels.

The basic rationale of the exploratory advice was the recognition of the fact that management objectives were lacking for most fish stocks where ACFM rendered advice, and that the scientists should not decide on objectives.

In 1981, ACFM clearly realized that many of the assessment working groups in ICES had problems. Some such groups had little capacity or time to take a closer look at the methods used in the assessments. The statistical treatment of data suffered from a lack of adequate access to computer programs, and the standard assessment methods introduced in the 1970s were not up to the job in the 1980s. This led to the establishment of a Working Group on Methods of Fish Stock Assessment, which became the focus of the improvements in assessment methods in the following years.

These changes were discussed with customers at two Dialogue Meetings in 1981 (ICES, 1982b) and 1982 (ICES, 1983b) and seemed to be well received.

6.3 David de G. Griffith (1982–1984)



At the Fourth Dialogue Meeting held 8 October 1982 at ICES Headquarters in Copenhagen (ICES, 1983b), the Acting ACFM Chair, David de G. Griffith, gave a presentation (Griffith, 1983) that focused mainly on the deterioration in the reporting of data, which had become worse during the previous year. The comments below are derived from that presentation.

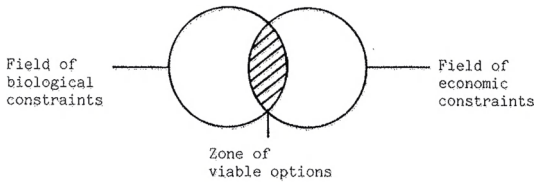
Five main issues compromised the precision of ICES assess-

ments, the first two being regarded as particularly serious:

> Poor monitoring and reporting of North Sea herring landings. This was so bad that "no meaningful assessment" could be made unless drastic improvements were implemented. In ACFM's words, "a continuation of the under- or non-reporting of catches taken in directed herring fisheries, and the apparent lack of will and/or capability of monitoring the catch composition in the industrial fisheries, reduces any attempt to make an assessment of the appropriate yield to be taken from the herring stocks to a theoretical exercise of little or no practical interest".
>
> Failure of reporting countries to allocate (to fishing area) large tonnages of mackerel landings (more than 22% of the total mackerel landings from the Western area were unallocated). Furthermore, ACFM feared that the 140 000 t gap between the officially reported landings (476 000 t) and the quantity derived from evidence available to the Mackerel Working Group (616 000 t) could be a "serious underestimate" of the real discrepancy.
>
> Inadequate coverage by surveys of young-fish abundance. These shortcomings were making it extremely difficult to forecast recruitment with any degree of precision, and continued to compromise the confidence with which ACFM could make predictions of stock biomass and catches. The importance of extending existing young-fish surveys, and initiating new ones, was emphasized.
>
> Lack of catch-at-age data from countries which took a large proportion of the total catch, thus "making a proper assessment difficult or impossible".
>
> Uncertainties concerning stock unity, especially mackerel in the Western area, North Sea sprat, and Celtic Sea demersal species.

The Acting ACFM Chair pointed out that responsibility for these problems lay ultimately with managers, both as overall financial controllers of fishery research and monitoring and as recipients of the quality-impaired advice which had to be based on such inadequate data.

In addition to highlighting these critical difficulties, ACFM, in its July 1982 report (ICES, 1983a), drew attention to the benefits that could accrue if the formulation of management advice could evolve to a position where biological issues were not considered entirely in isolation from economic considerations. Biology-based advice, it was pointed out, establishes only one set of constraints within which management ought to be implemented. Furthermore (referring to a key development in ACFM's advice format which had been introduced since 1978), it was also suggested that "even with the increased flexibility now built into ACFM advice to provide managers with a wider range of options", scientific advice based solely on biological grounds would have little likelihood of being accepted (and probably no prospect of being implemented or enforced), unless it also satisfied the constraints of economics (i.e. lay within that part of the biological "field", illustrated below, that overlaps with the economic "field"):



Additional benefits of a biology–economics linkage in the compilation of fishery management advice were suggested:

- it would allow the clearer illustration of optimal management strategies within biological constraints;
- dialogue between fishery scientists and economic analysts (and ACFM expressed a desire to receive advice from the latter as to how ACFM's biology-based output might be tailored to fit the requirements of economic analyses) could assist the development of rational and effective economic incentive/disincentive schemes;
- such dialogue could also facilitate the review of existing financial support systems for the catching end of the industry.

Attention was also drawn to the benefits that could be obtained from adopting, in fishery management, concepts used in addressing planning problems in the socio-economic sector—normative advice and exploratory advice—as discussed in Hoydal (1983).

Managers were urged to consider (again) the advantages of management through the regulation of fishing effort rather than catch regulation, referring to a paper that had concluded that effort regulations were more robust scientifically and required less frequent amendment than catch regulations (Sissenwine and Kirkley, 1982). Eumetric fishing (maximizing yield by pairing optimal mesh size to a given level of fishing effort) was also suggested, at least for single-species fisheries.

In conclusion, his 1982 presentation (Griffith, 1983) emphasized that no advances in the formulation of scientific advice could be achieved without radical improvement in much of the information then available to the stock assessment working groups and ACFM.

6.4 Øyvind Ulltang (1984–1987)

6.4.1 Basis and form of advice

During this period, no basic changes were made in the basis and form of advice. The five categories of stocks defined in 1981/1982 for the purpose of providing management advice were kept unchanged. However, ACFM requested that the assessment working groups in 1986 and 1987 try to define safe biological limits for the stocks they assessed. Although working group responses varied, target or minimum acceptable spawning stock levels were identified for many stocks. At the November 1986 ACFM meeting, it was further agreed to ask working groups to produce stock/recruitment

plots for each stock and to attempt to define alternative biological reference points (F_{high}, F_{med}, and F_{low}). In 1987, ACFM introduced the additional reference points F_{med} and F_{high} into its advice (ICES, 1988a) and noted that these were intended to provide guidelines for levels of fishing mortality at which it is probable (in the case of F_{med}) and doubtful (in the case of F_{high}) that recruitment would, in the long term, be sufficient to sustain a stable stock. It was furthermore noted that:

> "ACFM advice is, however, based on the evaluation of as many relevant factors as possible, including levels of F in relation to biological reference points, spawning–stock size in relation to historic levels, trends and recent levels of recruitment, and the precision of the assessments. Different factors dominate in different situations."

In May 1986, it was suggested that the ACFM report should include an executive summary or chair's summary which would include a general synthesis of the status of the stocks. This could perhaps be done on an area basis. The Chair agreed, as a first attempt, to prepare such a summary for the Baltic stocks, present it as part of his report to the IBSFC in September 1986, so that ACFM could examine and discuss it further at coming meetings. The Chair presented such a summary to the IBSFC, and a number of delegations stated that they regarded inclusion of such summaries in future reports of ACFM as desirable. However, when ACFM returned to the question in May 1987, some support was expressed for the overall summaries, but it was decided not to adopt any of the proposed forms at that time. The main concern was that only the additional summaries would be read and the more detailed form of the report would be ignored.

Figure 6.2. May 1987 ACFM meeting in Castle Room, ICES Headquarters, Palægade 2–4, Copenhagen. Left to right: Niels Axel Nielsen, Veikko Sjöblom, Fredric M. Serchuk, David de G. Griffith, Armando Astudillo, Roger S. Bailey, Sigfus M. Schopka, John G. Shepherd, Øyvind Ulltang, Tore Jacobsen, Vaughn C. Anthony, Ana Maria Caramelo, Jan Netzel, Albrecht Schumacher, Yuri Efimov, Rudolph Boddeke, Bernhard Vaske, Evald Ojaveer, Emory D. Anderson, and Michael J. Holden.

In November 1986, ACFM decided to try to standardize the report by giving, for each stock, a summary followed by the main text. In May 1987, it was agreed to proceed

along these lines by confining the report for each stock to a single-page summary, and if further explanatory remarks were necessary, that they should be confined to and labelled "Special comments" (Ulltang, 1987).

6.4.2 Database quality and its implication in advice

In 1986, ACFM expressed its concern that the databases for assessments had been deteriorating for a number of important stocks and stressed the need for an improvement in officially reported landings, levels of discards and biological samples of discards, and biological sampling of landings in mixed fisheries. When reviewing the situation in 1987, the situation had not changed significantly, resulting in the following warning from ACFM (ICES, 1988a):

> "ACFM is especially concerned about the lack of reliable catch data for a number of stocks. This may be caused by unreported catches, misreporting of catches by area, not having catches appropriately split into divisions, and inadequate sampling of landings in mixed fisheries. This not only makes assessments unreliable and, in some cases, impossible to carry out, but also implies that TACs for these fisheries cannot be effectively enforced."

6.4.3 Disastrous prediction of golden years

In its 1986 report (ICES, 1987a), ACFM presented a short- and medium-term prediction for Northeast Arctic cod, which gave a very optimistic view of the situation, leading to the following comment from ACFM:

> "ACFM stresses again that the present situation offers the possibility to rebuild the spawning stock while increasing catch quotas and, at the same time, reducing fishing mortality gradually towards a level close to F_{max}."

Unfortunately, all this turned out later to be completely wrong (see Table 6.3). Instead of golden years in the fishery, there was a crisis. The Chair later repeatedly returned to this as an example of what may happen if one does not make the best use of available biological knowledge in stock assessments. In Ulltang (1996), the following explanation of the disaster is given:

> "The assessment was based on high survey indices of cod from the 1984–1986 year classes. Because of the collapse in the capelin stock, cannibalism in the cod stock increased, strongly reducing the number of recruiting fish from these year classes. In addition, the individual growth of cod was strongly reduced because of the low capelin abundance. These effects could, to a certain extent, have been predicted (at least qualitatively) by taking into account the food requirements of the cod stock, since the collapse of the capelin stock was known at the time of the assessment."

Table 6.3. Predictions for Northeast Arctic cod in 1986 (ICES, 1987a) compared with the 1999 VPA estimates (ICES, 2001).

Year	Stock (1000 t)		Catch (1000 t)		$F_{(ages\ 5-10)}$	
	1986 prediction	1999 estimate	1986 prediction	1999 estimate	1986 prediction	1999 estimate
1986	1877	1316	410	430	0.54	0.85
1987	2636	1144	595	523	0.50	0.94
1988	3276	917	681	435	0.40	0.92
1989	3756	882	684	332	0.30	0.68

6.4.4 Interactions with IBSFC, NEAFC, and NASCO

It was always a pleasure to present the ACFM report to the fishery commissions. It was clear that all three commissions appreciated the work of the ICES assessment working groups and the advice of ACFM. While IBSFC and NEAFC had one annual meeting each in Warsaw and London, respectively, the North American Commission of NASCO met in North America in February each year, and the annual meeting of NASCO was generally held in Edinburgh in June. All of these meetings required the attendance of the ACFM Chair.

The presentations of the ACFM report at the NASCO meetings required more preparatory work by the Chair because of his non-familiarity with salmon fisheries and the special salmon terminology. However, the effort was more than repaid by the good reception the reports received at the NASCO meetings.

When presenting the ACFM report to the ISFBFC in 1987, it was especially emphasized that ACFM recommended again that, in order to achieve proper management of the resources, it was necessary to set separate TACs for each stock unit area, noting that zones of national fisheries jurisdiction have generally little relevance to stock boundaries.

At the NEAFC meeting in 1986, the ACFM Chair drew particular attention to the section of the May 1986 ACFM report (ICES, 1987a) dealing with the quality of the database and its implication on the advice.

6.4.5 Fifth Dialogue Meeting, October 1985

The Fifth Dialogue Meeting (ICES, 1986a) discussed the most recent advice provided by ACFM; effort regulation as an alternative to, or together with, catch (TACs and quotas) regulation; problems encountered with the present TAC advice system, including the problem of mixed fisheries; scientific aspects of the multispecies approach to resource management and implications for future advice; and the nature and form of interaction between ICES and fishery management bodies.

The ACFM Chair commented briefly on the report of the May 1985 ACFM meeting (ICES, 1986b), drawing particular attention to the assessment of some of the North Sea stocks where problems were being created by the increasingly unreliable catch statistics available for some fisheries, the high rates of exploitation, and the exploitation at early ages.

When the ACFM Chair offered his interpretation of the main points of the Dialogue Meeting at the November 1985 ACFM meeting, he said that this had been perhaps the best of the Dialogue Meetings thus far, mainly because some dialogue was achieved with managers and industry representatives. He noted that managers expressed a desire for stability in the fisheries, but were advised that both catch and effort cannot be stabilized.

6.5 Bernhard Vaske (1987–1990)

This period featured two Dialogue Meetings, the installation of a new PC-based computer system at ICES Headquarters in 1990, the development of a new computerized ICES fish stock assessment package, further improvement in standardizing input to ACFM from assessment working groups, and continued erosion in the quality of national reporting of fishery landings (e.g. an increase in the unreported landings of North Sea flatfish).

Figure 6.3. Speakers' table at the Sixth Dialogue Meeting held 27 October 1987 in Brussels. Left–right: Peter J. Ogdon (NEAFC Secretary), Bernhard Vaske (ACFM Chair), Emory D. Anderson (ICES Statistician), Basil B. Parrish (ICES General Secretary), Antonio Cardoso e Cunha (EC Fisheries Commissioner), Ole Johan Østvedt (ICES President), David de G. Griffith (former ACFM Chair), Finn Bergesen (Norwegian Fishermen's Association), Broer van der Meer (Netherlands Delegate to ICES), and Michael K. Holden (EC).

The Sixth Dialogue Meeting was held in Brussels in October 1987 (ICES, 1988c). The major topics of discussion were (i) stability in fisheries, (ii) management systems, and (iii) long-term objectives for resource utilization. The meeting was organized in debate style among three individuals representing scientists, administrators, and fishing industry, with provision for open discussion by the audience. The main points raised included the desire by industry for stable catch levels and for advice on technical measures. Complaints were made about some assessments and the subsequent advice, as well as precautionary TACs, which were necessary in the absence of sufficient data on which to base analytical assessments.

The Seventh Dialogue Meeting was held in London on 28 November 1989 (ICES, 1990). The main theme concerned the biological, economic, and social considerations

used in determining the objectives of fishery management, while taking into account the management of shared stocks. Four speakers representing fishery science (John G. Shepherd), economics (Rögnvaldur Hannesson), administration (Michael J. Holden), and the fishing industry (John Goodlad) presented papers and led the discussion. As at the Sixth Dialogue Meeting, the focus was on stability in fisheries and fishery management objectives. From a scientific perspective, stability is difficult to achieve because of large fluctuations in recruitment, unless fishing intensity is maintained at very low levels. Constant catch and constant fishing effort are not simultaneously possible. Medium- and long-term forecasts are unreliable, again because of recruitment variability. Regarding management objectives, ACFM bases its advice on reducing fishing mortality to one of several biological reference points. Such reductions, if implemented by managers, require reductions in fleet capacity or in fishing days.

In 1987, ACFM recognized the need to update the 10-year-old stock assessment software that had been implemented in 1977 on the old Norsk Data computer system, including the data structure and basic analytical programs. Therefore, a group was established in May 1987 to design a new stock assessment package that would make greater use of more disaggregated data (e.g. broken down by fleet and quarter). Work on the new package continued over several years before it was finally fully installed and made operational.

6.6 Fredric M. Serchuk (1990–1993)

6.6.1 Introduction

At the first meeting in November 1990 of his three-year term of office, the ACFM Chair said that he wished to outline his goals and objectives for ACFM and the assessment working groups. He paid tribute to the efforts of his predecessor, who had overseen many improvements in the way ACFM and the working groups operated. Nevertheless, he noted that the demands on ICES were constantly changing, and it was necessary to keep trying to change things for the better. With the assistance of quotations from Lewis Carroll and Edmund Burke and overhead transparencies, he described his goals and objectives (Annex 2).

Figure 6.4. November 1990 ACFM meeting in Castle Room, ICES Headquarters, Palægade 2–4, Copenhagen. Seated (left–right): H. Peter Cornus, Jan Netzel, John Molloy, Yuri Efimov, Fredric M. Serchuk, Roger S. Bailey, Richard J. R. Grainger, Rudolph Boddeke, Erling Bakken, and Alain Laurec. Standing (left–right): Carlos Sousa Reis, Johan Modin, Wolfgang Weber, André Forest, Sigfus M. Schopka, Eskild Kirkegaard, Jean-Jacques Maguire, José A. Pereiro, Ralph Mayo, Rudy De Clerk, Niels Daan, Tore Jakobsen, and Hjalti í Jákupsstovu.

In order to enhance the quality of scientific advice, efforts needed to be made to bridge the single species–multispecies gap, long-term advice needed to be improved, and risk analyses should be conducted or attempted. If possible, environment–fishery interactions should also be evaluated.

The productivity and efficiency of ACFM and the assessment working groups could be improved in many aspects. ACFM's procedure for reviewing working group reports could be made more thorough, and potential problems resolved before ACFM meetings. Working group chairs could be invited to attend ACFM meetings more frequently. Working groups could also operate more efficiently; improvements in the ICES assessment software, together with better preparation (data preprocessing) by working group members would help greatly. The production of a working group members' handbook might be useful. A rearrangement of the working groups by regrouping assessments on an area or fisheries basis could reduce the dissipation of talent, improve efficiency, and raise the quality of the analyses. Attempts needed to be made to reduce the assessment demands on working groups so that they might spend more time on other problems (e.g. data problems, research questions).

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Figure 6.5. A cartoon from the May 1990 ACFM meeting suggesting an analogy between stock assessments and the high striker contest at Tivoli.

Another area where there was a need for improvement was in interaction between ACFM and the working groups, ACMP, the ICES subject/area committees, NAFO, and the fishery commissions. Better publicity for ACFM and ICES would help with this. Communication with working groups could be enhanced by having ACFM members "shadow" particular groups. ACFM has a unique advantage in this regard because it has members from all ICES member countries.

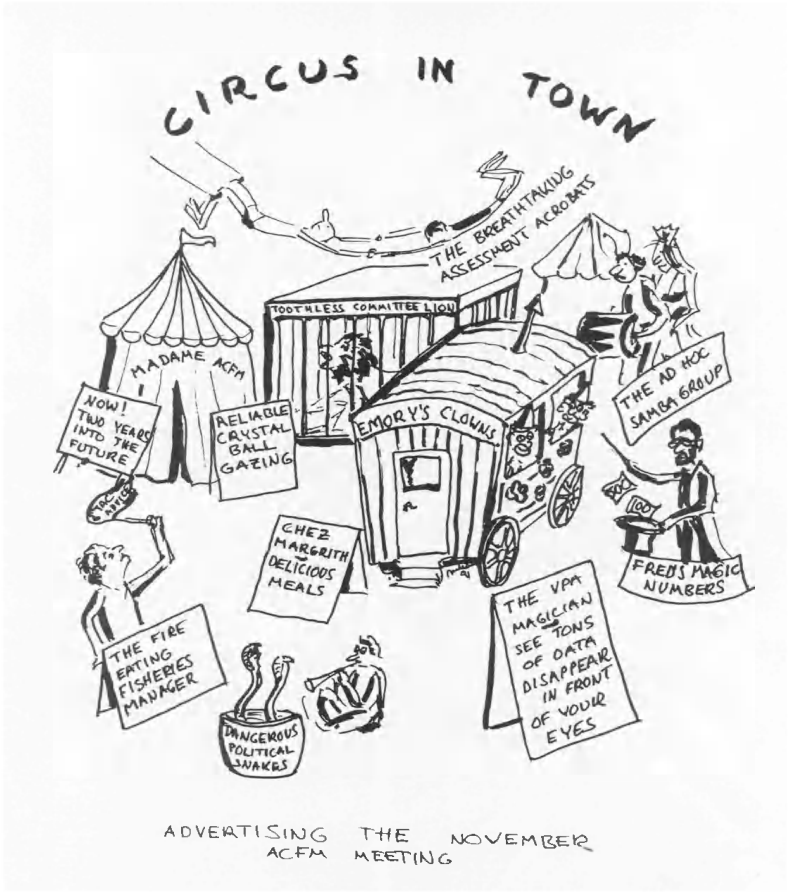


Figure 6.6. A cartoon circulated at the May 1990 ACFM meeting announcing the subsequent November 1990 meeting.

Finally, ACFM and other ICES committees needed to improve the advice on the impacts of fisheries on the ecosystem (other than the direct effect on fish) as well as on fishery interactions with marine mammals and seabirds. That subject is relevant to resolving conflicts between fisheries and ecosystem management.

Annexes 3 and 4 contain the text of two recommendations, one to the Bureau and the other to the General Secretary, prepared in October/November 1990 by ACFM (ICES, 1991b) to begin the process of addressing the goals and objectives summarized above and listed in Annex 2.

6.6.2 New form of ACFM advice

In autumn 1991, ACFM adopted a new approach to formulating its advice. The new approach was the result of a year-long process wherein ACFM examined and evaluated the basis and criteria that had been used in developing its scientific advice since 1981. ACFM believed that the new protocol was a significant improvement over its previous approach and would result in more objective, consistent, and credible management advice.

Under the new system, ACFM defined its objective as: "To provide the advice necessary to maintain viable fisheries within sustainable ecosystems." The specification of objectives for fishery management was recognized as a responsibility of management

bodies, not ACFM. The role of ACFM would be to provide the biological information and advice necessary for managers to achieve the objectives they selected. In some cases, however, ACFM may be in a position to comment on the implications of setting certain objectives and on the feasibility of achieving them. In providing its advice, ACFM would present options as to how management objectives could be reached and would clearly describe the implications and consequences of those options and their associated risks. ACFM may comment, for example, that an increase in fishing mortality was not expected to produce any gain in long-term yield, or that reductions in fishing mortality would allow for a greater buffer spawning stock as a hedge against future recruitment fluctuations. However, recommendations would only be made in cases where stocks were exploited outside safe biological limits (i.e. where stocks were below a "minimum biologically acceptable level" [MBAL] or expected to fall below that level in the near future at then rates of exploitation). For stocks in that category, ACFM would give advice on the measures needed to rectify the situation; the severity of the advice and the extent to which management options were possible would normally depend on the degree of stock depletion. When stocks were exploited within safe biological limits, ACFM would provide options without indicating a preference, but ACFM would indicate the biological consequences and risks associated with each option. In this latter situation, the choice of a particular option would be left to the managers. For those stocks where an analytical assessment was not yet feasible or where the state of exploitation could not be assessed precisely, ACFM would present information on recent landings trends and might be able to advise on likely changes in yield resulting from changes in fishing effort and/or exploitation patterns. Advice on precautionary TACs would generally be provided only if specifically requested.

In providing its advice, ACFM would normally identify a number of biological reference points (BRPs), which represented a set of signposts to enable scientists and managers to judge the state of exploitation of the stocks. The BRPs would refer to levels of fishing mortality on the yield-per-recruit curve, or to levels of fishing mortality that would affect the sustainability of recruitment. The BRPs were not the same as management objectives; they simply served as a guide to aid managers in choosing from the range of available options.

ACFM had long recognized the need to provide advice, wherever possible, within a multispecies context (ICES, 1985; Parrish, 1988). As scientific understanding of the nature of technical and biological interactions among fisheries and fish stocks improved, ACFM had striven (and would continue to strive) to take these interactions into account in its advice. ACFM regularly reviewed the developments and advances made by the ICES Multispecies Assessment Working Group, the ICES Working Group on Multispecies Assessment of Baltic Fish, the Working/Study Groups on Fisheries Units in Sub-areas VII and VIII, and the Working Group on Methods of Fish Stock Assessment with respect to mixed species and multispecies problems. Predation mortalities derived from multispecies VPA were then used routinely in the assessment of many finfish stocks in the North Sea and Baltic Sea, and predator–prey

relationships were also considered when providing ACFM advice for some boreal species (e.g. Barents Sea capelin and Northeast Arctic cod). Acknowledging the need to provide advice in the future on fishery systems (and not just on single stocks or single fisheries), ACFM in the previous year had initiated a restructuring of working groups towards area-based assessment working groups. Also, a Long-Term Management Measures Working Group was established and multispecies terms of reference were given to several of the remaining stock-based working groups (i.e. Atlanto-Scandian Herring and Capelin Working Group; Arctic Fisheries Working Group). It was expected that these changes would improve the possibilities for ACFM to provide integrated fisheries systems advice to managers in the years ahead.

Figure 6.7. Having fun at a party held during the May 1992 ACFM meeting are l-r Richard J. R. Grainger (ACFM Secretary, 1989-1992) and Fredric M. Serchuk (ACFM Chair, 1990–1993) posing as Batman and Robin. These titles had been self-imposed owing to their reputation of having a close and intense working relationship.

Figure 6.8. Participants at the May 1992 ACFM meeting duringa lunchtime break on Kongens Nytorv around the corner from ICES Headquarters at Palægade 2–4, Copenhagen. Left–right: Ad Corten, H. Peter Cornus, Ole Hagström, André Forest, Eskild Kirkegaard, John Browne, Eero Aro, Valery N. Schleinik, Niels Daan, Yuri Efimov, Jean-Jacques Maguire, Fredric M. Serchuk, Armando Austudillo, Tore Jakobsen, Bengt Sjöstrand, Javier Pereiro, Joseph W. Horwood, Carlos Sousa Reis, Wolfgang Weber, Richard J. R. Grainger, Gunnar Stefánsson, Rudy De Clerck, Hjalti í Jákupsstovu, Jan Netzel, and Ramón J. Conser.

However, as progress was being made in incorporating technical and biological interactions into assessments and predictions, it would be critical for management bodies to develop objectives for the management of fishery systems so that any scientific scenario analyses performed within a multispecies/mixed species framework would be relevant. The development and specification of quantifiable ecosystem objectives would be the greatest challenge to managers in the future, as highlighted in the discussions that occurred at the Eighth ICES Dialogue Meeting held in Gdynia, Poland in 1991 (ICES, 1993) and in the 1992 reports of the ICES Study Group on Ecosystem Effects of Fishing Activities (ICES, 1992a) and the ICES Steering Group on Fisheries/Environmental Management Objectives and Supporting Research Programmes in the Baltic Sea (ICES, 1992b).

6.7 Eskild Kirkegaard (1993–1996)

6.7.1 Goals of ACFM

As introduced by the preceding Chair, ACFM, at its October/November 1993 meeting, discussed the goals for the coming three years. Three main goals were identified (ICES, 1994):

- To enhance the quality of the advice. ACFM agreed to work for the incorporation of biological and technical interactions in the assessments and to provide medium-term projections, taking into account the uncertainty in data and methods. Quality of the basic data was identified as the most important problem in providing high quality stock assessments.
- To enhance the productivity and efficiency of ACFM. The increasing workload for ACFM made it necessary to revise the internal working procedure and to look at the interaction between ACFM and its working groups.
- To advance the role of ACFM and ICES in providing advice on ecosystem management. To be able to address the increased concern for the impact of fisheries on the ecosystem, ACFM stressed the importance of ICES being prepared to provide advice on the interaction between fisheries and the ecosystem.

6.7.2 Quality of advice

Looking back and knowing the situation in fisheries and fishery management in the Northeast Atlantic at the beginning of the 1990s, the goal of enhancing the quality of the advice was very ambitious. Many of the fish stocks in the Northeast Atlantic were under heavy pressure, fishing mortality had reached record-high levels, and many of the stocks were facing recruitment overfishing. The fisheries on the eastern Baltic cod stock and on some of the stocks at the Faroe Islands collapsed. For other stocks, like North Sea herring, the situation was tenuous, and the risk of stocks being depleted if

fishing continued at the same high levels was great.

The TACs implemented (by managers) had, for a number of stocks, proved to be inefficient at maintaining or reducing exploitation to sustainable levels, and enforcement and control of the management regulations was far from optimal. Underreporting and misreporting had increased dramatically, and the catch and effort data from a number of important fisheries were unreliable. At the same time, some of the fishery research institutes in ICES member countries were suffering from cuts in funding, and it was not possible to set up alternative data-collection systems to compensate for the unreliable catch statistics being submitted.

That situation created a pressure on ACFM as a body. The need for high-quality advice was obvious, but the problems with under- and misreporting and cuts in funding undermined not only the quality of the assessments, but also the possibility of improving the situation. The cod fisheries in the Baltic Sea illustrated the impossible situation into which ACFM was being placed. Management of those fisheries was chaotic, misreported and underreported landings in 1993 and 1994 being perhaps twice as high as the reported landings. ACFM attempted to estimate the landings using data from research vessel surveys, but the survey data were too noisy, and it proved impossible to assess the state of the stocks, so the advice provided in 1995 was based on the assessment from 1993.

ICES raised yet again the issue of catch statistics being unreliable. Official letters were sent to all member countries pointing out the importance of catch statistics being accurate, pointing out that, if they were not, ACFM would be unable to assess the stocks and to provide management advice. Some improvements in the quality of catch statistics were observed in 1995 and 1996, but a lack of accuracy in reported landings by species and area was still a major problem, and the question of what to do when catch statistics were unreliable had not been answered.

Although ACFM in general was unable to enhance the quality of the assessment of the state of the stocks, a major improvement in the advice was achieved by changing the means of presentation of the advice. Not only the inclusion in the ACFM report of medium-term probability plots of the development of stocks and catches, but also the revision of the format of the report introduced in 1994, were major steps forward in providing "users" with a clearer, more easily accessible description of the basis for the advice. These changes were well received by both fishery commissions and member countries.

6.7.3 Working protocols

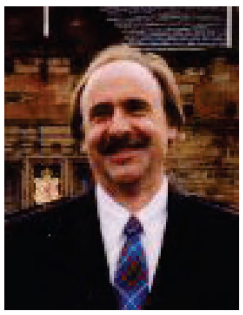
The working tradition of ACFM had always been to work in plenary, with all members participating in all discussions, a tradition considered by many to be one of its strengths. The number of stocks and the complexity of the assessments in 1993 had, however, reached a stage where it was impossible for ACFM to continue to work in this way unless its two annual meetings were prolonged significantly. Therefore, to allow more time for quality-checking the assessments but without extending the length of the meetings, a system of carrying out the review of assessments in two parallel subgroups was introduced in 1994. Not only did that system allow more time for checking and discussing the assessments, but it also showed that more members of ACFM took an active part in the discussions in the subgroups than in the plenary.

6.7.4 Environmental issues

At an international level, concern over the impact of fisheries on the environment was

growing. Questions such as the bycatch of marine mammals, the discarding of part of the catches, the effect of overfishing on the ecosystem, and physical disturbance of the seabed by trawling were on the agenda not only for nature conservation groups, but also for intergovernmental organizations such as OSPAR, HELCOM, and IMM. To enhance ICES ability to provide quality advice on the ecosystem impacts of fishery, the Working Group on Ecosystem Effects of Fishing Activities had been established. The 1993 report of that group (ICES, 1995) was the first major attempt by ICES, scientifically, to describe and evaluate the impact of fishing on components of the ecosystem other than the fish and shellfish stocks that were the target of the fisheries. The role of ACFM in reviewing that information and in providing advice on environmental issues was unclear, however. Environmental issues were not integrated into the ACFM advice on fisheries, because doing so was generally accepted as being the responsibility of the Advisory Committee on Marine Environment (ACME). There was clearly a need for cooperation between ACFM, with its expertise in fisheries, and ACME, with its responsibility for providing advice on ecosystem management. On the initiative of the two Chairs, therefore, a joint meeting of ACME and ACFM was held in 1994 to explore the possibilities for cooperation. The meeting was meant to be a first step towards developing a more flexible way of dealing with advice involving the expertise of both committees. Despite strong pressure from the two Chairs for a formal forum for coordination of ICES advisory work, however, the idea did not receive much support within ICES, and it was left to the two Chairs to coordinate the advice of the two committees themselves.

6.8 Jean-Jacques Maguire (1996–1999)



The workload of ACFM increased substantially during the first part of the 1990s, and the demands on the ACFM Chair became greater than could be reasonably expected from a scientist employed fulltime by an ICES member country's institute. The knowledge and experience required of the ACFM Chair meant that suitable candidates were likely already to occupy senior positions at their home institutes. Very few institutes from ICES member countries were so rich in personnel that they could free one of their senior staff members for the equivalent of half a person-year or more for a three-year period.

At the 1996 Annual Science Conference in Reykjavík, candidates for the ACFM chairmanship indicated that they would stand only if their home institute was financially compensated. The objective of such compensation was to decrease the workload associated with the candidate's normal activities at home in order to make time for them to address ACFM duties. Such activities included attending and chairing the ACFM meetings and conference calls (and attending some working group meetings), preparing for and presenting the advice to fishery commissions, attending the Annual Science Conference, and participating in the Consultative Committee and other

ICES initiatives[5]. The Council agreed to pay compensation for the Chairs of both ACFM and ACME[6] for a trial three-year period.

Compensation was not provided for the 2000–2003 chairmanship, even if the problem of availability of suitable candidates had not been resolved, because only a single candidate was allowed by his home institute to stand for the 1999 election. This situation was clearly a reflection of the persisting heavy workload on experienced staff at national institutes. Having only one candidate for such a prestigious, albeit difficult and demanding, responsibility as ACFM Chair, arguably reflected a serious melancholy within the organization[7].

Various alternatives to compensation for the Chair were considered, including adding the responsibilities of ACFM Chair to those of the ICES Fishery Secretary. This was seen as possibly providing temporary relief, but it was not seen as a long-term solution for three principle reasons: (i) it was necessary to refresh the helm of ACFM in order to maintain its responsiveness; (ii) if ACFM continued to function as a 19-member-country group of peers providing consensus advice, the peers would want to choose their Chair; and (iii) with cost recovery in place, advice presented to the commissions by an ICES Headquarters staff member also involved in financial discussions would not have the same standing as that provided by an independent, elected official chosen by his/her peers and speaking on their behalf. In addition, from a financial perspective, adding the responsibilities of the ACFM Chair to those of the Fishery Secretary would end up being at least as expensive as compensating national institutes because the ICES Secretariat would end up having to hire additional help to relieve the Fishery Secretary of some of his/her duties.

On the scientific advisory side, the 1996–1999 period had witnessed the adoption and implementation by ACFM of the precautionary approach (PA) in the provision of fishery management advice. ICES had been the undeniable leader (Garcia and De Leiva, 2000) in the implementation of the PA, so providing a strong incentive to other fishery management or advisory organizations to follow. ICES own implementation of the PA was widely criticized, however, including by the UK House of Commons Select Committee on Agriculture, mainly because ICES did not consult sufficiently before implementing a PA[8], and others suggested that the PA should apply not only to the protection of fish stocks, but also to the protection of fishing. The principles of intergenerational equity, one of the main tenets of the PA, and sustainable utilization both imply that the approach should explicitly incorporate the protection of fishing communities, not only the resources on which they depended (Hilborn *et al.*, 2001). From a fishery conservation perspective, however, the implementation of the PA by

[5] During 1996–1999, these activities, including travel, amounted to 90–110 days per year, or close to half a person-year.

[6] Although finding a chair for ACME was not seen as a problem at the time.

[7] Compensation was reinstituted from 2002 on.

[8] http://www.publications.parliament.uk/pa/cm199899/cmselect/cmagric/141/14105.htm

ICES appears to have signalled a change in the proportion of stocks that were outside safe biological limits.

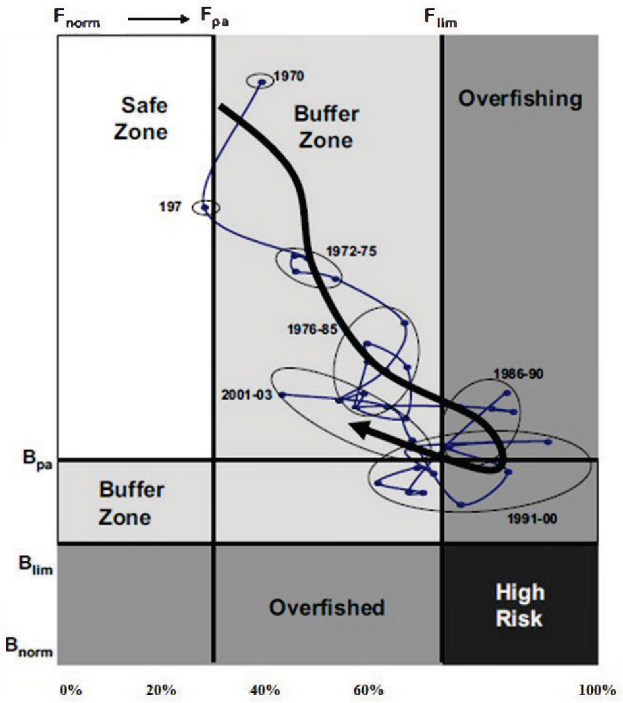


Figure 6.9. Evolution of the proportion of ICES stocks within safe biological limits (within SBL), in transit, and outside SBL according to Garcia and De Leiva (2000).

It is necessary to stress here that ACFM did not make a conscious decision not to consult before implementing the PA in its advice; it merely assumed that consultations would happen through the normal process of presenting ACFM advice to national authorities and interested parties by ACFM members and to commissions by the ACFM Chair. ACFM could have decided to consult widely before using the PA in providing advice, but there is no doubt that the process would not have advanced as rapidly as it did if the consultation suggested had been made. In addition, during those years, the European Commission explicitly and repeatedly expressed its opposition to ACFM consulting directly with producer, fisher, and processor organizations. It is obvious that discussing the PA reference points before using them in the advice would have delayed the implementation of necessary measures by fishery management authorities.

ACFM clearly stated in the introduction to its report, and the Chair certainly emphasized that point when presenting the advice, that ACFM felt it had a scientific responsibility to identify limit reference points, but that F_{pa} and B_{pa} were proposals open for discussion. The distance between the PA point and the limits has a scientific component linked to uncertainties, but it also depends on the tolerance to risk of interested parties.

Few changes, others than those made necessary by the implementation of the PA, were made to the format of the ACFM report. The reports were made openly availa-

ble on the Internet, and stock assessment data were made accessible under password protection. The physical facilities available to ACFM had been considerably improved under the chairmanship of Eskild Kirkegaard (1993–1996). In 1997, a local area network (LAN) was installed in the Castle Room at ICES Headquarters, allowing working group and ACFM members to use their laptops, to share information, and to access the Internet.

In 1997, the Bureau Working Group on the Restructuring of the ICES Advisory Committees identified a need to provide integrated advice and suggested that a single advisory committee be created. Instead of merging ACFM and ACME into a single advisory committee, ICES created a third advisory committee, the Advisory Committee on Ecosystems (ACE), and later a mechanism to coordinate the three advisory committees, the Management Committee on the Advisory Process (MCAP). The creation of ACOM in 2007 closely followed the recommendation made in 1997.

Figure 6.10. A cartoon depicting discussion at ACFM meeting in November 1999.

In 1997, a new structure for the ICES scientific committees was also implemented. The Resource Management, Baltic, and Living Resource Committees would have been logical successors to the Demersal, Pelagic, and Baltic Fish Committees that previously formed part of ACFM. However, scheduling problems prevented the chair of the Living Resource Committee from participating, and bearing in mind the objective of providing integrated advice, the chair of the Marine Habitat Committee was invited to participate in ACFM and became the regular third chair during the years 1996–1999. Participation in ACFM by the Marine Habitat Committee chair

(Astrid Jarre-Teichmann) was instrumental in coming very close to using the multispecies Baltic assessment as the basis for advice in May 1999; through ACFM, she initiated the pilot project of developing integrated advice, again for the Baltic Sea.

There was considerable discussion at ACFM on ways to decrease the workload of the working group/ACFM process and to increase the quality assurance of the assessments and advice, but little real progress was achieved. Using simplified methodology to provide advice and subcontracting assessments and preparation of advice to individual institutes were two of the interesting ideas worth pursuing, as was the formal implementation of quality assurance.

Sadly, the 1996–1999 period was marked by the illness and premature retirement in late 1998 of the Fishery Secretary, Roger S. Bailey.

6.9 Tore Jakobsen (2000–2003)

At the threshold of the new millennium, ICES as an advisory body was faced with many challenges. Some were of a general form, e.g. how to improve the consistency in the advice and how to improve dialogue with managers, the fishing industry, and other stakeholders. Others require more urgent solutions. The main ones were to:

solve the problem of the increasing workload of ACFM,

meet the demands for timely advice, especially on fishery management,

integrate both fishery and environmental issues in ecosystem management advice.

The demand for fishery management advice was growing. The number of stocks for which advice was requested had been increasing and a large number of deep-water species had been added to the commercial fish fauna receiving some attention. Ecosystem management would not reduce the need for TAC advice and might instead add to the workload by creating a need for the monitoring of non-commercial species and incorporating fishery advice in relation to those. Hence, the workload of ACFM and the scientific community that produced the data and the basic calculations would probably continue to increase.

There were limitations to the number of requests ICES could handle without impairing the quality of its advice. One might, of course, hope that the increasing demand for advice was paralleled by an increase in funding for the supporting research. However, such a hope was probably unrealistic and other solutions were therefore needed. A continuous dialogue with managers was needed to try to reduce to a minimum the number and the complexity of requests being serviced. In particular, it has to be stressed that ICES was not well equipped to handle *ad hoc* requests for midyear advice, e.g. requests based on the expectation that new surveys or other new information might increase the recommended TAC.

For some stocks, it was possible to provide multiannual advice that did not require annual updating of the assessment. However, for stocks that were outside safe biological limits or were declining, multiannual advice was usually neither scientifically advisable nor acceptable to managers. The number of candidate stocks for multian-

nual advice was, therefore, at that time, relatively small.

The working procedures of ACFM could be made more effective. More standardized procedures for assessment, quality control, and formulation of advice might save time, and a process to achieve this had been started by the ICES Secretariat. In particular, the review process could be more effective. Basically, the review of an assessment was a technical procedure that required a certain insight in the methods applied and, as such, should not be so sensitive to requirements for national representation. If the review were to be based on the views of designated experts and separated from the formulation of the advice, the process should be more effective and also improve in quality.

ICES was committed, through Memoranda of Understanding with client commissions, to provide advice on request. One requirement of the clients was that ICES advice had to be timely, i.e. clients must receive the advice in due time before management decisions had to be made. The scheduling of ACFM did not meet this requirement in all cases. Therefore, in 2000, as a trial procedure, advice to NASCO was produced outside the main ACFM meeting by having a small group of experts meet to formulate the advice, which then was circulated to ACFM members for comments before being finalized. A special request by IBSFC was dealt with in the same manner.

A new development was that NEAFC and the EU demanded advice by 15 October of each year. One way to meet this demand was to move both the ACFM autumn meeting and the meetings of the relevant working groups forward. For the stocks managed by NEAFC, this could, in most years, probably be achieved without too much of a problem. For the North Sea demersal stocks, however, there was an issue because the results of surveys crucial to the assessment would not be available until after the advice was given. Therefore, either the managers had to accept advice without taking into account the most recent survey results or ICES would have to create a framework that could update the advice, if needed, without having a full meeting, e.g. a solution similar to the one adopted for the NASCO advice. ICES looked for possible solutions and had discussions with the managers to obtain an understanding of the consequences if earlier advice were needed.

It was generally agreed that the advisory structure in ICES needed to be changed to meet the demands of an ecosystem approach to management. A planning process to achieve this had been going on for some time, but had, thus far, been inconclusive. Suggested solutions included merging ACFM and ACME into one advisory committee, creating regional committees, and splitting the then committees into smaller ones. The process appeared to be in its final stage, but the final outcome was still not known.

Whatever the result, the advisory framework within ICES would still need to fulfil the following requirements:

- There must be sufficient time and expertise for reviewing assessments and advising on TACs.
- National representation must be secured at all vital stages of the advisory process.
- Advice must be given when requested by clients.
- Consistency in the advice had to be secured.

To find an advisory committee structure that would meet these demands and at the

same time take into account the need for integrated advice was not a simple task. However, ICES was the only organization in this part of the world that had the expertise and the experience needed to find a solution.

In 2000, ICES established two new committees: "...there is an increasing need for multidisciplinary advice, particularly in relation to the interaction between the exploitation of living resources and the environment and ecosystems. For this reason the Council established the Advisory Committee for Ecosystems (ACE).... ACE will have the primary responsibility for scientific information and advice on the status and outlook for marine ecosystems, and on exploitation of living marine resources in an ecosystem context. ACE will provide a focus for advice that integrates considerations of the marine environment, such as the ecosystem effects of fishing. The Committee will be in the forefront of the development of advice on ecosystem management."

"...overall responsibility for managing the production and delivery of scientific advice rests with the ... Management Committee for the Advisory Process (MCAP). Membership of MCAP consists of the Chair and Vice-chair of ACFM, and the Chairs of ACME, ACE and the Consultative Committee. The General Secretary is an *ex officio* member."

Although the process of merging the advice initially was very slow, the creation of those committees was a formalization of a process leading towards the establishment of ACOM.

6.10 Poul Degnbol (2004–2005)

Poul Degnbol's chairmanship (2004–2005) was characterized by movement towards the ecosystem approach, allowing stakeholders into the advisory process (following the Thirteenth Dialogue Meeting in 2004 in Galway; ICES, 2004a) and improving some of the assessments that had caused problems, particularly those of blue whiting and mackerel. This effort is described in the first volume of the 2004 ACFM report (ICES, 2004b), introducing, *inter alia*, descriptions of the ecosystem context of the fishery advice. Poul already had a long list of articles and books to his name, especially dealing with fishery issues beyond stock assessments. He always contributed to the understanding of advisory processes and stressed the need to see everything in the context of fishery systems, an issue discussed by ICES at the Working Group on Fishery Systems in the 2000s. The changed strategy basically came out of that working group and the Policy and Knowledge in Fisheries Systems (PKFM) project along with some other studies commissioned and made by ICES. The results of the PKFM project are summarized in Schwach *et al.* (2007) (See Section 7).

6.10.1 Introduction

Marine management needs to take an integrative view and include ecosystem considerations, i.e. to use an ecosystem approach. ICES is already implementing an ecosystem approach in its advisory work, in response to several political declarations calling for such an approach, e.g. Reykjavík 2001, Bergen 2002, and the World Sum-

mit on Sustainable Development held in Johannesburg in 2003. Ecosystem considerations were included in ICES advice in the past as a response to requests for advice on ecosystems but more specifically in relation to fisheries. For example, in response to requests from environmental and fishery commissions, the need to maintain a food base for predators has been the basis for the advice provided on capelin and sandeel.

Numerous large national and international programmes exist with the aim of developing an ecosystem approach to managing the marine environment and its resources. Some of these programmes are described in the Report of the ICES Advisory Committee on Ecosystems of 2002 (ICES, 2002), listed by region. There is general consensus on the intent of the expression "ecosystem approach", but actual definitions vary, so this must be considered when interpreting reports on the implementation of the ecosystem approach.

Figure 6.11. H. C. Andersens Boulevard, 44–46, home of the ICES Secretariat since 2004, was the venue for the ACFM meetings from October 2004 through 2007.

Taking an ecosystem approach to management contributes to ensuring long-term sustainability for marine resource use, including fisheries. Fishing fleet capacity in many regions exceeds the level ensuring long-term sustainability and there is mounting evidence that the fisheries sector and other human activities are having a serious impact on those ecosystems, with many fish stocks being depleted. The most effective way to achieve ecosystem objectives for fisheries is to implement the measures advised for many years based on single-stock fishery considerations, by reducing considerably the level of exploitation of the various fish stocks. Measures that result in this effect will reduce the pressures on biota and habitats and contribute to restoring stocks to full reproductive capacity, providing the basis for higher long-term yields. A management approach including ecosystems considerations serves multiple objectives and needs to emphasize strong stakeholder participation and focus on human behaviour as the central management dimension.

At the Thirteenth ICES Dialogue Meeting (26–27 April 2004), there was discussion on how ICES planned to introduce an ecosystem approach. Implementation would include stakeholder interaction and be incremental. Starting in 2004, ICES had introduced mechanisms on an experimental basis, allowing stakeholders to provide inputs to the assessments and to obtain better insight into the advisory process. The results were first evaluated in 2005 (Wilson, 2005; Wilson and Hegland, 2005), and ICES then introduced appropriate adjustments to the proposal for stakeholder involvement, taking into account the role of the EU's Regional Advisory Councils. The plan acknowledged that understanding of the functioning of ecosystems was confined to certain ecosystem components and that this situation would remain so for the foreseeable future, despite understanding of systems improving.

Understanding was not uniform among ecosystems; there were ecosystems for which more data and better understanding of the critical processes existed than for other systems. Therefore, implementation of the ecosystem approach and the ability of ICES to satisfy information requirements from clients varied among ecosystems.

6.10.2 New report format

The ICES advice changed in several aspects; the changes required integration between the outputs of the then advisory committees and reorganization of the advice on an area/ecosystem basis. The objectives were:

(i) To provide advice on the basis of an ecosystem approach:

Distinguish between fisheries advice in an ecosystem context and advice on other marine-related human activities in an ecosystem context;

The development of the form of advice with fully integrated ecosystem considerations is a longer-term process;

The first step in this process would be to present ICES fishery advice in an ecosystem context, i.e. advising on an area basis and integrating information on the ecosystem and fisheries, including ecosystem impacts of fisheries;

Ecosystem advice beyond fishery aspects should be integrated in the same ecosystem-structured context;

In 2004, ACE and ACFM reports were partly integrated, organized on an ecosystem (area) basis, with stock summaries and background text on ecosystem and environmental issues as explanatory text in annexes;

In 2005, the integration of the ACE and ACFM reports continued, and the ACME report began to become integrated in the same format.

(ii) For fishery advice, transformation of the traditional stock-based approach required:

That the mixed fisheries issue be dealt with, i.e. starting from the human impact (fisheries) to the catch brought on deck (a mixture of species) to the impact on individual stocks;

Fisheries are confined to an area, seldom to a stock, so reform required a reorganization of the advice on an area basis. This reorganization of ACFM advice had been initiated in 2003, and the Committee continued this development in 2004 by:

Integrating all stocks into the area advice, developing databases to underpin the fisheries/area approach, developing fishery forecast methods, if possible, presenting fleet/fisheries forecasts. Fisheries advice should, furthermore, be revised to include long-term considerations of management targets relating to, *inter alia*, yield by:

- Developing concepts for management targets;
- Identifying targets for individual stocks;
- Developing methods to evaluate harvest control rules (HCRs), recovery plans, etc.;
- Developing an advisory framework where advice was long term but with short-term implications;
- Understanding that the decision on targets was a matter of policy and, therefore, was not to be taken by ICES in an advisory capacity. However, ICES would assist policy-makers in the decision process by providing information on the choices and their likely implications.

As a consequence of these changes, the ICES advice from 2004 appeared in a new, integrated format, as described above.

6.10.3 Scientific basis for advice

Ecosystem approach

Before an ecosystem approach could be implemented, ecosystems had to be defined. The identification of marine ecosystems for management advice had to be based on their oceanographic and biological coherence, but also to be practical by corresponding, as well as possible, with existing area definitions used in management. ICES had adopted a regional definition of ecosystems for its advice. That form of definition was not practical for all populations, e.g. widely migrating stocks of fish and sea mammals that occurred in several of the regional ecosystems, illustrating that the systems were open ones. Also, from a physical oceanography perspective, regional ecosystems were open systems, at least when considering longer time horizons. However, for the time being, a regional approach seemed to be the better option.

Management advice under an ecosystem approach was a multistep procedure that included identification of ecosystems, identification of the relevant ecosystem components, and linking human activities to impact on those ecosystems.

At that time, ICES implementation considered primary effects on a number of ecosystem components; it was hoped that these would be the components where the impacts were most profound. This procedure differed from having an overall ecosystem model with a single all-encompassing ecosystem health function, a proposition that ICES did not consider practical at that time. ICES stressed that implementation was an evolving process, so it was only for that time that the approach was confined to the evaluation of the primary effects.

The extent of knowledge differed between regions, and the extent to which ICES was able to implement an ecosystem approach therefore also varied between regions.

During that time, the ICES work to implement an ecosystem approach in its advice was seen as an interesting case for sociologists of science studying the policy–science interface, including the research projects including the "Policy and Knowledge in Fisheries Management (PKFM) project, which ran from 2003 through 2005, and the "Scientific Advice for Fisheries Management at Multiple Scales (SAFMAMS) project, which ran from 2005 to 2008. The developments specific to the implementation of an ecosystem approach were discussed in Wilson (2009).

Sector approach

As a first step, assessors listed the human activities taking place in the sector and identified the ecosystems that were affected. The next step was to detail these impacts through mapping each activity and its impact for as many ecosystem components as allowed by the available data and the then understanding of the processes. Then, the impact of the specific human activity was compared with the impact of all human activities, again component by component, i.e. to determine whether that specific impact was significant among all human impacts. Finally, the impact of the sector under study was related to the acceptable overall impact for each component, e.g. based on sustainability considerations. Doing so required a quality status assessment of the ecosystem component. Going through the process component by component allowed the development of advice in an ecosystem context, but the analysis of human impacts under this approach only included a subset of all the ecosystem components.

Assessment of quality status of ecosystems

An overall quality status report started from identifying the components of the ecosystem, and the first step was to assess the status of ecosystem components for which there was information. To provide management advice, the next step was to identify the human activities that had a major impact on each component and to evaluate whether a reduction in human impact was desirable. These impacts would be identified by sector to allow managers to take action. Assessing the status of the ecosystem was addressed within ICES/OSPAR under the heading ecosystem quality objectives (EcoQOs).

6.10.4 Form of ICES advice

According to international agreements, including that concluded at the UN World Summit on Sustainable Development in 2002, the management of human impacts on marine ecosystems had to be based on the precautionary approach. Management based on the precautionary approach seeks to be risk-averse, but society may choose to pursue specific benefits from marine ecosystems, such as transport, the sustainable harvest of living resources, recreational activities, and the deposition of waste. Therefore, management to achieve these benefits would be bounded by the requirement for risk-aversion, as stipulated by the precautionary approach.

ICES provided advice based on an ecosystem approach to management. In relation to a specific sector, the advice addressed specific issues arising from the practices within that sector. Beyond that, ICES also advised on the overall state of the ecosystem.

Fishery advice

This was the result of a three-step process:

(i) Single-stock exploitation boundaries were identified first. These were the boundaries for the exploitation of the individual fish stock and were identified on the basis of its status, consistent with the precautionary approach and, if target reference points had been defined or management plans that were precautionary had been decided, in relation to targets or plans. The single-stock boundaries also included considerations of the ecosystem implications of harvesting that species in the ecosystem whenever such implications were known to exist. These single-stock exploitation limits were presented in the stock summaries in Section 4 of the report, and collected in a table for each area in Section 3. The single-stock boundaries would apply directly as advice in the absence of mixed fisheries issues and ecosystem concerns beyond the impact of fishing on that stock.

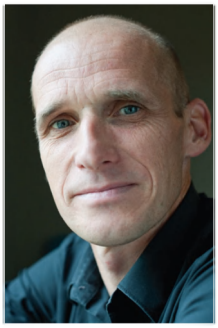
(ii) Mixed-fishery issues were addressed second. For stocks harvested in mixed fisheries, the single-stock exploitation boundaries would apply to all stocks taken simultaneously. It was therefore necessary to identify the major constraints within which mixed fisheries should operate and through this analysis to identify the additional constraints that further limited the fishing possibilities. Such major constraints may be the stocks in the stock assemblage that were outside precautionary limits and therefore may become the limiting factor for all fisheries exploiting it. This implied that the stocks that were considered to be in the most critical state may determine the advice on stocks taken together with the critical stocks. This second step was therefore to identify the species within mixed fisheries that had the most restrictive catch limits, because such constraints, when applied across all species in mixed fisheries, further limited fishing possibilities. The single-stock exploitation limits were combined in relation to fisheries on an area basis in Section 3 of the report.

(iii) The third and final consideration regarded the ecosystem concerns that were not related to one specific stock, but rather to mixed fisheries or to groups of stocks. Such concerns may, for instance, include habitat and biota impacts of dragged gear, incidental bycatch of non-commercial species, and food-chain effects when such impacts were known. Ecosystem concerns may represent further boundaries to fisheries beyond those implied by single-stock concerns and mixed-fishery issues.

The overall advice for mixed fisheries was therefore threefold: (i) limit the harvest of a critical stock as bycatch or of a targeted catch to the limit applying to that stock across all fisheries; (ii) harvest within single-stock exploitation boundaries for all other stocks; and (iii) in the event that further ecosystem impacts of fisheries beyond removal of the stocks included in the assessments were identified, such concerns may further restrain specific fisheries. The consequence may be that a fishery may fish less

than the single-stock exploitation boundary for its target stocks if a critical stock was taken as a bycatch or other ecosystem concerns were to be addressed.

6.11 Martin Pastoors (2006–2007)



The final two years of ACFM before it was dissolved and merged into a single ICES Advisory Committee (ACOM) were already heavily influenced by the need for integrating scientific advice.

In negotiations on the new Memorandum of Understanding between ICES and the European Commission, the timing of the provision of fishery advice became an important issue. Commissioner Joe Borg requested that ICES propose an advisory process that generated all the fishery advice in June instead of the previous situation where two sets of advice were released: one in early June and the second in October. The early provision of advice was expected to allow more time for consultations and deliberations before the next fishing year (e.g. with reference to the role of the Regional Advisory Councils, RACs).

In the letter sent on behalf of ICES, President Michael Sissenwine raised two important issues that would hinder the early provision of advice:

> "Resource survey data collected during the summer months will not be available at the time June advice is prepared. This could make it necessary to revise advice in some years to take account of new data from a summer survey.
>
> The seasonal workload of national laboratories and scientists that prepare fisheries management advice will increase, because scale and otolith samples from the latter part of the previous year will need to be processed more rapidly."

Although it was thought that a full transition in timing would not be possible in 2006, ICES offered an interim solution to make available the peer-reviewed assessment reports that provided the basis for the October advice in August 2006, so that management consultations and deliberations for 2007 could start earlier than previously.

The idea to reduce the workload of assessment expert groups had already been discussed for many years. Formally, a system of benchmark, observations list, and updated assessments had been initiated in 2004, but in practice, this was not closely adhered to by expert groups because of unforeseen and important deviations in data or assumptions.

The first real reallocation of the timing of an expert group was in 2007 when the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak was rescheduled to meet in May instead of October, but with an additional session by correspondence in September. This resulted in early advice for the stocks covered by the Working Group, but the revisions in September still proved to be substantial for several stocks.

The requests for a change in timing of the advice, in combination with the requirement to integrate the fishery, ecological, and environmental advice better, gave impetus to the reform of the advisory process. In July 2006, a Brainstorming Meeting on the ICES Advisory Process was held in Dublin (ICES, 2006b), to discuss the future of an integrated advisory process. During that meeting, which was attended by the chairs of the advisory committees, leadership of the ICES Secretariat, the ICES President, and a number of national ICES Delegates, the contours of the new advisory

process were drafted, which would later (in 2008) be developed into the ICES Advisory Committee (ACOM). All through 2006 and 2007, the reform of the advisory process would take substantial time and much effort by the advisory committees and the expert groups. The ACFM Consultation at the September 2007 ASC (Helsinki, Finland) was exceptionally heated on the issue. The reason was that the "sandwich approach" of an earlier provision of advice in combination with limiting the time available for expert group work was considered by a number ACFM members and working group chairs to be counterproductive to the provision of more-integrated advice. It was only after a long, extra session on a Friday afternoon that ACFM agreed to the reform proposal to be tabled at the meeting of Delegates in early October. The proposal essentially consisted of combining the three existing advisory committees (ACFM, ACME, and ACE) into a single advisory committee (ACOM) that would be devoted to designing the strategic approach to advice. The real advisory work was foreseen to be developed by Advice Drafting Groups, which would receive inputs from several relevant expert groups and which would write the integrated advice. The proposal also incorporated a combination of the review process with the advice-drafting process. The ICES Council decided in November 2007 to adopt the new advisory system, but changed the proposal to maintain a separate role for the review groups. Formally, the advisory committees (ACFM, ACME, and ACE) were dissolved on 31 December 2007. In practice, the new ACOM came into being in February 2008.

Figure 6.12. Last meeting of ACFM held at ICES Headquarters, H. C. Andersens Boulevard 44–46, Copenhagen, October 2007. Seated (left–right): Michala Ovens, Dankert Skagen, Martin Pastoors, Yuri Efimov, Frans van Beek, and Einar Hjörleifsson. Standing (left–right): Christian Olesen, Ari Leskelä, Barbara Schoute, Sigurd Tjelmeland, E. John Simmonds, Jesper Boje, Alain Biseau, Henrik Sparholt, Gary Shepherd, Denis Rivard, Joachim Gröger, Maurice Clarke, Jan Horbowy, Fátima Cardador, Massimiliano Cardinale, Valentin Trujillo, Michele Casini, Sarunas Toliusus, Maris Plikshs, Hans Lassen, and Wim Demaré.

At the last meeting of ACFM in October 2007, the Chair organized a history session during which the participation of ACFM members from the beginning of ACFM in 1977 was tabulated. Of the active members then, Yuri Efimov (Russia) had the highest ACFM meeting attendance (26 meetings), but in the overall ranking, Bengt Sjöstrand (Sweden), then retired, ranked highest with 31 meetings. Special "awards" were allocated to Dankert Skagen (Norway) and Einar Hjörleifsson (Iceland) for philosophical contributions, to Frans van Beek (Netherlands) for his ongoing and persis-

tent efforts to clean up the language in ACFM reports, and, of course, to Margaret Moody (ICES Secretariat) for her amazing gourmet contributions to the ACFM dinners.

7 Controlling fishing mortality with TACs

The inherent problem in controlling fishing mortality with annual TACs (total allowable catches) has been discussed regularly by the ICES community for many years. One good example is in the report of the Working Group on Methods of Fish Stock Assessments held in St John's, Newfoundland, 20–27 June 1991 (ICES, 1991c).

There is also rich literature from the Northwest Atlantic. Sinclair *et al.* (1990) noticed that retrospective analysis of the assessments made using current methodology sometimes indicate significant biases in estimates of both fishing mortality and population abundance. In such analyses on real datasets, the most recent assessment has to be used as the best estimate of reality.

7.1 TAE or TAC

Reference is made to Section 2.4 describing the developments in the Northeast Atlantic towards the general use of TACs by fishery managers to control fishing mortality. It is not difficult to understand that it is easier to allocate TACs than total allowable effort (TAE) between countries. However, the focus on TACs has meant that information on fishing fleets and their activities and research on other management measures, such as technical measures and closed areas, have remained on the "back burner".

7.2 Controlling fishing mortality in the Northeast Atlantic

Many fishery biologists in the Northeast Atlantic have been feeding what has been called "the TAC machine" for the past four decades (Holm and Nielsen, 2004; Schwach *et al.*, 2007). The fishery management authorities in Iceland, Norway, the Russian Federation, and the EU, as well as regional fishery management organizations (NEAFC, NASCO), have requested advice on annual TACs from the provider of almost all scientific advice in the region, the International Council for the Exploration of the Sea, ICES. The only exception has been the fishery authorities in the Faroe Islands, which, since 1996, have run a TAE regime for their mixed demersal fisheries for cod, haddock, saithe, and other demersal species.

It should be noted that two of the foremost examples of successful TAC management are found in the Northeast Atlantic: (i) the recovery of the Norwegian spring-spawning (Atlanto-Scandian) herring stock; (ii) the rebuilding of the Northeast Arctic cod stock to levels even higher than just after World War II. Gezelius and Raakjær (2008), however, point out that the costs of control and enforcement in the Norwegian management system are significant.

For obvious reasons, effort management does not make sense in pelagic fisheries, where TACs have to be used. In recent years, though, the EU has introduced limits on fishing days on top of the TAC regimes. ICES, in its 2012 advice for 2013[9], presents

[9] http://www.ices.dk/committe/acom/comwork/report/2012/2012/mix-nsea.pdf

options for mixed fisheries in the North Sea, advice based on single-stock assessments combined with knowledge of the species composition of catches in North Sea fisheries. Furthermore, ICES has provided multispecies considerations for Baltic Sea fish stocks, which incorporate knowledge of the impacts fish stocks have on each other. These considerations serve as a starting point for a dialogue between ICES and policy-makers to foster the development of a multispecies approach to fisheries management in the Baltic[10].

7.3 Controlling fishing mortality: two ways to use stock assessments

Estimates of fishing mortality from stock assessments can be used in various ways to underpin management measures aimed at controlling fishing mortality. The most common is to calculate TACs by forecasting the catch corresponding to desired levels of fishing mortality, i.e. TAC management. Another approach is to use historical levels of fishing mortality to estimate partial fishing mortalities and catchabilities by fishing vessel categories, link effort to fishing mortality, and allocate effort to each category, summing to the desired level of total fishing mortality, i.e. TAE management. Using the assessments of the demersal fisheries in Faroe Islands waters as a case study, these two approaches and their inherent problems have been described by Hoydal (2012).

7.4 TAC management: forecasting problem

The problems associated with TAC assessments have been discussed regularly within ICES. Bertelsen and Sparholt (2002), in an internal ACFM document, discussed the problem of estimating spawning–stock biomass (SSB) in the TAC year. They compared estimates in the year of advice with "true estimates", i.e. estimates from years where the estimates of SSB had converged. In their summary, they conclude that "six of the most important and best monitored stocks were analyzed for correlation between forecasted and realized SSB. The correlation was very low and not significant for any of the stocks." Those six stocks were North Sea cod, North Sea plaice, North Sea sole, North Sea herring, central Baltic cod, and Northeast Arctic cod.

In the document too, reference was made to earlier studies by Brander (1987), Cook *et al.* (1991), and Patterson *et al.* (2000). A study by van Beek and Pastoors (1999) showed that there was no correlation between predicted and realized fishing mortality. Actually, there is reasonable literature on the problems of advising on fishing mortality and stock levels and the reasons for not getting it right. In the van Beek and Pastoors (1999) document, some explanations were offered as to why there was a lack of correlation, but the fact remained that both stock and fishing mortality estimates that were the basis of the annual advice offered to managers were inherently inaccurate. In addition, they were prone to be affected by factors not taken into account in the assessment. A well-known example is the advice on Northeast Arctic cod in 1986 (see Section 6.4.3).

[10] http://www.ices.dk/news-and-events/Documents/Press%20releases/20120730%20ICES_Advice_Press%20release.pdf

Jesper Raakjær Nielsen and John G. Shepherd described the situation in precise terms. Nielsen, speaking at the FAREC International Conference 2004[11], noted that fisheries policy is based on the assumption that processes and quantification in biological and social systems are understood and can be predicted. Mainstream models are based on single-stock approaches and are deterministic or probalistic because of the precautionary approach. The tendency to add new regulations as new problems are encountered has led to too much focus being placed on micromanagement. The mainstream approach has not respected the limits to precision in predictions, and management requirements have bypassed what science can deliver and undermined the acceptance of science by fishers. He stressed the need to tackle the basic fishing capacity problems and the need for more simple, transparent, and tailor-made management measures to solve specific problems.

The problems with TAC regimes in the North Sea and under the EU Common Fisheries Policy were described by Shepherd (2003).

> "Fishing effort is difficult to measure accurately, and comparisons between different types and sizes of boats and different gears are very difficult to make. However, in adopting effort control we would be accepting that fine-tuning the management of individual stocks in a fishery is impossible, and that effective but broad-brush control would be preferable to the apparent (but actually ineffective) precision management using TACs and quotas. A broad-brush but enforceable measure of fishing effort would therefore be acceptable. Whatever we choose, we must be able to monitor it effectively, and ensure that any restrictions imposed can actually be enforced in practice. For both these reasons it seems probable that something like days-at-sea would be the most practicable starting point. Measures which are more closely related to fishing activity, like days or hours fished, would of course be preferable in principle, but could not be used unless ways of monitoring and enforcing them effectively can be devised."

7.5 Relationship between ICES and the fishing industry

The problems with TAC management have affected the relationship between ICES and the fishing industry. Relatively late in the ACFM period, the industry became involved in certain aspects of the production of advice. The "*ex cathedra*" delivery[12] of the advice had been accused of giving the impression that the scientists make the real decisions on TACs, leading industry to focus on the advice rather than on management decisions on quotas and their implementation.

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[11] In presentation at FAREC International Conference 2004: Fisheries management systems: does the practice follow the theory? Held 3-4 June 2004 in Tórshavn, Faroe Islands (http://archive.neafc.org/reports/annual-meeting/am_2004/docs/2004-15_torshavn_conf.pdf)

[12] Discussion Paper. Improving decision-making for fisheries management: elements of effective fisheries management with a focus on the Faroe Islands. Fisheries Cooperation Joint Meeting on 21 April 2010. Nordic countries.

Some big problems in some important assessments created mistrust in the industry. The 1986 assessment of Northeast Arctic cod – that of blue whiting at the start of the 2000s and those of demersal stocks around the Faroe Islands in the early 1990s, are examples where the assessments clearly were wide of the mark.

8 External view

Two academic papers are summarized in this chapter. The first is a PhD thesis entitled "Fisk, forskning og forvaltning – en analyse af Nordsøens fiskerirådgivning, 1974–2002" (Fish, research and management - an analysis of North Sea fisheries advice, 1974–2002) by René Taudal Poulsen, Centre for Maritime and Regional Studies, University of Southern Denmark, Esbjerg (Poulsen, 2002). The second is a paper by Vera Schwach, Denis Bailly, Anne-Sofie Christensen, Alyne E. Delaney, Poul Degnbol, Wim L. T. van Densen, Petter Holm, H. Anne McLay, Kåre Nolde Nielsen, Martin A. Pastoors, and Stuart A. Reeves entitled: "Policy and knowledge in fisheries management: a policy brief "(Schwach *et al.*, 2007) published in the ICES Journal of Marine Science as part of the Proceedings of the 2006 ICES Symposium on Fisheries Management Strategies.

8.1 Fish, research, and management

Poulsen (2002) referred to the theories of Ulrik Beck and to the analysis by Finlayson (1994) on the role of biological advice in the collapse of the cod stocks on the Grand Banks and other stocks on the Canadian east coast. Beck saw a modern movement from the industrial society to a risk society, and in that new society, production of science lost its innocence and role as an agent for poverty alleviation and was seen as an activity that increased risk. A new understanding of nature provides nature with a fresh political dimension, and minimizing risk becomes a central concern. In that situation, it is the responsibility of science to identify the consequences of technological development, but in doing so, science cannot provide truth, but must accept that science is based on hypotheses that cannot be proven (only falsified).

Following Beck, Poulsen asked how fishery biologists have handled risk. Is fishery science without truth? Have the advisers been feudalized by the managers requiring advice?

In his book "Fishing for Truth", Finlayson (1994) sought to analyze the Canadian fisheries advice for cod off Newfoundland in the years 1977–1990. Basically, Finlayson pointed out that the advice failed because it was too optimistic and fishery biologists did not acknowledge the uncertainty in the stock assessments. Finlayson is a sociologist and wanted to identify the institutions behind this disservice. He notes that the scientists did not give any options to the managers, because they were afraid that the managers would always choose the highest one. On the other hand, managers did not want options, because of the complicated political decision process and not being able to handle uncertainty. He also stated that the institutions had no incentive to listen to the fishers or to solicit their information; there were groups of fishers, especially those inshore, who expressed concern about the stock situation.

Poulsen gave a detailed, and fairly accurate, description of the discussions at ICES, starting with the pre-ACFM statement (ICES, 1977). He saw the tone of the report as very confident on behalf of the biologists and quoted from the report:

> "Because biologically based objectives such as the highest physical yield from a resource has been thought to represent a more generally acceptable aim for fisheries management than for instance economic objectives, fishery scientists have played a primary role in formulating and promoting objectives for resource management."

The message was clear: biology rules. Poulsen referred to a critique from Niels Daan[13]. Daan especially criticized the $F_{0,1}$ target, finding it to be arbitrary and misleading when natural mortality is unknown. Basically, he stated, it is an economic measure, not a biological one, so he felt that biologists should abstain from recommending such measures on which they had no expertise. Instead they should limit themselves to illustrating changes in biomass and catch per unit of effort at different levels of fishing mortality, giving them a less prominent role. At the time, Daan's view was not common in ICES.

Discussions on the advice given in the first years of ACFM, especially on North Sea mixed fisheries, were influenced by scientific progress in handling multispecies effects. In 1977, Andersen and Ursin (1977) had published their seminal article on extending the Beverton–Holt model from single species to multispecies considerations. Already in 1981, an ICES working group was looking at multispecies advice in the Baltic (ICES., 1981d). Technical interactions, interactions between fleets fishing the same stocks, were also discussed at the time, and questions were being raised about the rationale of just looking at single-stock assessments.

Poulsen believed that ICES in the first five years of ACFM had been authoritative. The advice was to reduce fishing mortality by a small amount (generally 10% annually for each single stock). At the same time, it had been clearly expressed at Dialogue Meetings that managers wanted "clean" biological advice and options.

The role of the advisers changed when ACFM decided to give options and to proceed from "normative" to "exploratory advice (Hoydal, 1983). Managers were informed about this at the Fourth Dialogue Meeting in October 1982. Poulsen saw this as biologists steering away from the authoritative role; managers would have to decide on targets. In continuous dialogue with the main customers of ICES, the form of advice had been changed (safe biological limits), but in situations where managers were not setting targets, explorative advice was the sensible option. At the same time, ACFM made a plea for including scientific assessments of social and economic questions in the advice. It was pointed out that, as a start, stock assessments on a fleet basis may be one way to do this, and for some stocks, the data required might already be available.

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[13] Taken from an interview of Niels Daan, Netherlands Institute for Fisheries Research, IJmuiden, on 9 March 2000 by Helen M. Rozwadowsi for her book, "The Sea Knows no Boundaries: A Century of Marine Science under ICES".

Poulsen saw the scientific discussion in the period up to 1987 as dominated by multi-species considerations and a search for defining reference points other than $F_{0.1}$ and F_{max}. The work of the Working Groups on Methods of Fish Stock Assessments and Multispecies Assessment clarified the consequences of different reference points and suggested that universal reference points probably were not the answer. In the same period, the need for conservation became more prominent, whereas optimizing catches was not so important.

Poulsen also observed that since TACs were the only product demanded from managers, this caused problems for the advisers, especially in mixed fisheries in the North Sea. The perennial problems with discards and unreliable catch data cast doubts about the whole point of advice and management. Poulsen also defined 1991–2001 as a period dealing with risk and uncertainty, saying, "Where possible, ACFM also takes uncertainty into account by providing indications of the biological risk associated with particular management options."

The new reference points that were developed did not set targets, but aimed at avoiding risk, moving the advisers farther from any decision-making. Giving up on delivering advice on "best solutions" was seen by some as a defeat for biologists, but others saw it as realizing the limits of advice and the role of biologists.

Poulsen finally dealt with how ACFM met the international developments in the latter half of the 1990s and onwards: the precautionary approach and the ecosystem approach.

8.2 Policy and knowledge in fisheries management: a policy brief

The second paper (Schwach *et al.*, 2007), summarized below, is based on the EU's Policy and Knowledge in Fisheries Management project that focused on the scientific knowledge base for current management system in European fisheries. It gave a very informative overview of all aspects of the advisory process and the interface between management and science. According to the paper's abstract:

> "The EU project Policy and Knowledge in Fisheries Management investigated the use of biological knowledge in various parts of the fisheries system, using North Sea cod as a case study. The project examined the way scientific advice was generated from technical and institutional perspectives, as well as the way claims about science appeared in both policy-setting and in public debate through the press. The results suggested that many people involved in the system want a new way to reflect about science in management. People from all major stakeholder groups are calling for a more interactive system of producing a common knowledge base. Such a system could bring uncertainty from its current marginal role as the leftovers of certainty to the heart of the science process. It would require stakeholders to help address uncertainty and to negotiate a more realistic placement of burden of proof."

The choice of North Sea cod here was important because the assessment of that stock over the years had caused, perhaps, the greatest problem for the advisory system and had sparked a number of academic papers that scrutinized the assessments, the advice, and its results in controlling fishing mortality.

The article stated the following:

> "The current management system in EU waters is widely acknowledged to be performing poorly in terms of sustainable exploitation (CEC, 2001). In 2003, 22% of the stocks managed under the Common Fisheries Policy (CFP) were outside safe biological limits (ICES, 2005b). A feeling of distrust has developed among all groups of actors, and the overall legitimacy of the CFP has been called into question. Perhaps the most important positive aspect of the situation is that so many people from so many different parts of the fisheries system recognize the need for change. Solutions are being sought within the present stock-based total allowable catch (TAC) system and through an examination of alternative systems. In both cases, it will be important to consider and actively integrate non-biological information, and to consider technological, socio-economic, and political processes. The suitability of a single-species TAC as the main management tool for mixed fisheries, such as those exploiting a suite of demersal species in the North Sea, including cod, is questionable, because of the multispecies, multifleet nature of the fishery (Daan, 1997).
>
> "The annual scientific advice produced as the TAC machine grinds away is a core element of the management of the cod fishery. We evaluate cod advice through a historical analysis of the work done within the relevant ICES assessment working groups (WG) up to and including 2002 (see Reeves and Pastoors, 2007, for details)."

Regarding the production of scientific advice, the authors evaluated the principal tools, some form of VPA coupled with a short-term catch forecast. The paper noted that:

> "The evaluation indicated a methodological development phase characterized by frequent changes in the tuning models used before 1987, followed by a period of more stability in model choice (1987–1995), during which the VPA performed quite consistently (Reeves and Pastoors, 2007). However, assessments since 1997 have been characterized by substantial bias, mean F in the most recent year being underestimated by some 30% compared with the most recent estimates for the same years, and stock numbers overestimated. Retrospective patterns of this form have been noted in assessment of other stocks (ICES, 1991c; Mohn, 1999; Jónsson and Hjörleifsson, 2000) and may arise from changes in catch data, abundance indices, or model assumptions.
>
> "The assessment model introduced after 2002 and currently in use allows for either possibility through estimation of removals that are not accounted for in

> the landings, such as discards, illegal landings, or losses through increased natural mortality."

The paper also investigated the problems associated with other estimates that affect the short-term forecasts which are the basis for TACs, and noted that:

> "Short-term forecasts have always been overly optimistic. This has been caused primarily by overestimating recruitment in the current year and the year ahead, although in some years this has been exacerbated by overestimating weights-at-age, and also by the bias in VPA stock numbers during recent years (Reeves and Pastoors, 2007)."

It was also noted that:

> "The problems that have arisen cannot be attributed to lack of expertise or time, although workloads have increased (Reeves and Pastoors, 2007). Rather, they may be attributed, at least in part, to the form of advice required. In particular, systematic overestimation of incoming year classes in recent forecasts is linked to a series of below-average year classes, which may in itself be partly the consequence of a reduced spawning stock associated with the high rate of exploitation. Therefore, the assessment/advisory system appears to become less effective when the stock is in greatest trouble. The results also suggest that scientific resources could have been deployed more effectively if there had been more reflection, i.e. more regular monitoring of assessment quality and forecasts to detect and respond to problems as they occurred. Perhaps the WG also had a tendency to address mainly the mathematical aspects of problems, where more biological input might have been useful (Reeves and Pastoors, 2007).
>
> "The TAC machine has a tremendous impact on the way fisheries science is conducted and on the professional lives of scientists. We observed nine WG and committee sessions related to the production of scientific advice. In addition, 29 formal in-depth interviews with fisheries scientists and close observers of the advisory process were carried out, as well as a random-sample attitude survey of European fisheries scientists, with a total of 465 (51% response rate) valid responses (Wilson and Delaney, 2005; Wilson and Hegland, 2005).
>
> "Scientists were found to be under systematic pressure to 'inflate the natural science boundary', by which we mean various efforts to expand the range of issues that can be resolved legitimately through the methods and investigations available to them. Fisheries scientists are being asked more and more to expand their models to deal explicitly with allocation problems, and to address problems and concepts more directly suited to the social and economic sciences, such as requests for fisheries-based rather than stock-based advice. The scientists are resisting these pressures because they prefer to stick to questions that they are well suited to answer, given their scientific and methodological training. The drivers behind the inflation of the science boundary

are the large and real problems faced by managers in trying to identify objective grounds on which to base politically sensitive decisions. Based particularly on our investigation of the communications between the CEC and ICES, the needs of managers might best be characterized as 'flexible advice with no room for interpretation'. This need is real even if paradoxical. Managers require flexibility to be able to make politically acceptable decisions, but they cannot justify their decisions with scientific advice if that advice can be interpreted in different ways.

"These tensions take institutional form, for example, in the situation where the same scientists are employed to provide advice under the separate rubrics of ICES and STECF (Scientific, Technical and Economic Committee for Fisheries of the EU).

"The TAC machine has negative effects on the scientists involved. Fisheries scientists, on average, scored their job satisfaction well above the mean of our survey's scale. However, assessment scientists, while still scoring above the mean of the scale, scored significantly lower than other scientists. The lower satisfaction is linked to the great demand to travel and to frustrations about their chances to produce peer-reviewed scientific publications. Stock assessment work is seen by many as repetitive and boring, 'engineering' more than science.

"Perhaps the most serious observation was a growing belief among scientists that their activities are far from their understanding of what science is. This point may be illustrated by quoting a scientist discussing North Sea cod during a WG: '[instead of] adding another rinky-dink, we should stop pretending we know how many fish there are'. In our survey, 16% stated that they sometimes, and 60% that they often or very often, feel like they are being asked to create certainty that is not really there, whereas 14% and 56%, respectively, similarly described their feeling about being asked to answer impossible questions. Many scientists in the advisory system see themselves as being asked to play a difficult role under sometimes trying conditions, then having the results of their efforts changed by the management system into a decision that they no longer see as based on scientific knowledge.

"The poor performance of North Sea cod management is an indication of systemic weaknesses in the management system as such, and in the policy subsystem in particular. We came to this conclusion after conducting and analysing 30 interviews with key participants and observers in the management processes of North Sea cod from EU Member States and Norway, and detailed examinations of relevant policy documents (see Wilson and Delaney, 2005, for details).

"The TAC machine has been constructed to solve political problems, particularly in relation to the principle of relative stability (Holden, 1994). The TAC

is a consequence of the strong commitment within the EU to allocate resources among member states. Relative stability is operationalized as fixed percentage shares of the TAC for single species. Although relative stability can be translated, in principle, into other regulatory mechanisms (e.g. effort control), such transformations are bound to be contestable because of their inherent complexity, for example in the context of mixed-fisheries issues. The TAC machine constitutes an instrument to control the effects of all fisheries combined on individual stocks, and also to provide suitable measures for political negotiation, especially for achieving compromises on resource allocation. These factors have contributed to the apparent institutional success of the TAC machine (Holm and Nielsen, 2004).

"Despite its institutional success, the capacity of the TAC system to adapt to an unpredictable but continuously changing ecosystem within which the fisheries operate is extremely limited. The situation would have been less severe if the recipients of the advice had been able to respond to the warning signals embedded in the advice, particularly to frequently repeated reminders that the agreed TAC was failing to control fishing mortality sufficiently. Within the mixed fisheries context, the reliance on catch forecasts as the diagnostic tool and on single-stock TAC as the intervention instrument has obvious and foreseeable weaknesses. The combination of these weaknesses with large overcapacity of fleets and inadequate monitoring, control, and surveillance creates a system prone to failure."

9 Still outstanding for ACOM

The ongoing discussions in ICES addressing all problems related to the advice, the search for perfection to make the ICES machinery more efficient, to provide more focus on the fisheries and the fishing fleet, integrating ecosystem concerns into the fishery advice, and sorting out the thorny question of the interface between science and advice is still ongoing beyond ACFM.

The External Panel, 2011–2012 to Review ICES Advisory Services (ICES, 2012a, 2012b, 2012c) gave, *inter alia*, the advice in the sections below on outstanding problems.

9.1 Data problem

In recent years, there have been problems with delivery of fishery data by certain countries, the data are often provided in an aggregated form, and the system for providing data to ICES expert groups is not as transparent as it should be. The models used by ICES are generally credible, and there have been recent efforts to introduce more statistically sound ones. The Review Panel commends the initiatives taken by ICES to develop its role in providing integrated advice.

The Review Panel recommends that ICES consider introducing a formal data call system for data used by the expert groups in assessments. The data should not be aggregated and should be specified in detail. A data call for recurring advice could be issued annually, and data calls for non-recurring advice could be issued as necessary.

9.2 Direct clients and the scientific community

The Review Panel believes that ICES advice is relevant and credible, but that communication between the direct clients and the scientific community is poor, especially for communication to stakeholders and public media. The Review Panel notes that it is important that the advice, though based on science, be developed in a dialogue between ICES and the recipients of the advice.

The Review Panel recommends that ICES continually evaluate the format of the ICES advice from the perspective of the recipient, and that ICES consider establishing a public-relations strategy focusing on ways to "translate" ICES advice into language understandable by the general public.

The Review Panel recommends that ICES consider changes in how the advice is delivered, from the present "*ex cathedra*" approach to an approach with greater communication with the advice recipients, to ensure that the advice is useful and understood.

9.3 ICES business model and pressure on the scientific community

The Review Panel believes that the management of the ICES advisory process is appropriate, but that the process is overstretched. The Review Panel believes that workload and access to human resources for the ICES advisory process is a problem, primarily because too few scientists are doing most of the work. Access to the required

science expertise seems adequate, but here too, resources are being stretched. The Panel notes that ICES cannot force member countries to participate in preparing ICES advice, and that funding for national institutes is very tight. Also, the Panel believes that the ICES advisory process does not provide sufficient incentives for individual scientists to participate, such as payment for services or advancement of scientific careers.

The Review Panel recommends that ICES considers using the Secretariat to play a larger role in conducting update assessments and in generally supporting the advisory process. ICES might also consider contracting individual experts or institutes to conduct the update assessments.

It also recommends that ACOM considers the overlap between advice drafting groups and ACOM, to design a more efficient process, and that ICES investigates the possibility of establishing a more robust review system, based on information of how independent peer reviews are undertaken outside Europe.

9.4 Addressing policy and societal needs

This cannot be said with respect to creating a basis for making societal and policy choices. How a particular societal choice will affect social groups and communities must be measured in socio-economic terms. With respect to fishery advice, this is exacerbated by the focus on stock assessments in the advice and the lack of description of the affected fisheries.

The Review Panel recommends that ICES widen the scope of the ICES advice to include descriptions of the various industry sectors having an impact on the oceans, their economies, and the social conditions of dependent communities. This includes data on fleet activity and economy, and the dependence of fishing communities on these activities.

9.5 Outstanding issues at end of ACFM era

From the outset, members of ACFM had a reasonable understanding of the precarious relationship between managers and scientists, and the proper roles of these two groups in setting up robust management systems. This was the backdrop to many of the early discussions on normative and exploratory advice.

Despite numerous Dialogue Meetings involving managers, scientists, and fishing industry representatives, and the opening up of input from the industry, a robust balance between the various actors on the fisheries scene was not evident at the end of the ACFM era. The perception that scientists were ultimately in charge and dictated the subsequent year's fishing possibilities to the other partners of the fishery system remained a serious problem, and that perception was strengthened by the role of scientists in evaluating management plans, deeming them sustainable or not.

The problem was confounded by the lack of success in bringing evident improvements to the scientific basis into mainstream advice. Major and commendable attempts within ICES to improve science by positioning individual stocks and fisheries

into a larger context were neither absorbed into the mainstream ICES advice nor affected the requests for advice from managers. There are some major examples of this:

- Following Andersen and Ursin's seminal work in the 1970s, massive effort went into modelling and acquiring data for multispecies interaction (i.e. the "Years of the Stomach" in 1981 and 1991) and technical interaction (i.e. interaction between fishing fleets), thus bringing advice beyond the single stock and single fishery approach.
- Reports in the 2000s on fishery systems aimed at placing advice as part of larger fishery systems.
- Dedicated attempts in the late 1990s and early 2000s to produce robust estimates of B_{pa}, F_{pa}, B_{lim}, and $B_{pa,,}$ fundamental to the precautionary approach, did not succeed for some stocks.
- The focus on stock assessments took the focus off fishing fleets and fleet monitoring, and their effort has been on the "back burner" for many years, including quantitative assessments of other management tools, such as closed areas and gear measures.
- The inherent uncertainty in the annual TAC point estimates that correspond to desired levels of fishing mortality has so frequently been demonstrated in retrospective analysis.

Requests to scientists should always be "If we set fishing mortality at such and such a level, what will the consequences be?" rather than "Recommend a certain fishing mortality level", which sadly is much more common.

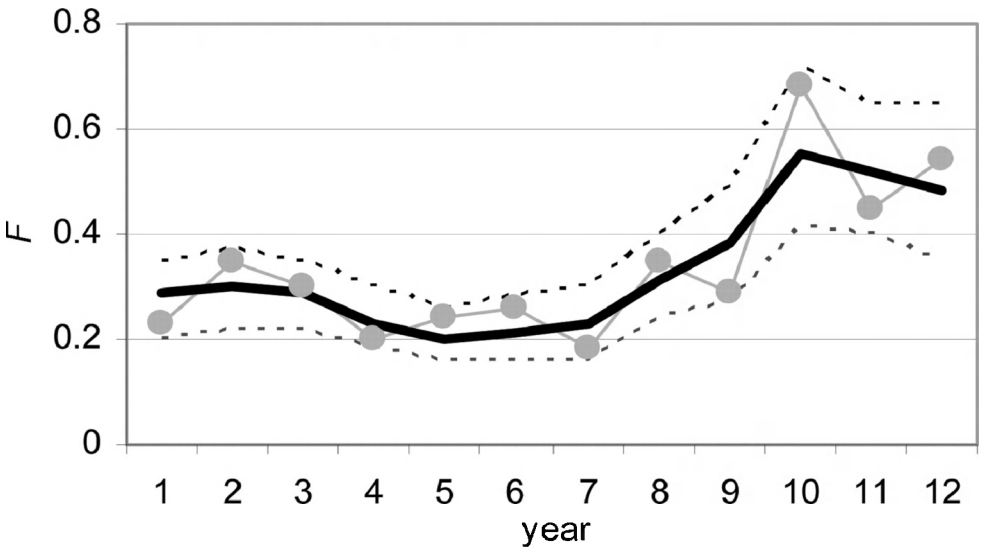

Figure 9.1. Annual point estimates (dots), "true" value (solid line), and confidence limits (dashed lines) of fishing mortality from a hypothetical assessment (from Hoydal, 2007).

These facts should have made the delivery of advice more "humble" and spurred ACFM to provide its advice with more caveats, explanations of risks, and, as a whole, treat parts of the advice as "forward-looking statements" within the meaning of the

United States Private Securities Litigation Reform Act of 1995[14], as done in other marine industry sectors. By its very nature, forward-looking information involves many assumptions as well as known and unknown risks and uncertainties, both general and specific. Although it is believed that the expectations represented by such forward-looking statements are reasonable, there can be no assurance that such expectations will prove to be correct (Hoydal, 2007).

ACFM should, in many instances, have resisted the requests to provide advice every year, although such requests are understandable in a situation where many stocks had been fished at far too high levels of fishing mortality, and the fisheries were, to a large extent, dependent on recruitment. A lot of fuss and effort could have been avoided, for example by setting TACs for three-year periods for those stocks that had a favourable age distribution.

[14] http://www.gpo.gov/fdsys/pkg/PLAW-104publ67/content-detail.html

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Annex 1: Participants at meetings of the Advisory Committee on Fishery Management, 1977–2007

1977/1978

Affiliation	Member	Alternate
Chair	Alan Saville	
Chair, Demersal Fish Committee	Claude Maurin	
Chair, Pelagic Fish Committee	Jakob Jakobsson	
Chair, Baltic Fish Committee	Ole Bagge	
Belgium	Rudy De Clerck	
Canada	L. Scott Parsons	
Denmark	Kristian Popp Madsen	
Federal Republic of Germany	Albrecht Schumacher	
Finland	Veikko Sjöblom	
France	Alain Maucorps	
German Democratic Republic	Bernhard Vaske	
Iceland	Sigfus M. Schopka	
Ireland	David de G. Griffith	
Netherlands	Klaus H. Postuma	
Norway	Øyvind Ulltang	
Poland	Józef Popiel	
Portugal	Emygdio Cadima	
Spain	Alvaro Fernández	
Sweden	Bengt Sjöstrand	
UK	David H. Cushing	
USA	Bradford E. Brown	Robert L. Edwards
USSR	Alexander S. Bogdanov	
ICES Statistician, ACFM Secretary	Vadim Nikolaev	

1978/1979

Affiliation	Member	Alternate
Chair	Alan Saville	
Chair, Demersal Fish Committee	Kjartan Hoydal	
Chair, Pelagic Fish Committee	Jakob Jakobsson	
Chair, Baltic Fish Committee	Ole Bagge	
Belgium	Rudy De Clerck	
Canada	L. Scott Parsons	William G. Doubleday
Denmark	Kristian Popp Madsen[1]	
Federal Republic of Germany	Albrecht Schumacher	
Finland	Veikko Sjöblom	
France	Alain Maucorps	
German Democratic Republic	Bernhard Vaske	
Iceland	Sigfus M. Schopka	
Ireland	David de G. Griffith	
Netherlands	Klaus H. Postuma	
Norway	Øyvind Ulltang	
Poland	Józef Popiel	
Portugal	Emygdio Cadima	
Spain	Alvaro Fernández	
Sweden	Bengt Sjöstrand	
UK	David H. Cushing	
USA	Bradford E. Brown	Robert L. Edwards
USSR	Alexander S. Bogdanov	
ICES Statistician, ACFM Secretary	Vadim Nikolaev	

[1]Replaced by Hans Lassen in October 1979. [2]Replaced by Vasiliĭ P. Ponomarenko in October 1979.

1979/1980

Affiliation	Member	Alternate
Chair	Alan Saville	
Chair, Demersal Fish Committee	Kjartan Hoydal	
Chair, Pelagic Fish Committee	Ole Johan Østvedt	
Chair, Baltic Fish Committee	Ole Bagge	
Belgium	Rudy De Clerck	
Canada	Allenby T. Pinhorn	
Denmark	Hans Lassen	
Federal Republic of Germany	Albrecht Schumacher	
Finland	Veikko Sjöblom	
France	Alain Maucorps	
German Democratic Republic	Bernhard Vaske	
Iceland	Jakob Jakobsson	Sigfus M. Schopka
Ireland	David de G. Griffith	
Netherlands	Klaus H. Postuma	
Norway	Øyvind Ulltang	
Poland	Józef Popiel	
Portugal	Emygdio Cadima	
Spain	José A. Pereiro	
Sweden	Bengt Sjöstrand	
UK	David H. Cushing	
USA	Vaughn C. Anthony	Robert L. Edwards
USSR	Viacheslav K. Zilanov	Vasiliĭ P. Ponomarenko

ICES Statistician, ACFM Secretary	Vadim Nikolaev

[1]Replaced by Anthony C. Burd in July 1980.

1980/1981

Affiliation	Member	Alternate
Chair	Kjartan Hoydal	
Chair, Demersal Fish Committee	Anthony C. Burd	
Chair, Pelagic Fish Committee	Ole Johan Østvedt[1]	
Chair, Baltic Fish Committee	Otto Rechlin	
Belgium	Rudy De Clerck	
Canada	Ralph H. Halliday	
Denmark	Hans Lassen	
Federal Republic of Germany	Albrecht Schumacher	
Finland	Veikko Sjöblom[1]	
France	Alain Maucorps	
German Democratic Republic	Bernhard Vaske	
Iceland	Jakob Jakobsson	Sigfus M. Schopka
Ireland	David de G. Griffith	
Netherlands	Klaus H. Postuma	
Norway	Øyvind Ulltang	
Poland	Józef Popiel[1]	
Portugal	Emygdio Cadima	Ana Maria Tavares
Spain	José A. Pereiro	
Sweden	Bengt Sjöstrand	
UK	Alan Saville	
USA	Vaughn C. Anthony	Robert L. Edwards
USSR	Sergey A. Studenetsky[1]	Vasiliĭ P. Ponomarenko[2]
ICES Statistician, ACFM Secretary	Vadim Nikolaev	

[1]Unable to attend the November 1981 meeting. [2]Replaced October 1981 by Anatoly I. Mukhin, who participated in the November meeting.

April 1982

Affiliation	Member	Alternate
Chair	David de G. Griffith	
Chair, Demersal Fish Committee	Anthony C. Burd	
Chair, Pelagic Fish Committee	Ole Johan Østvedt	
Chair, Baltic Fish Committee	Otto Rechlin[1]	
Belgium	Rudy De Clerck	Frank Redant
Canada	Ralph H. Halliday	Richard Wells
Denmark	Hans Lassen	Kristian Popp Madsen
Federal Republic of Germany	Albrecht Schumacher	H. Peter Comus
Finland	Veikko Sjöblom[1]	Raimo Parmanne
France	Alain Maucorps	Jacques Guéguen
German Democratic Republic	Bernhard Vaske[1]	
Iceland	Jakob Jakobsson[1]	Sigfus M. Schopka[2]
Ireland	John Molloy	
Netherlands	Klaus H. Postuma	Rudolph Boddeke
Norway	Øyvind Ulltang	
Poland	Józef Popiel[1]	
Portugal	Emygdio Cadima[1]	Ana Maria Tavares
Spain	José A. Pereiro	Alvaro Fernández
Sweden	Bengt Sjöstrand	

UK	Alan Saville	
USA	Vaughn C. Anthony	Robert L. Edwards
USSR	Sergey A. Studenetsky[1]	Vasiliĭ P. Ponomarenko
ICES Statistician, ACFM Secretary	Kjartan Hoydal	

[1]Unable to attend. [2]Attended in place of member.

July 1982

Affiliation	Member	Alternate
Chair	David de G. Griffith	
Chair, Demersal Fish Committee	Anthony C. Burd	
Chair, Pelagic Fish Committee	Ole Johan Østvedt	
Chair, Baltic Fish Committee	Otto Rechlin	
Belgium	Rudy De Clerck	Frank Redant
Canada	Ralph H. Halliday	Richard Wells
Denmark	Hans Lassen	Kristian Popp Madsen
Federal Republic of Germany	Albrecht Schumacher	H. Peter Comus
Finland	Veikko Sjöblom	Raimo Parmanne
France	Alain Maucorps	Jacques Guéguen
German Democratic Republic	Bernhard Vaske	
Iceland	Jakob Jakobsson	Sigfus M. Schopka
Ireland	John Molloy	
Netherlands	Klaus H. Postuma	Rudolph Boddeke
Norway	Øyvind Ulltang	
Poland	Józef Popiel[1]	
Portugal	Emygdio Cadima[1]	Ana Maria Tavares
Spain	José A. Pereiro	Alvaro Fernández
Sweden	Bengt Sjöstrand	
UK	Alan Saville	
USA	Vaughn C. Anthony	Robert L. Edwards
USSR	Sergey A. Studenetsky[1]	Yuri Efimov[2]
ICES Statistician, ACFM Secretary	Kjartan Hoydal	

[1]Unable to attend. [2]Attended in place of member.

November 1982

Affiliation	Member	Alternate
Chair	David de G. Griffith	
Chair, Demersal Fish Committee	Anthony C. Burd	
Chair, Pelagic Fish Committee	Ole Johan Østvedt	
Chair, Baltic Fish Committee	Otto Rechlin	
Belgium	Rudy De Clerck	Frank Redant
Canada	Ralph H. Halliday	Richard Wells
Denmark	Niels Axel Nielsen[1]	Kristian Popp Madsen
Federal Republic of Germany	Albrecht Schumacher	H. Peter Comus
Finland	Veikko Sjöblom	Raimo Parmanne
France	Alain Maucorps	Jacques Guéguen
German Democratic Republic	Bernhard Vaske	
Iceland	Jakob Jakobsson	Sigfus M. Schopka
Ireland	John Molloy	
Netherlands	Klaus H. Postuma	Rudolph Boddeke
Norway	Øyvind Ulltang	
Poland	Józef Popiel[1]	
Portugal	Emygdio Cadima[1]	Ana Maria Caramelo[2]

Spain	José A. Pereiro	Alvaro Fernández
Sweden	Bengt Sjöstrand	
UK	Alan Saville	
USA	Vaughn C. Anthony	Robert L. Edwards
USSR	Sergey A. Studenetsky[1]	Yuri Efimov[2]
ICES Statistician, ACFM Secretary	Kjartan Hoydal	

[1]Unable to attend. [2]Attended in place of member.

May 1983

Affiliation	Member	Alternate
Chair	David de G. Griffith	
Chair, Demersal Fish Committee	Anthony C. Burd	
Chair, Pelagic Fish Committee	Alain Maucorps	
Chair, Baltic Fish Committee	Otto Rechlin	
Belgium	Rudy De Clerck	Frank Redant
Canada	Ralph H. Halliday	Richard Wells
Denmark	Niels Axel Nielsen	Kristian Popp Madsen
Federal Republic of Germany	Albrecht Schumacher	H. Peter Cornus
Finland	Veikko Sjöblom	Raimo Parmanne
France	Jacques Guéguen	Jean Dardignac
German Democratic Republic	Bernhard Vaske	
Iceland	Jakob Jakobsson[1]	Sigfus M. Schopka[2]
Ireland	John Molloy	
Netherlands	Klaus H. Postuma	Rudolph Boddeke
Norway	Øyvind Ulltang	Odd Nakken
Poland	Józef Popiel	Jan Netzel
Portugal	Emygdio Cadima[1]	Ana Maria Caramelo[2]
Spain	José A. Pereiro	Alvaro Fernández
Sweden	Bengt Sjöstrand	Johan Modin
UK	Alan Saville	David J. Garrod
USA	Vaughn C. Anthony	Robert L. Edwards
USSR	Vadim Nikolaev	Yuri Efimov
ICES Statistician, ACFM Secretary	Kjartan Hoydal	

[1]Unable to attend. [2]Attended in place of member.

October/November 1983

Affiliation	Member	Alternate
Chair	David de G. Griffith	
Chair, Demersal Fish Committee	Anthony C. Burd	
Chair, Pelagic Fish Committee	Alain Maucorps	
Chair, Baltic Fish Committee	Otto Rechlin	
Belgium	Rudy De Clerck	Frank Redant
Canada	William G. Doubleday	Ralph H. Halliday
Denmark	Niels Axel Nielsen	Kristian Popp Madsen
Federal Republic of Germany	Albrecht Schumacher	H. Peter Cornus
Finland	Veikko Sjöblom	Raimo Parmanne
France	Jacques Guéguen	Jean Dardignac
German Democratic Republic	Bernhard Vaske	
Iceland	Jakob Jakobsson	Sigfus M. Schopka
Ireland	John Molloy	
Netherlands	Klaus H. Postuma	Rudolph Boddeke
Norway	Øyvind Ulltang	Odd Nakken

Poland	Józef Popiel[1]	Jan Netzel[2]
Portugal	Emygdio Cadima	Ana Maria Caramelo
Spain	José A. Pereiro	Alvaro Fernández
Sweden	Bengt Sjöstrand	Johan Modin
UK	Alan Saville	David J. Garrod
USA	Vaughn C. Anthony	Robert L. Edwards
USSR	Vadim Nikolaev[1]	Yuri Efimov[2]
ICES Statistician, ACFM Secretary	Kjartan Hoydal	

[1]Unable to attend. [2]Attended in place of member.

May 1984

Affiliation	Member	Alternate
Chair	David de G. Griffith	
Chair, Demersal Fish Committee	Bernhard Vaske	
Chair, Pelagic Fish Committee	Alain Maucorps	
Chair, Baltic Fish Committee	Jan Netzel	
Belgium	Rudy De Clerck	Frank Redant
Canada	William G. Doubleday	Ralph H. Halliday
Denmark	Niels Axel Nielsen	Kristian Popp Madsen
Federal Republic of Germany	Albrecht Schumacher	H. Peter Cornus
Finland	Veikko Sjöblom	Raimo Parmanne
France	Jacques Guéguen	Jean Dardignac
German Democratic Republic	Otto Rechlin	
Iceland	Jakob Jakobsson	Sigfus M. Schopka
Ireland	John Molloy	
Netherlands	Klaus H. Postuma	Rudolph Boddeke
Norway	Øyvind Ulltang	Odd Nakken
Poland	Józef Popiel	
Portugal	Emygdio Cadima[1]	Ana Maria Caramelo[2]
Spain	José A. Pereiro	Alvaro Fernández
Sweden	Bengt Sjöstrand	Johan Modin
UK	David J. Garrod	
USA	Vaughn C. Anthony	Robert L. Edwards
USSR	Vadim Nikolaev[1]	Yuri Efimov[2]
ICES Statistician, ACFM Secretary	Kjartan Hoydal	

[1]Unable to attend. [2]Attended in place of member.

November 1984

Affiliation	Member	Alternate
Chair	Øyvind Ulltang	
Chair, Demersal Fish Committee	Bernhard Vaske	
Chair, Pelagic Fish Committee	Alain Maucorps	
Chair, Baltic Fish Committee	Jan Netzel	
Belgium	Rudy De Clerck	Frank Redant
Canada	William G. Doubleday	Ralph H. Halliday
Denmark	Niels Axel Nielsen	Kristian Popp Madsen
Federal Republic of Germany	Albrecht Schumacher	H. Peter Cornus
Finland	Veikko Sjöblom[1]	Raimo Parmanne
France	Jacques Guéguen	Jean Dardignac
German Democratic Republic	Otto Rechlin	
Iceland	Sigfus M. Schopka[1]	Ólafur Halldórsson[2]

Ireland	David de G. Griffith	
Netherlands	Klaus H. Postuma	Rudolph Boddeke
Norway	Odd Nakken	Gunnar Sætersdal
Poland	Józef Popiel	
Portugal	Emygdio Cadima[1]	Ana Maria Caramelo[2]
Spain	José A. Pereiro	Alvaro Fernández
Sweden	Bengt Sjöstrand	Johan Modin
UK	David J. Garrod	Roger S. Bailey
USA	Vaughn C. Anthony	Robert L. Edwards
USSR	Vadim Nikolaev	Yuri Efimov
ICES Statistician, ACFM Secretary	Kjartan Hoydal	

[1]Unable to attend. [2]Attended in place of member.

May 1985

Affiliation	Member	Alternate
Chair	Øyvind Ulltang	
Chair, Demersal Fish Committee	Bernhard Vaske	
Chair, Pelagic Fish Committee	Alain Maucorps	
Chair, Baltic Fish Committee	Jan Netzel	
Belgium	Rudy De Clerck	Frank Redant
Canada	William G. Doubleday	Ralph H. Halliday
Denmark	Niels Axel Nielsen	Kristian Popp Madsen
Federal Republic of Germany	Albrecht Schumacher	H. Peter Cornus
Finland	Veikko Sjöblom[1]	Raimo Parmanne
France	Jacques Guéguen	Jean Dardignac
German Democratic Republic	Otto Rechlin	
Iceland	Sigfus M. Schopka	Ólafur Halldórsson
Ireland	David de G. Griffith	
Netherlands	Klaus H. Postuma	Rudolph Boddeke
Norway	Odd Nakken	Gunnar Sætersdal
Poland	Józef Popiel	
Portugal	Emygdio Cadima[1]	Ana Maria Caramelo[2]
Spain	José A. Pereiro	Alvaro Fernández
Sweden	Bengt Sjöstrand	Johan Modin
UK	David J. Garrod	Roger S. Bailey
USA	Vaughn C. Anthony	Robert L. Edwards
USSR	Vadim Nikolaev	Yuri Efimov
ICES Statistician, ACFM Secretary	Kjartan Hoydal	

[1]Unable to attend. [2]Attended in place of member.

November 1985

Affiliation	Member	Alternate
Chair	Øyvind Ulltang	
Chair, Demersal Fish Committee	Bernhard Vaske	
Chair, Pelagic Fish Committee	Roger S. Bailey	
Chair, Baltic Fish Committee	Jan Netzel[1]	
Belgium	Rudy De Clerck	Frank Redant
Canada	Richard Wells	William G. Doubleday
Denmark	Niels Axel Nielsen	Kristian Popp Madsen
Federal Republic of Germany	Albrecht Schumacher	H. Peter Cornus
Finland	Veikko Sjöblom	Raimo Parmanne

France	Jacques Guéguen	Jean Dardignac
German Democratic Republic	Otto Rechlin	
Iceland	Sigfus M. Schopka[1]	Ólafur Halldórsson[2]
Ireland	David de G. Griffith	
Netherlands	Klaus H. Postuma	Rudolph Boddeke
Norway	Odd Nakken	Gunnar Sætersdal
Poland	Józef Popiel	
Portugal	Emygdio Cadima	Ana Maria Caramelo
Spain	José A. Pereiro	Armando Astudillo
Sweden	Bengt Sjöstrand	Johan Modin
UK	David J. Garrod	
USA	Vaughn C. Anthony[1]	Fredric M. Serchuk[2]
USSR	Vadim Nikolaev[1]	Yuri Efimov[2]
ICES Statistician, ACFM Secretary	Emory D. Anderson	

[1]Unable to attend. [2]Attended in place of member.

May 1986

Affiliation	Member	Alternate
Chair	Øyvind Ulltang	
Chair, Demersal Fish Committee	Bernhard Vaske	
Chair, Pelagic Fish Committee	Roger S. Bailey	
Chair, Baltic Fish Committee	Jan Netzel	
Belgium	Rudy De Clerck	Frank Redant
Canada	Richard Wells[1,2]	William G. Doubleday
Denmark	Niels Axel Nielsen	Kristian Popp Madsen
Federal Republic of Germany	Albrecht Schumacher	H. Peter Cornus
Finland	Veikko Sjöblom[1]	Raimo Parmanne[3]
France	Jacques Guéguen	Jean Dardignac
German Democratic Republic	Otto Rechlin	
Iceland	Sigfus M. Schopka	Ólafur Halldórsson
Ireland	David de G. Griffith	
Netherlands	Klaus H. Postuma	Rudolph Boddeke
Norway	Odd Nakken[1]	Johannes Hamre[3]
Poland	Józef Popiel	
Portugal	Emygdio Cadima	Ana Maria Caramelo
Spain	José A. Pereiro[1]	Armando Astudillo[3]
Sweden	Bengt Sjöstrand	Johan Modin
UK	David J. Garrod	
USA	Vaughn C. Anthony[1]	Fredric M. Serchuk[3]
USSR	Vadim Nikolaev[1]	Yuri Efimov
ICES Statistician, ACFM Secretary	Emory D. Anderson	

[1]Unable to attend. [2]Ralph G. Halliday attended for Canada. [3]Attended in place of member.

November 1986

Affiliation	Member	Alternate
Chair	Øyvind Ulltang	
Chair, Demersal Fish Committee	Vaughn C. Anthony[1]	
Chair, Pelagic Fish Committee	Roger S. Bailey	
Chair, Baltic Fish Committee	Evald A. Ojaveer[1]	
Belgium	Rudy De Clerck	Frank Redant
Canada	James S. Beckett[1]	Richard Wells
Denmark	Niels Axel Nielsen	Kristian Popp Madsen

Federal Republic of Germany	Albrecht Schumacher	H. Peter Cornus
Finland	Veikko Sjöblom	Raimo Parmanne
France	Jacques Guéguen[1]	Benoit Mesnil[2]
German Democratic Republic	Bernhard Vaske[3]	Otto Rechlin[2]
Iceland	Sigfus M. Schopka[1]	Ólafur Halldórsson[2]
Ireland	David de G. Griffith	
Netherlands	Rudolph Boddeke	Niels Daan
Norway	Johannes Hamre	Tore Jakobsen
Poland	Jan Netzel	
Portugal	Emygdio Cadima[1]	Ana Maria Caramelo[2]
Spain	José A. Pereiro	Armando Astudillo
Sweden	Bengt Sjöstrand[1]	Johan Modin[2]
UK	John G. Shepherd	Rodney Jones
USA	Fredric M. Serchuk	
USSR	Yuri Efimov	Valery N. Shleinik
ICES Statistician, ACFM Secretary	Emory D. Anderson	

[1]Unable to attend. [2]Attended in place of member. [3]Attended as outgoing Chair, Demersal Fish Committee in place of Vaughn C. Anthony, newly elected Chair.

May 1987

Affiliation	Member	Alternate
Chair	Øyvind Ulltang	
Chair, Demersal Fish Committee	Vaughn C. Anthony	
Chair, Pelagic Fish Committee	Roger S. Bailey	
Chair, Baltic Fish Committee	Evald A. Ojaveer	
Belgium	Rudy De Clerck	Frank Redant
Canada	James S. Beckett	Richard Wells
Denmark	Niels Axel Nielsen[1]	Kristian Popp Madsen
Federal Republic of Germany	Albrecht Schumacher	H. Peter Cornus
Finland	Veikko Sjöblom	Raimo Parmanne
France	Jacques Guéguen	Benoit Mesnil
German Democratic Republic	Bernhard Vaske	Otto Rechlin
Iceland	Sigfus M. Schopka	Ólafur Halldórsson
Ireland	David de G. Griffith	
Netherlands	Rudolph Boddeke	Niels Daan
Norway	Johannes Hamre[2]	Tore Jakobsen[3]
Poland	Jan Netzel	
Portugal	Emygdio Cadima[2]	Ana Maria Caramelo[3]
Spain	José A. Pereiro[2]	Armando Astudillo[3]
Sweden	Bengt Sjöstrand	Johan Modin
UK	John G. Shepherd	
USA	Fredric M. Serchuk	
USSR	Yuri Efimov	Valery N. Shleinik
Observer, Commission of the EC	Michael J. Holden	
ICES Statistician, ACFM Secretary	Emory D. Anderson	

[1]Represented by Henrik Sparholt for the first three days of the meeting. [2]Unable to attend. [3]Attended in place of member.

October/November 1987

Affiliation	Member	Alternate
Chair	Bernhard Vaske	
Chair, Demersal Fish Committee	Vaughn C. Anthony	
Chair, Pelagic Fish Committee	Roger S. Bailey	
Chair, Baltic Fish Committee	Evald A. Ojaveer[1]	
Belgium	Rudy De Clerck	Frank Redant
Canada	James S. Beckett	Richard Wells
Denmark	Niels Axel Nielsen	Kristian Popp Madsen
Federal Republic of Germany	Albrecht Schumacher	H. Peter Cornus
Finland	Veikko Sjöblom	Raimo Parmanne
France	Jacques Guéguen[1]	Benoit Mesnil[2]
German Democratic Republic	Otto Rechlin	
Iceland	Sigfus M. Schopka	Ólafur Halldórsson
Ireland	David de G. Griffith[1]	Richard J. R. Grainger[2]
Netherlands	Rudolph Boddeke	Niels Daan
Norway	Johannes Hamre	Tore Jakobsen
Poland	Jan Netzel	Jerzy L. Kleniewski
Portugal	Emygdio Cadima[1]	Ana Maria Caramelo[2]
Spain	José A. Pereiro	Armando Astudillo
Sweden	Bengt Sjöstrand[1]	Johan Modin[2]
UK	John G. Shepherd	Rodney Jones
USA	Fredric M. Serchuk	
USSR	Yuri Efimov	Valery N. Shleinik
Observer, Commission of the EC	Michael J. Holden	
ICES Statistician, ACFM Secretary	Emory D. Anderson	

[1]Unable to attend. [2]Attended in place of member.

May 1988

Affiliation	Member	Alternate
Chair	Bernhard Vaske	
Chair, Demersal Fish Committee	Vaughn C. Anthony	
Chair, Pelagic Fish Committee	Roger S. Bailey	
Chair, Baltic Fish Committee	Evald A. Ojaveer	
Belgium	Rudy De Clerck	Frank Redant
Canada	James S. Beckett	Richard Wells
Denmark	Niels Axel Nielsen	Kristian Popp Madsen
Federal Republic of Germany	Albrecht Schumacher	H. Peter Cornus
Finland	Veikko Sjöblom	Raimo Parmanne
France	Jacques Guéguen	Benoit Mesnil
German Democratic Republic	Otto Rechlin	
Iceland	Sigfus M. Schopka	Ólafur Halldórsson
Ireland	David de G. Griffith	Richard J. R. Grainger
Netherlands	Rudolph Boddeke	Niels Daan
Norway	Johannes Hamre[1]	Tore Jakobsen[2]
Poland	Jan Netzel	Jerzy L. Kleniewski
Portugal	Emygdio Cadima	Ana Maria Caramelo
Spain	José A. Pereiro	Armando Astudillo
Sweden	Bengt Sjöstrand	Johan Modin[2]
UK	John G. Shepherd	Rodney Jones
USA	Fredric M. Serchuk	
USSR	Yuri Efimov[1]	Valery N. Shleinik[2]

Observer, Commission of the EC	Michael J. Holden
ICES Statistician, ACFM Secretary	Emory D. Anderson

[1]Unable to attend. [2]Attended in place of member.

November 1988

Affiliation	Member	Alternate
Chair	Bernhard Vaske	
Chair, Demersal Fish Committee	Vaughn C. Anthony	
Chair, Pelagic Fish Committee	Erling Bakken[1,2]	
Chair, Baltic Fish Committee	Evald A. Ojaveer	
Belgium	Rudy De Clerck	Frank Redant
Canada	James S. Beckett	Richard Wells
Denmark	Niels Axel Nielsen	Eskild Kirkegaard[3]
Federal Republic of Germany	H. Peter Cornus	Gert Rauck
Finland	Mikael Hildén	Raimo Parmanne
France	Jacques Guéguen[1]	Benoit Mesnil[4]
German Democratic Republic	Otto Rechlin	
Iceland	Sigfus M. Schopka	Ólafur Halldórsson
Ireland	David de G. Griffith[1]	Richard J. R. Grainger[4]
Netherlands	Rudolph Boddeke	Niels Daan
Norway	Johannes Hamre	Tore Jakobsen
Poland	Jan Netzel	Jerzy L. Kleniewski
Portugal	Luiz Saldanha	Carlos Sousa Reis
Spain	José A. Pereiro[1]	Armando Astudillo[4]
Sweden	Bengt Sjöstrand[1]	Johan Modin[1]
UK	John G. Shepherd	Rodney Jones
USA	Fredric M. Serchuk	
USSR	Yuri Efimov	Valery N. Shleinik
Observer, Commission of the EC	Michael J. Holden	
Observer, Faroe Islands and Greenland	Kjartan Hoydal	Hans Lassen
ICES Statistician, ACFM Secretary	Emory D. Anderson	

[1]Unable to attend. [2]Represented by Roger S. Bailey, outgoing Chair, Pelagic Fish Committee. [3]Attended for several days in place of Niels Axel Nielsen. [4]Attended in place of member.

May 1989

Affiliation	Member	Alternate
Chair	Bernhard Vaske	
Chair, Demersal Fish Committee	Vaughn C. Anthony	
Chair, Pelagic Fish Committee	Erling Bakken	
Chair, Baltic Fish Committee	Evald A. Ojaveer	
Belgium	Rudy De Clerck	Frank Redant
Canada	Jean-Jacques Maguire[1]	James S. Beckett[2]
Denmark	Niels Axel Nielsen[1]	Eskild Kirkegaard[2]
Federal Republic of Germany	H. Peter Cornus	Gert Rauck
Finland	Mikael Hildén	Raimo Parmanne
France	Jacques Guéguen	Benoit Mesnil[4]
German Democratic Republic	Otto Rechlin	
Iceland	Sigfus M. Schopka[1]	Ólafur K. Pálsson
Ireland	David de G. Griffith	
Netherlands	Rudolph Boddeke	Niels Daan
Norway	Johannes Hamre[1]	Tore Jakobsen[2]
Poland	Jan Netzel	Jerzy L. Kleniewski

Portugal	Luiz Saldanha[1,3]	Carlos Sousa Reis
Spain	José A. Pereiro[1]	Armando Astudillo[2]
Sweden	Bengt Sjöstrand	Johan Modin
UK	Roger S. Bailey	John G. Shepherd
USA	Fredric M. Serchuk	
USSR	Yuri Efimov	Valery N. Shleinik
Observer, Commission of the EC	Michael J. Holden[1]	Willem Brugge[2]
Observer, Faroe Islands and Greenland	Kjartan Hoydal[1]	Hans Lassen[2]
ICES Statistician, ACFM Secretary	Richard J. R. Grainger	

[1]Unable to attend. [2]Attended in place of member. [3]Represented by Manuel Lima Dias.

November 1989

Affiliation	Member	Alternate
Chair	Bernhard Vaske	
Chair, Demersal Fish Committee	Niels Daan	
Chair, Pelagic Fish Committee	Erling Bakken	
Chair, Baltic Fish Committee	Wolfgang Weber	
Belgium	Rudy De Clerck	Frank Redant
Canada	Jean-Jacques Maguire	James S. Beckett
Denmark	Niels Axel Nielsen[1]	Eskild Kirkegaard[2]
Federal Republic of Germany	H. Peter Cornus	Gert Rauck
Finland	Mikael Hildén[1]	Raimo Parmanne[2]
France	Benoit Mesnil	André Forest
German Democratic Republic	Otto Rechlin	
Iceland	Sigfus M. Schopka	Ólafur K. Pálsson
Ireland	David de G. Griffith[1]	John Molloy[2]
Netherlands	Rudolph Boddeke	
Norway	Tore Jakobsen	Ingolf Røttingen
Poland	Jan Netzel	Jerzy L. Kleniewski
Portugal	Luiz Saldanha[1,3]	Carlos Sousa Reis
Spain	José A. Pereiro[1]	Armando Astudillo[2]
Sweden	Bengt Sjöstrand[1]	Johan Modin[2]
UK	Roger S. Bailey	John G. Shepherd
USA	Fredric M. Serchuk[1]	Ralph Mayo[2]
USSR	Yuri Efimov	Valery N. Shleinik[4]
Observer, Commission of the EC	Michael J. Holden[1]	Willem Brugge[2]
Observer, Faroe Islands and Greenland	Hjalti í Jákupsstovu	Frank Riget
ICES Statistician, ACFM Secretary	Richard J. R. Grainger	

[1]Unable to attend. [2]Attended in place of member. [3]Represented by Fátima Cardador. [4]Attended for several days in place of member.

May 1990

Affiliation	Member	Alternate
Chair	Bernhard Vaske	
Chair, Consultative Committee	John G. Pope[1]	
Chair, Demersal Fish Committee	Niels Daan	
Chair, Pelagic Fish Committee	Erling Bakken	
Chair, Baltic Fish Committee	Wolfgang Weber	
Belgium	Rudy De Clerck	Frank Redant
Canada	Jean-Jacques Maguire[2]	James S. Beckett
Denmark	Niels Axel Nielsen[1]	Eskild Kirkegaard[1]
Federal Republic of Germany	H. Peter Cornus	Gert Rauck

Finland	Mikael Hildén	Raimo Parmanne
France	Benoit Mesnil[2]	André Forest[3]
German Democratic Republic	Otto Rechlin	
Iceland	Sigfus M. Schopka[2]	Ólafur K. Pálsson[3]
Ireland	John Browne	John Molloy
Netherlands	Rudolph Boddeke[2]	Ad Corten[3]
Norway	Tore Jakobsen	Ingolf Røttingen
Poland	Jan Netzel	Jerzy L. Kleniewski
Portugal	Luiz Saldanha[2]	Carlos Sousa Reis[3]
Spain	José A. Pereiro	Armando Astudillo
Sweden	Bengt Sjöstrand	Johan Modin
UK	Roger S. Bailey	John G. Shepherd
USA	Fredric M. Serchuk	Ralph Mayo
USSR	Yuri Efimov	Valery N. Shleinik
Observer, Commission of the EC	Michael J. Holden[2]	Willem Brugge[3]
Observer, Faroe Islands and Greenland	Hjalti í Jákupsstovu[1]	Frank Riget[1]
ICES Statistician, ACFM Secretary	Richard J. R. Grainger	

[1]Attended only part of meeting. [2]Unable to attend. [3]Attended in place of member.

October/November 1990

Affiliation	Member	Alternate
Chair	Fredric M. Serchuk	
Chair, Demersal Fish Committee	Niels Daan	
Chair, Pelagic Fish Committee	Erling Bakken	
Chair, Baltic Fish Committee	Wolfgang Weber	
Belgium	Rudy De Clerck	Frank Redant
Canada	Jean-Jacques Maguire	James S. Beckett
Denmark	Eskild Kirkegaard	Poul Degnbol
Finland	Mikael Hildén	Raimo Parmanne
France	Benoit Mesnil[1]	André Forest[2]
Germany0	H. Peter Cornus	Bernhard Vaske
Iceland	Sigfus M. Schopka	Ólafur K. Pálsson
Ireland	John Browne[1]	John Molloy[2]
Netherlands	Rudolph Boddeke	Ad Corten
Norway	Tore Jakobsen	Ingolf Røttingen
Poland	Jan Netzel	Jerzy L. Kleniewski
Portugal	Carlos Sousa Reis	Maria J. de Figueiredo
Spain	José A. Pereiro	Javier Pereiro
Sweden	Bengt Sjöstrand[1]	Johan Modin[2]
UK	Roger S. Bailey	John G. Shepherd
USA	Ralph Mayo	Ramón J. Conser
USSR	Yuri Efimov[3]	Valery N. Shleinik[3]
Observer, Commission of the EC	Alain Laurec[3]	Willem Brugge[3]
Observer, Faroe Islands and Greenland	Hjalti í Jákupsstovu[3]	Frank Riget[3]
ICES Statistician, ACFM Secretary	Richard J. R. Grainger	

[1]Unable to attend. [2]Attended in place of member. [3]Attended only part of meeting.

May 1991

Affiliation	Member	Alternate
Chair	Fredric M. Serchuk	
Chair, Consultative Committee	John G. Pope[1]	
Chair, Demersal Fish Committee	Niels Daan	
Chair, Pelagic Fish Committee	Erling Bakken	
Chair, Baltic Fish Committee	Wolfgang Weber	
Belgium	Rudy De Clerck	Frank Redant
Canada	Jean-Jacques Maguire	James S. Beckett
Denmark	Eskild Kirkegaard	Poul Degnbol
Finland	Mikael Hildén	Raimo Parmanne
France	Benoit Mesnil	André Forest
Germany	H. Peter Cornus	Bernhard Vaske
Iceland	Sigfus M. Schopka	Ólafur K. Pálsson
Ireland	John Browne	John Molloy
Netherlands	Rudolph Boddeke	Ad Corten
Norway	Tore Jakobsen	Ingolf Røttingen
Poland	Jan Netzel	Jerzy L. Kleniewski
Portugal	Carlos Sousa Reis	Maria J. de Figueiredo
Spain	José A. Pereiro	Javier Pereiro
Sweden	Bengt Sjöstrand	Johan Modin
UK	Roger S. Bailey	John G. Shepherd
USA	Ralph Mayo	Ramón J. Conser
USSR	Yuri Efimov[1]	Valery N. Shleinik[1]
Observer, Commission of the EC	Alain Laurec	Willem Brugge
Observer, Faroe Islands and Greenland	Hjalti í Jákupsstovu[1]	Frank Riget[1]
Chair, Baltic Salmon and Trout Assessment Working Group	Curt Eriksson[1,2]	
ICES Statistician, ACFM Secretary	Richard J. R. Grainger	

[1]Attended only part of meeting. [2]Attended by invitation.

October/November 1991

Affiliation	Member	Alternate
Chair	Fredric M. Serchuk	
Chair, Demersal Fish Committee	Niels Daan	
Chair, Pelagic Fish Committee	Ole Hagström	
Chair, Baltic Fish Committee	Wolfgang Weber	
Belgium	Rudy De Clerck	Frank Redant
Canada	Jean-Jacques Maguire	James S. Beckett
Denmark	Eskild Kirkegaard[1]	Poul Degnbol[1]
Finland	Mikael Hildén[2]	Eero Aro[3]
France	Benoit Mesnil	André Forest
Germany	H. Peter Cornus[2]	Bernhard Vaske[3]
Iceland	Sigfus M. Schopka	Ólafur K. Pálsson
Ireland	John Browne	John Molloy
Netherlands	Rudolph Boddeke	Ad Corten
Norway	Tore Jakobsen	Ingolf Røttingen
Poland	Jan Netzel	Jerzy L. Kleniewski
Portugal	Carlos Sousa Reis	Maria J. de Figueiredo
Spain	José A. Pereiro	Javier Pereiro
Sweden	Bengt Sjöstrand[2]	Johan Modin[3]
UK	Roger S. Bailey	John G. Shepherd

USA	Ralph Mayo	Ramón J. Conser
USSR	Yuri Efimov[1]	Valery N. Shleinik[1]
Observer, Commission of the EC	Alain Laurec[2]	David W. Armstrong[3]
Observer, Faroe Islands and Greenland	Hjalti í Jákupsstovu[1]	Frank Riget[1]
Chair, Working Group on Methods of Fish Stock Assessment	Gunnar Stefánsson[4]	
ICES Statistician, ACFM Secretary	Richard J. R. Grainger	

[1]Attended part-time. [2]Unable to attend. [3]Attended in place of member. [4]Attended by invitation.

1992

Affiliation	May	October/November
Chair	Fredric M. Serchuk	Fredric M. Serchuk
Chair, Consultative Committee	Christopher C. E. Hopkins[1]	
Chair, Demersal Fish Committee	Niels Daan	Eero Aro
Chair, Pelagic Fish Committee	Ole Hagström	Ole Hagström
Chair, Baltic Fish Committee	Wolfgang Weber	Wolfgang Weber[2]
Chair, ACMP	Graham Topping[1]	
Belgium	Rudy De Clerck	Rudy De Clerck
Canada	Jean-Jacques Maguire	-[3]
Denmark	Eskild Kirkegaard	Poul Degnbol
Finland	Eero Aro	-[3]
France	André Forest	Benoit Mesnil
Germany	H. Peter Cornus[1] Bernhard Vaske[1]	H. Peter Cornus
Iceland	Gunnar Stefánsson	Gunnar Stefánsson
Ireland	John Browne	John Browne
Netherlands	Ad Corten	Rudolph Boddeke
Norway	Tore Jakobsen	Tore Jakobsen
Poland	Jan Netzel	Jan Netzel
Portugal	Carlos Sousa Reis	Carlos Sousa Reis
Russia	Yuri Efimov[1] Valery N. Shleinik[1]	Yuri Efimov[1] Valery N. Shleinik[1]
Spain	Javier Pereiro	Javier Pereiro
Sweden	Bengt Sjöstrand	Johan Modin
UK	Joseph W. Horwood	Joseph W. Horwood
USA	Ramón J. Conser	Ralph Mayo
Observer, Commission of the EC	Armando Astudillo	David W. Armstrong
Observers, Faroe Islands and Greenland	Hjalti í Jákupsstovu[1] Frank Riget[1]	Hjalti í Jákupsstovu[1] Holger Hovgård[1]
Chair, Working Group on North Atlantic Salmon	Kevin Friedland[1,4]	
Chair, Working Group on the Assessment of Mackerel, Horse Mackerel, Sardine and Anchovy		Agustus Eltink[1,4]
ICES Fishery Secretary, ACFM Secretary	Richard J. R. Grainger	Richard J. R. Grainger
ICES Fishery Secretary designate		Roger S. Bailey[1]
ICES Fisheries Assessment Scientist	Henrik Sparholt[1]	Henrik Sparholt[1]
ICES System Analyst	Leif Pedersen[1]	Leif Pedersen[1]

[1]Attended part-time. [2]Represented new Chair, Baltic Fish Committee. [3]Not represented. [4]Attended by invitation.

1993

Affiliation	May	October/November
Chair	Fredric M. Serchuk	Eskild Kirkegaard
Chair, Consultative Committee	Christopher C. E. Hopkins[1]	Christopher C. E. Hopkins[1]
Chair, Demersal Fish Committee	Eero Aro	Eero Aro
Chair, Pelagic Fish Committee	Ole Hagström	Ole Hagström
Chair, Baltic Fish Committee	Bengt Sjöstrand	Bengt Sjöstrand
Belgium	Rudy De Clerck	Rudy De Clerck
Canada	Jean-Jacques Maguire	Jean-Jacques Maguire[1]
Denmark	Eskild Kirkegaard	Poul Degnbol
Finland	Erkki Ikonen	Erkki Ikonen
France	André Forest	Benoit Mesnil
Germany	Bernhard Vaske	H. Peter Cornus
Iceland	Gunnar Stefánsson	Gunnar Stefánsson
Ireland	John Browne	John Browne
Netherlands	Niels Daan	Niels Daan
Norway	Svein A. Iversen	Svein A. Iversen
Poland	Jan Netzel	Jan Netzel
Portugal	Maria J. de Figueiredo	Maria J. de Figueiredo[1] Carlos Sousa Reis[1]
Russia	Yuri Efimov[1] Valery N. Shleinik[1]	Yuri Efimov[1] Valery N. Shleinik[1]
Spain	Javier Pereiro	José A. Pereiro
Sweden	Johan Modin	Johan Modin
UK	Joseph W. Horwood	Joseph W. Horwood
USA	Ramón J. Conser	Ralph Mayo
Observer, Commission of the EC	David W. Armstrong	David W. Armstrong
Observers, Faroe Islands and Greenland	Hjalti í Jákupsstovu[1] Søren Anker Pedersen[1]	Hjalti í Jákupsstovu[1] Jesper Boje[1]
Chair, Baltic Salmon and Trout Assessment Working Group	Curt Eriksson[1]	
Chair, Working Group on Nephrops and Pandalus Stocks	Nick Bailey[1]	
ICES Fishery Secretary, ACFM Secretary	Roger S. Bailey	Roger S. Bailey
ICES Fisheries Assessment Scientist	Henrik Sparholt	Henrik Sparholt
ICES System Analyst	Leif Pedersen[1]	Leif Pedersen[1]

[1]Attended part-time.

1994

Affiliation	May	October/November
Chair	Eskild Kirkegaard	Eskild Kirkegaard
Chair, Demersal Fish Committee	Eero Aro	Eero Aro
Chair, Pelagic Fish Committee	Ole Hagström	Robert L. Stephenson
Chair, Baltic Fish Committee	Bengt Sjöstrand	Bengt Sjöstrand
Belgium	Willy Vanhee	Rudy De Clerck
Canada	Jean-Jacques Maguire[1]	Jean-Jacques Maguire
Denmark	Poul Degnbol	Poul Degnbol
Estonia	Ahto Järvik	Ahto Järvik
Finland	Erkki Ikonen	Erkki Ikonen
France	André Forest	Benoit Mesnil
Germany	Otto Rechlin	H. Peter Cornus
Iceland	Gunnar Stefánsson	Sigfus M. Schopka
Ireland	John Browne	John Browne

Latvia	Maris Vitins	Maris Vitins
Netherlands	Niels Daan	Henk J. L. Heessen
Norway	Ingolf Røttingen	Svein A. Iversen
Poland	Jan Netzel	Jan Horbowy
Portugal	Graca Pestana	Carlos Sousa Reis[1]
Russia	Yuri Efimov[1] Valery N. Shleinik[1]	Yuri Efimov[1] Valery N. Shleinik[1]
Spain	José A. Pereiro	Javier Pereiro
Sweden	Johan Modin	Ole Hagström
UK	Edward C. E. Potter[2]	Robin M. Cook
USA	Ramón J. Conser	Ralph Mayo
Observer, Commission of the EC	David W. Armstrong	David W. Armstrong
Observers, Faroe Islands and Greenland	Hjalti í Jákupsstovu[1] Jesper Boje[1]	Hjalti í Jákupsstovu[1] Jesper Boje[1]
Chair, Study Group on Seals and Small Cetaceans in European Seas	Joseph Harwood[1]	
Chair, Working Group on the Assessment of Northern Shelf Demersal Stocks		Michael Armstrong[1]
ICES Fishery Secretary, ACFM Secretary	Roger S. Bailey	Roger S. Bailey
ICES Fisheries Assessment Scientist	Henrik Sparholt	Henrik Sparholt
ICES System Analyst	Leif Pedersen[1]	Leif Pedersen[1]

[1]Attended part-time. [2]Substituted for Joseph W. Horwood.

1995

Affiliation	May	October/November
Chair	Eskild Kirkegaard	Eskild Kirkegaard
Chair, Demersal Fish Committee	Eero Aro	Frans A. van Beek
Chair, Pelagic Fish Committee	Robert L. Stephenson	Robert L. Stephenson
Chair, Baltic Fish Committee	Bengt Sjöstrand	Eero Aro
Belgium	Willy Vanhee	Rudy De Clerck
Canada	Jean-Jacques Maguire	-
Denmark	Poul Degnbol	Poul Degnbol
Estonia	Ahto Järvik	Tiit Rait[1]
Finland	Erkki Ikonen	Erkki Ikonen
France	André Forest	Benoit Mesnil
Germany	H. Peter Cornus[2] Otto Rechlin[2]	H. Peter Cornus
Iceland	Gunnar Stefánsson	Ólafur K. Pálsson[3]
Ireland	John Browne	John Browne
Latvia	Maris Vitins	Maris Vitins
Netherlands	Niels Daan	Henk J. L. Heessen
Norway	Svein A. Iversen	Svein A. Iversen
Poland	Jan Netzel	Jan Horbowy
Portugal	Graca Pestana	Graca Pestana
Russia	Yuri Efimov[2] Valery N. Shleinik[2]	Yuri Efimov[2] Valery N. Shleinik[2]
Spain	Javier Pereiro	Javier Pereiro
Sweden	Ole Hagström	Ole Hagström
UK	Robin M. Cook	Robin M. Cook
USA	Ralph Mayo	Wendy Gabriel
Observer, Commission of the EC	Armando Astudillo	David W. Armstrong
Observers, Faroe Islands and Greenland	Hjalti í Jákupsstovu[2] Jesper Boje[2]	Jákup Reinert[2] Jesper Boje[2]

Chair, Working Group on the Assessment of Northern Shelf Demersal Stocks	Sten Munch-Petersen[2]	
Chair, Working Group on Long-Term Management Measures	Kevin Stokes[2]	
Chair, Arctic Fisheries Working Group		Knut Sunnanå[2]
Chair, Multispecies Assessment Working Group		Jake C. Rice[2]
ICES Fishery Secretary, ACFM Secretary	Roger S. Bailey	Roger S. Bailey
ICES Fisheries Assessment Scientist	Henrik Sparholt	Henrik Sparholt
ICES System Analyst	Leif Pedersen[2]	Leif Pedersen[2]

[1]Substituted for Ahto Järvik. [2]Attended part-time. [3]Substituted for Gunnar Stefánsson.

1996

Affiliation	May	October/November
Chair	Eskild Kirkegaard	Eskild Kirkegaard
Chair, Demersal Fish Committee	Frans A. van Beek	Frans A. van Beek
Chair, Pelagic Fish Committee	Robert L. Stephenson	Robert L. Stephenson
Chair, Baltic Fish Committee	Eero Aro	Eero Aro
Belgium	Rudy De Clerck	Willy Vanhee
Canada	Jake C. Rice	Jake C. Rice
Denmark	Poul Degnbol	Poul Degnbol
Estonia	Tiit Rait	Ahto Järvik
Finland	Erkki Ikonen	Tapani Pakarinen
France	Benoit Mesnil	Benoit Mesnil
Germany	H. Peter Cornus	H. Peter Cornus
Iceland	Gunnar Stefánsson	Sigfus M. Schopka
Ireland	John Browne	John Browne Paul Connolly[1]
Latvia	Maris Plikshs	Maris Vitins
Netherlands	Niels Daan	Henk J. L. Heessen
Norway	Asgeir Aglen	Asgeir Aglen
Poland	Jan Netzel	Jan Horbowy
Portugal	Graca Pestana	Graca Pestana
Russia	Yuri Efimov[2] Valery N. Shleinik[2]	Yuri Efimov[2] Valery N. Shleinik[2]
Spain	Javier Pereiro	Javier Pereiro
Sweden	Bengt Sjöstrand	Bengt Sjöstrand
UK	Robin M. Cook	Robin M. Cook
USA	Wendy Gabriel	Ralph Mayo
Observer, Commission of the EC	Ole Hagström	David W. Armstrong
Observers, Faroe Islands and Greenland	Jákup Reinert[2] Jesper Boje[2]	Hjalti í Jákupsstovu[2] Jesper Boje[2]
Chair, Study Group on the Biology and Assessment of Deep-Sea Fisheries Resources	John D. M. Gordon[3]	
Chair, North-Western Working Group	Jákup Reinert[3]	
Chair, Northern Pelagic and Blue Whiting Fisheries Working Group	Ingolf Røttingen[3]	
Chair, Herring Assessment Working Group for the Area South of 62°N	Reidar Toresen[3]	
Chair, Baltic Fisheries Assessment Working Group	Jan Horbowy[3]	
Chair, Working Group on North Atlantic Salmon	Edward C. E. Potter[3]	
Chair, Baltic Salmon and Trout Assessment Working Group	Lars Karlsson[3]	
Chair, Working Group on the Assessment of Northern Shelf Demersal Stocks		Michael Armstrong[1]

Chair, Working Group on the Assessment of Southern Shelf Demersal Stocks		Michael Pawson[1]
Chair, Working Group on the Assessment of Mackerel, Horse Mackerel, Sardine and Anchovy		Carmela Porteiro[1]
Chair, Arctic Fisheries Working Group		Knut Sunnanå[1]
Chair, Working Group on the Assessment of Demersal Stocks in the North Sea		Poul Degnbol[1]
ICES Fishery Secretary, ACFM Secretary	Roger S. Bailey	Roger S. Bailey
ICES Fisheries Assessment Scientist	Henrik Sparholt	Henrik Sparholt
ICES System Analyst	Leif Pedersen[2]	Leif Pedersen[2]

[1]Attended Subgroup meetings 24–26 October. [2]Attended part-time. [3]Attended Subgroup meetings 16–18 May.

May 1997

Affiliation	Participant	Meetings		
		A	B	C
Chair	Jean-Jacques Maguire	x	x	x
Chair, Demersal Fish Committee	Frans A. van Beek	x	x	x
Chair, Pelagic Fish Committee	Robert L. Stephenson	x	x	x
Chair, Baltic Fish Committee	Eero Aro	x	x	x
Belgium	Rudy De Clerck	x		
Canada	Jake C. Rice	x	x	x
Denmark	Hans Lassen	x	x	x
Estonia	Tiit Rait	x	x	x
Finland	Tapani Pakarinen	x	x	x
France	André Forest	x	x	x
Germany	Cornelius Hammer		x	
	Hildrun Müller	x	x	x
Iceland	Gunnar Stefánsson	x	x	x
Ireland	John Browne	x	x	x
Latvia	Maris Vitins	x	x	x
Netherlands	Niels Daan	x	x	x
Norway	Are Dommasnes	x	x	x
Poland	Jan Horbowy	x	x	x
Portugal	Maria-Fatima Borges	x	x	x
Russia	Yuri Efimov[1]	x	x	x
	Valery N. Shleinik[1]	x	x	x
Spain	José A. Pereiro	x	x	x
Sweden	Bengt Sjöstrand	x	x	x
UK	Robin M. Cook	x	x	x
USA	Kevin Friedland	x	x	x
Observer, Commission of the EC	Ole Hagström	x		x
Observers, Faroe Islands and Greenland	Jesper Boje[1]	x	x	x
	Jákup Reinert[1]	x	x	x
Chair, North-Western Working Group	Jákup Reinert	x	x	x
Chair, Working Group on Nephrops Stocks	David B. Bennett		x	
Chair, Baltic Salmon and Trout Assessment Working Group	Lars Karlsson		x	
Chair, Working Group on North Atlantic Salmon	Larry Marshall		x	
Chair, Northern Pelagic and Blue Whiting Fisheries Working Group	Ingolf Røttingen		x	
Chair, Herring Assessment Working Group for the Area South of 62°N	Reidar Toresen		x	
ICES Fishery Secretary, ACFM Secretary	Roger S. Bailey	x	x	x
ICES Fisheries Assessment Scientist	Henrik Sparholt	x	x	x
ICES System Analyst	Leif Pedersen[1]	x		

A, Plenary sessions, 19–23 May; B, Subgroups, 14–16 May; C, Special meeting, 17 May. [1]Attended part-time.

October 1997

Affiliation	Participant	Meetings	
		A	B
Chair	Jean-Jacques Maguire	x	x
Chair, Consultative Committee	Robin M. Cook	x	x
Chair, Resource Management Committee	Robert L. Stephenson	x	x
Chair, Baltic Committee	Eero Aro		x
Belgium	Willy Vanhee	x	x
Canada	Jake C. Rice	x	
Denmark	Poul Degnbol	x	x
Estonia	Ahto Järvik	x	x
Finland	Tapani Pakarinen	x	x
France	Benoit Mesnil	x	x
Germany	Cornelius Hammer	x	x
Iceland	Sigfus M. Schopka	x	
Ireland	John Molloy	x	x
Latvia	Maris Plikshs	x	x
Netherlands	Niels Daan	x	x
Norway	Asgeir Aglen	x	x
Poland	Jan Horbowy	x	x
Portugal	Maria-Fatima Borges	x	x
Russia	Yuri Efimov[1]		x
	Valery N. Shleinik[1]	x	x
Spain	José A. Pereiro	x	x
Sweden	Bengt Sjöstrand	x	x
UK	Joseph W. Horwood	x	
USA	Mark Terceiro	x	x
Observer, Commission of the EC	Jacques Bastinck	x	
Observers, Faroe Islands and Greenland	Per Kanneworff[1]	x	x
	Hjalti í Jákupsstovu[1]	x	x
Observer, NAFO	H. Peter Cornus	x	
Chair, Working Group on the Assessment of Northern Shelf Demersal Stocks	Michael Armstrong		x
Chair, Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak	Poul Degnbol		x
Chair, Working Group on the Assessment of Mackerel, Horse Mackerel, Sardine and Anchovy	Carmela Porteiro		x
Chair, Arctic Fisheries Working Group	Knut Sunnanå		x
Chair, Working Group on the Assessment of Southern Shelf Demersal Stocks	Michael Pawson		x
Chair, Joint ICES/NAFO Working Group on Harp and Hooded Seals	Gary Stenson		x
Chair, Study Group on the Assessment of Other Fish and Shellfish Species	Robert K. Mohn		x
Chair, Elasmobranch Fisheries Working Group	Paul Walker		x
ICES Fishery Secretary, ACFM Secretary	Roger S. Bailey	x	x
ICES Fisheries Assessment Scientist	Henrik Sparholt	x	x

A, Plenary sessions, 27–31 October; B, Subgroups, 22–26 October. [1]Attended part-time.

May 1998

Affiliation	Participant	Meetings	
		A	B
Chair	Jean-Jacques Maguire	x	x
Chair, Consultative Committee	Robin M. Cook	x	x
Chair, Resource Management Committee	Robert L. Stephenson	x	x
Chair, Baltic Committee	Eero Aro	x	x
Belgium	Willy Vanhee	x	x
Canada	Jake C. Rice	x	x
Denmark	Hans Lassen	x	x
Estonia	Tiit Rait	x	x
Finland	Tapani Pakarinen	x	x
France	André Forest	x	x
Germany	Cornelius Hammer	x	x
	Otto Rechlin		x
Iceland	Gunnar Stefánsson	x	x
Ireland	John Browne	x	x
Latvia	Maris Vitins	x	x
Netherlands	Henk J. L. Heessen	x	x
Norway	Are Dommasnes	x	x
	Asgeir Aglen		x
Poland	Jan Horbowy	x	x
Portugal	Maria-Fatima Borges	x	x
Russia	Valery N. Shleinik	x	x
Spain	Carmela Porteiro	x	x
Sweden	Bengt Sjöstrand	x	x
UK	Kevin Stokes	x	x
USA	Wendy Gabriel	x	x
Observer, Commission of the EC	Ole Hagström	x	
Observers, Faroe Islands and Greenland	Jesper Boje[1]	x	x
	Jákup Reinert[1]	x	x
Observer, NAFO	H. Peter Cornus	x	
Chair, North-Western Working Group	Jákup Reinert		x
Chair, Baltic Salmon and Trout Assessment Working Group	Lars Karlsson		x
Chair, Working Group on North Atlantic Salmon	Larry Marshall		x
Chair, Northern Pelagic and Blue Whiting Fisheries Working Group	James Carscadden		x
Chair, Herring Assessment Working Group for the Area South of 62°N	E. John Simmonds		x
Chair, Study Group on the Biology and Assessment of Deep-Sea Fisheries Resources	John D. M. Gordon		x
Chair, EIFAC/ICES Working Group on Eels	Willem Dekker		x
Chair, Arctic Fisheries Working Group	W. Raymond Bowering		x
ICES Fisheries Assessment Scientist	Henrik Sparholt	x	x

A, Plenary sessions, 18–22 May; B, Subgroups, 13–16 May. [1]Attended part-time.

October 1998

Affiliation	Participant	Meetings	
		A	B
Chair	Jean-Jacques Maguire	x	x
Chair, Consultative Committee	Robin M. Cook	x	
Chair, Resource Management Committee	Robert L. Stephenson	x	x
Chair, Baltic Committee	Eero Aro	x	x
Chair, Marine Habitat Committee	Astrid Jarre-Teichmann		
Belgium	Willy Vanhee	x	x
Canada	Jake C. Rice	x	x
Denmark	Eskild Kirkegaard	x	x
Estonia	Ahto Järvik	x	x
Finland	Petri Suuronen	x	
France	Benoit Mesnil	x	x
Germany	Cornelius Hammer	x	x
Iceland	Einar Hjörleifsson	x	x
Ireland	John Molloy	x	x
Latvia	Maris Plikshs	x	x
Netherlands	Fran van Beek	x	x
Norway	Asgeir Aglen		x
Poland	Jan Horbowy	x	x
Portugal	Maria-Fatima Borges	x	x
Russia	Valery N. Shleinik	x	x
Spain	Carmela Porteiro	x	x
Sweden	Bengt Sjöstrand	x	x
UK	Kevin Stokes	x	x
USA	Mark Terceiro	x	x
Observer, Commission of the EC	David Armstrong	x	
Observer, Faroe Islands and Greenland	Per Kanneworff	x	x
Observer, NAFO	H. Peter Cornus	x	
Chair, Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak	Frans van Beek		x
Chair, Working Group on the Assessment of Northern Shelf Demersal Stocks	Stuart Reeves		x
Chair, Working Group on the Assessment of Mackerel, Horse Mackerel, Sardine and Anchovy	Kenneth Patterson		x
Chair, Arctic Fisheries Working Group	W. Raymond Bowering		x
Chair, Working Group on the Assessment of Southern Shelf Demersal Stocks	Michael Pawson		x
Chair, Joint ICES/NAFO Working Group on Harp and Hooded Seals	Gary Stenson		x
Chair, Study Group on the Assessment of Other Fish and Shellfish Species	Robert K. Mohn		x
Chair, Pandalus Assessment Working Group	Sten Munch-Petersen		x
ICES Fisheries Assessment Scientist	Henrik Sparholt	x	x

A, Plenary sessions, 26–29 October; B, Subgroups, 20–24 October.

May 1999

Affiliation	Participant	Meetings	
		A	B
Chair	Jean-Jacques Maguire	x	x
Chair, Resource Management Committee	Robert L. Stephenson	x	x
Replacing Chair, Baltic Committee	Eero Aro	x	x
Replacing Chair, Living Resources Committee	Astrid Jarre-Teichmann	x	x
Belgium	Willy Vanhee	x	x
Canada	Jake C. Rice	x	x
Denmark	Holger Hovgaard	x	x
Estonia	Toomas Saat	x	x
Finland	Petri Suuronen	x	
	Sakari Kuikka		x
France	André Forest	x	x
Germany	Cornelius Hammer	x	x
Iceland	Sigfus M. Schopka	x	x
Ireland	John Browne	x	x
Latvia	Maris Vitins	x	x
Netherlands	Fran van Beek	x	x
Norway	Dankert Skagen	x	x
Poland	Jan Horbowy	x	x
Portugal	Manuela Azevedo	x	x
Russia	Valery N. Shleinik	x	x
Spain	Carmela Porteiro	x	x
Sweden	Bengt Sjöstrand	x	x
UK	Kevin Stokes	x	x
USA	Mark Terceiro	x	x
Observer, Commission of the EC	Ole Hagström	x	
Observers, Faroe Islands and Greenland	Jesper Boje[1]	x	x
	Jákup Reinert[1]	x	x
Observer, NAFO	H. Peter Comus	x	
Chair, North-Western Working Group	Jesper Boje		x
Chair, Baltic Fisheries Assessment Working Group	Tiit Raid		x
Chair, Baltic Salmon and Trout Assessment Working Group	Tapani Pakarinen		x
Chair, Working Group on North Atlantic Salmon	Larry Marshall		x
Chair, Northern Pelagic and Blue Whiting Fisheries Working Group	James Carscadden		x
Chair, Herring Assessment Working Group for the Area South of 62°N	E. John Simmonds		x
ICES Fisheries Adviser	Hans Lassen	x	x
ICES Fisheries Assessment Scientist	Henrik Sparholt	x	x

A, Plenary sessions, 17–20 May; B, Subgroups, 12–15 May. [1]Attended part-time.

October/November 1999

Affiliation	Participant	Meetings	
		A	B
Chair	Tore Jakobsen	x	x
Chair, Consultative Committee	Robin M. Cook	x	
Chair, Resource Management Committee	Robert L. Stephenson	x	x
Chair, Oceanography Committee	Harald Loeng	x	x
Belgium	Willy Vanhee	x	x
Canada	Jake C. Rice	x	x
Denmark	Eskild Kirkegaard	x	x
Estonia	Toomas Saat	x	x
Finland	Jukka Pönni	x	x
France	Benoit Mesnil	x	x
Germany	Cornelius Hammer	x	x
Iceland	Einar Hjörleifsson	x	x
Ireland	John Molloy	x	x
Latvia	Maris Vitins	x	x
Netherlands	Henk J. L. Heessen	x	x
Norway	Asgeir Aglen	x	x
Poland	Jan Horbowy	x	x
Portugal	Maria-Fatima Borges	x	x
Russia	Valery N. Shleinik	x	x
Spain	Carmela Porteiro	x	x
Sweden	Bengt Sjöstrand	x	x
UK	Kevin Stokes	x	x
USA	Mark Terceiro	x	x
Observer, Commission of the EC	Armando Astudillo	x	
Observers, Faroe Islands and Greenland	Jesper Boje[1]	x	x
	Hjalti í Jákupsstovu[1]	x	x
Observer, NAFO	Michael C. S. Kingsley	x	
Chair, Working Group on the Assessment of Northern Shelf Demersal Stocks	Stuart Reeves		x
Chair, Working Group on the Assessment of Mackerel, Horse Mackerel, Sardine and Anchovy	Kenneth Patterson		x
Member, Arctic Fisheries Working Group	Bjarte Bogstad		x
Chair, Working Group on the Assessment of Southern Shelf Demersal Stocks	Alain Biseau		x
Chair, Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak	Frans van Beek		x
Member, Pandalus Assessment Working Group	Sten Munch-Petersen		x
ICES Fisheries Adviser	Hans Lassen	x	x
ICES Fisheries Assessment Scientist	Henrik Sparholt	x	x

A, Plenary sessions, 26–30 October; B, Subgroups, 1–4 November. [1]Attended part-time.

May/June 2000

Affiliation	Participant	Meetings	
		A	B
Chair	Tore Jakobsen	x	x
Replacing Chair, Baltic Committee	Eero Aro		
Chair, Resource Management Committee	Robert L. Stephenson	x	x
Belgium	-		
Canada	Jake C. Rice	x	x
Denmark	Holger Hovgaard	x	x
Estonia	Toomas Saat	x	x
Finland	Sakari Kuikka	x	x
France	André Forest	x	x
Germany	Cornelius Hammer	x	x
Iceland	Sigfus M. Schopka	x	x
Ireland	John Molloy	x	x
Latvia	Maris Plikshs	x	x
Netherlands	Frans van Beek	x	x
Norway	Dankert Skagen	x	x
Poland	Jan Horbowy	x	x
Portugal	Fátima Cardador	x	x
Russia	Valery N. Shleinik	x	x
Spain	Carmela Porteiro	x	x
Sweden	Bengt Sjöstrand	x	x
UK	Kevin Stokes	x	x
USA	Steven X. Cadrin	x	x
Observer, Commission of the EC	Ole Hagström	x	
Observers, Faroe Islands and Greenland	Jesper Boje[1]	x	x
	Jákup Reinert[1]	x	x
Chair, North-Western Working Group	Jesper Boje		x
Chair, Baltic Fisheries Assessment Working Group	Tiit Raid		x
Chair, Baltic Salmon and Trout Assessment Working Group	Tapani Pakarinen		x
Chair, Working Group on North Atlantic Salmon	Larry Marshall		x
Chair, Arctic Fisheries Working Group	W. Raymond Bowering		x
Chair, Northern Pelagic and Blue Whiting Fisheries Working Group	James Carscadden		x
Chair, Herring Assessment Working Group for the Area South of 62°N	E. John Simmonds		
Chair, Study Group on the Biology and Assessment of Deep-Sea Fisheries Resources	John D. M. Gordon		
ICES Fisheries Adviser	Hans Lassen	x	x
ICES Fisheries Assessment Scientist	Henrik Sparholt	x	x

A, Plenary sessions, 29 May–1 June; B, Subgroups, 25–27 May. [1]Attended part-time.

October/November 2000

Affiliation	Participant	Meetings	
		A	B
Chair	Tore Jakobsen	x	x
Chair, Consultative Committee	Robin M. Cook	x	
Replacing Chair, Baltic Committee	Eero Aro	x	x
Chair, Living Resources Committee	R. Colin A. Bannister	x	x
Belgium	Wim Demaré	x	x
Canada	Jake C. Rice	x	x
Denmark	Sten Munch-Petersen	x	x
Estonia	Toomas Saat	x	x
Finland	-		
France	Alain Biseau	x	x
Germany	Cornelius Hammer	x	x
Iceland	Einar Hjörleifsson	x	x
Ireland	Paul Connolly	x	x
Latvia	Maris Vitins	x	x
Netherlands	Henk J. L. Heessen	x	x
Norway	Asgeir Aglen	x	x
Poland	Jan Horbowy	x	x
Portugal	Manuela Azevedo	x	x
Russia	Valery N. Shleinik	x	x
Spain	Carmela Porteiro	x	x
Sweden	Bengt Sjöstrand	x	x
UK	R. Colin A. Bannister	x	x
USA	Mark Terceiro	x	x
Observer, Commission of the EC	Ole Hagström	x	
Observers, Faroe Islands and Greenland	Jesper Boje[1]	x	x
	Jákup Reinert[1]	x	x
Observer, NAFO	W. Raymond Bowering	x	
Chair, Working Group on the Assessment of Southern Shelf Demersal Stocks	Alain Biseau		x
Chair, Pandalus Assessment Working Group	Bengt Sjöstrand		x
Chair, Working Group on the Assessment of Northern Shelf Demersal Stocks	Stuart Reeves		x
Chair, Working Group on the Assessment of Mackerel, Horse Mackerel, Sardine and Anchovy	Dankert Skagen		x
Chair, Arctic Fisheries Working Group	W. Raymond Bowering		x
Chair, Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak	Frans van Beek		x
Chair, Joint ICES/NAFO Working Group on Harp and Hooded Seals	Tore Haug		x
Chair, EIFAC/ICES Working Group on Eels	Larry Marshall		x
ICES Fisheries Adviser	Hans Lassen	x	x
ICES Fisheries Assessment Scientist	Henrik Sparholt	x	x

A, Plenary sessions, 30 October–2 November; B, Subgroups, 24–28 October. [1]Attended part-time.

May 2001

Affiliation	Participant	Meetings	
		A	B
Chair	Tore Jakobsen	x	x
Vice-Chair	Frans van Beek	x	x
Interim Chair, Consultative Committee	Alain Maucorps	x	
Chair, Resource Management Committee	Carl O'Brien	x	x
Belgium	-		
Canada	Jake C. Rice	x	x
Denmark	Holger Hovgaard	x	x
Estonia	Robert Aps	x	x
Finland	Jukka Pönni		
France	André Forest	x	x
Germany	Tomas Gröhsler	x	x
Iceland	Sigfus M. Schopka	x	x
Ireland	John Molloy	x	x
Latvia	Georgs Kornilovs	x	x
Netherlands	Henk J. L. Heessen	x	x
Norway	Dankert Skagen	x	x
Poland	Jan Horbowy	x	x
Portugal	Fátima Cardador	x	x
Russia	Vladimir I. Shlibanov	x	x
Spain	Carmela Porteiro	x	x
Sweden	Bengt Sjöstrand	x	x
UK	Philip Kunzlik	x	x
USA	Steven X. Cadrin	x	x
Observer, Commission of the EC	Kenneth Patterson	x	
Observers, Faroe Islands and Greenland	Jesper Boje[1]	x	x
	Jákup Reinert[1]	x	x
Chair, North-Western Working Group	Jesper Boje		x
Chair, Baltic Fisheries Assessment Working Group	Maris Plikshs		x
Chair, Baltic Salmon and Trout Assessment Working Group	Tapani Pakarinen		x
Chair, Northern Pelagic and Blue Whiting Fisheries Working Group	Asta Gudmundsdottir		x
Chair, Herring Assessment Working Group for the Area South of 62°N	Marinelle Basson		x
Chair, Study Group on the Further Development of the Precautionary Approach to Fishery Management	R. Colin A. Bannister		x
Chair, Working Group on Nephrops Stocks	Frank Redant		x
Chair, EIFAC/ICES Working Group on Eels	Larry Marshall		x
ICES Fisheries Adviser	Hans Lassen	x	x
ICES Fisheries Assessment Scientist	Henrik Sparholt	x	x

A, Plenary sessions, 22 and 28–31 May; B, Subgroups, 23–26 May. [1]Attended part-time.

October 2001

Affiliation	Participant	Meetings	
		A	B
Chair	Tore Jakobsen	x	x
Vice-Chair	Frans van Beek	x	x
Chair, Resource Management Committee	Carl O'Brien	x	x
Belgium	Wim Demaré	x	x
Canada	-		
Denmark	Sten Munch-Petersen	x	x
Estonia	Toomas Saat	x	x
Finland	Jukka Pönni	x	x
France	Alain Biseau	x	x
Germany	Cornelius Hammer	x	x
Iceland	Einar Hjörleifsson	x	x
Ireland	Colm Lordan	x	x
Latvia	Maris Plikshs	x	x
Netherlands	Martin Pastoors	x	x
Norway	Odd M. Smedstad	x	x
Poland	Jan Horbowy	x	x
Portugal	Manuela Azevedo	x	x
Russia	Yuri Efimov	x	x
Spain	Carmela Porteiro	x	x
Sweden	Bengt Sjöstrand	x	x
UK	Philip Kunzlik	x	x
USA	Mark Terceiro	x	x
Observer, Commission of the EC	Eskild Kirkegaard	x	
Observer, Faroe Islands	Hjalti í Jákupsstovu	x	x
Replacing Chair, Working Group on the Assessment of Northern Shelf Demersal Stocks	Carl O'Brien		x
Chair, Working Group on the Assessment of Southern Shelf Demersal Stocks	Alain Biseau		x
Chair, Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak	Martin Pastoors		x
Chair, Pandalus Assessment Working Group	Bengt Sjöstrand		x
Chair, Working Group on the Assessment of Mackerel, Horse Mackerel, Sardine and Anchovy	Dankert Skagen		x
Chair, EIFAC/ICES Working Group on Eels	Willem Dekker		x
ICES Fisheries Adviser	Hans Lassen	x	x
ICES Fisheries Assessment Scientist	Henrik Sparholt	x	x

A, Plenary sessions, 9 and 15–17 October; B, Subgroups, 10–13 October.

May 2002

Affiliation	Participant	Meetings	
		A	B
Chair	Tore Jakobsen	x	x
Chair, Resource Management Committee	Carl O'Brien	x	x
Chair, Baltic Committee	Brian MacKenzie	x	x
Chair, Consultative Committee	Jake C. Rice	x	
Belgium	Willy Vanhee	x	x
Canada	Denis Rivard	x	x
Denmark	Stuart Reeves	x	x
Estonia	Toomas Saat	x	x
Finland	Ari Leskelä	x	x
France	André Forest	x	x
Germany	Cornelius Hammer	x	x
Iceland	Sigfus M. Schopka	x	x
Ireland	Ciaran Kelly	x	x
Latvia	Georgs Kornilovs	x	x
Netherlands	Martin Pastoors	x	x
Norway	Dankert Skagen	x	x
Poland	Jan Horbowy	x	x
Portugal	-		
Russia	Vladimir I. Shlibanov	x	x
Spain	Carmela Porteiro	x	x
Sweden	Bengt Sjöstrand	x	x
UK	Philip Kunzlik	x	x
USA	Steven X. Cadrin	x	x
Observers, Commission of the EC	Eskild Kirkegaard	x	x
	Franco Biagi	x	x
Observer, Greenland	Jesper Boje	x	x
Observer, Faroe Islands	Jákup Reinert	x	x
Chair, North-Western Working Group	Einar Hjörleifsson		x
Chair, Baltic Fisheries Assessment Working Group	Maris Plikshs		x
Chair, Baltic Salmon and Trout Assessment Working Group	Tapani Pakarinen		x
Chair, Northern Pelagic and Blue Whiting Fisheries Working Group	Asta Gudmundsdottir		x
Chair, Herring Assessment Working Group for the Area South of 62°N	Else Torstensen		x
Chair, Arctic Fisheries Working Group	Sigbjørn Mehl		x
Chair, Study Group on Sea bass	Michael Pawson		x
Expert, Flatfish Project Team	Michael T. Smith		x
Chair, Working Group on Nephrops Stocks	Michael Bell		x
ICES Fisheries Adviser	Hans Lassen	x	x
ICES Fisheries Assessment Scientist	Henrik Sparholt	x	x

A, Plenary sessions, 21 and 27–30 May; B, Subgroups, 22–25 May.

October 2002

Affiliation	Participant	Meetings	
		A	B
Chair	Tore Jakobsen	x	x
Incoming Chair	Poul Degnbol	x	
Chair, Resource Management Committee	Carl O'Brien	x	x
Chair, Consultative Committee	Jake C. Rice	x	
Belgium	Wim Demaré	x	x
Canada	Denis Rivard	x	x
Denmark	Sten Munch-Petersen	x	x
Estonia	Toomas Saat	x	x
Finland	Jari Raitaniemi	x	x
France	Alain Biseau	x	x
Germany	Christopher Zimmermann	x	x
Iceland	Einar Hjörleifsson	x	x
Ireland	Colm Lordan	x	x
Latvia	Maris Plikshs	x	x
Netherlands	Frans van Beek	x	x
Norway	Odd M. Smedstad	x	x
Poland	Jan Horbowy	x	x
Portugal	Manuela Azevedo	x	x
Russia	Yuri Efimov	x	x
Spain	Carmela Porteiro	x	x
Sweden	Bengt Sjöstrand	x	x
	Joakim Hjelm		x
UK	Philip Kunzlik	x	x
USA	Mark Terceiro	x	x
Observer, Commission of the EC	Kenneth Patterson	x	x
Chair, Working Group on the Assessment of Southern Shelf Stocks of Hake, Monk and Megrim	Alain Biseau		x
Chair, Pandalus Assessment Working Group	Bengt Sjöstrand		x
Chair, Working Group on the Assessment of Southern Shelf Demersal Stocks	Steve Flatman		x
Chair, Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak	Martin Pastoors		x
Chair, Working Group on the Assessment of Mackerel, Horse Mackerel, Sardine and Anchovy	Dankert Skagen		x
Chair, Working Group on the Assessment of Northern Shelf Demersal Stocks	Michael Armstrong		x
ICES Fisheries Adviser	Hans Lassen	x	x
ICES Fisheries Assessment Scientist	Henrik Sparholt	x	x

A, Plenary sessions, 14–17 October; B, Subgroups, 9–12 October.

May/June 2003

Affiliation	Participant	Meetings	
		A	B
Chair	Poul Degnbol	x	x
Chair, Resource Management Committee	Carl O'Brien	x	x
Chair, Baltic Committee	Brian MacKenzie		x
Chair, Consultative Committee	Jake C. Rice	x	x
Belgium	Willy Vanhee	x	x
Canada	-		
Denmark	Holger Hovgaard	x	x
Estonia	Robert Aps		x
Finland	Ari Leskelä	x	x
France	André Forest	x	x
Germany	Tomas Gröhsler	x	x
Iceland	Sigfus M. Schopka		x
Ireland	Ciaran Kelly	x	x
Latvia	Georgs Kornilovs	x	x
Netherlands	Martin Pastoors	x	x
Norway	Dankert Skagen	x	x
Poland	Jan Horbowy	x	x
Portugal	Fátima Cardador	x	x
Russia	Yuri Efimov	x	x
	Vladimir I. Shlibanov		
Spain	Carmela Porteiro	x	x
Sweden	Bengt Sjöstrand	x	x
UK	Philip Kunzlik	x	x
USA	Gary Shepherd	x	x
Observer, Commission of the EC	Kenneth Patterson	x	x
Observer, Greenland	Jesper Boje	x	x
Observer, Faroe Islands	Jákup Reinert	x	x
Chair, Baltic Salmon and Trout Assessment Working Group	Ingemar Perä	x	
Chair, North-Western Working Group	Einar Hjörleifsson	x	
Chair, Baltic Fisheries Assessment Working Group	Maris Plikshs	x	
Chair, Northern Pelagic and Blue Whiting Fisheries Working Group	Asta Gudmundsdottir	x	
Chair, Herring Assessment Working Group for the Area South of 62°N	Else Torstensen	x	
Chair, Arctic Fisheries Working Group	Sigbjørn Mehl	x	
Chair, Working Group on Nephrops Stocks	Michael Bell	x	
ICES Fisheries Adviser	Hans Lassen	x	x
ICES Fisheries Assessment Scientist	Henrik Sparholt	x	x
ICES Scientific Secretary	Mette Bertelsen	x	x

A, Subgroups, 28–31 May; B, Plenary sessions, 27 May and 2–5 June.

October 2003

Affiliation	Participant	Meetings	
		A	B
Chair	Poul Degnbol	x	x
Chair, Resource Management Committee	Carl O'Brien	x	x
Chair, Living Resources Committee	Henk J. L. Heessen	x	x
Chair, Consultative Committee	Jake C. Rice	x	x
Belgium	Wim Demaré	x	x
Canada	Denis Rivard	x	x
Denmark	Sten Munch-Petersen	x	x
Estonia	Toomas Saat	x	x
Finland	Jari Raitaniemi	x	x
France	Alain Biseau	x	x
Germany	Christopher Zimmermann	x	x
Iceland	Einar Hjörleifsson	x	x
Ireland	Colm Lordan	x	x
Latvia	Maris Plikshs	x	x
Netherlands	Frans van Beek	x	x
Norway	Reidar Toresen	x	x
Poland	Jan Horbowy	x	x
Portugal	Manuela Azevedo	x	x
Russia	Yuri Efimov	x	x
	Vladimir I. Shlibanov		
Spain	Carmela Porteiro	x	x
Sweden	Bengt Sjöstrand	x	x
UK	Philip Kunzlik	x	x
USA	Steven X. Cadrin	x	x
Observer, Commission of the EC	Eskild Kirekegaard	x	x
Chair, Pandalus Assessment Working Group	Sten Munch-Petersen		x
Chair, Joint ICES/NAFO Working Group on Harp and Hooded Seals	Tore Haug		x
Chair, Working Group on the Assessment of Southern Shelf Stocks of Hake, Monk and Megrim	Valentin Trujillo		x
Chair, Working Group on the Assessment of Northern Shelf Demersal Stocks	Rick Officer		x
Chair, Working Group on the Assessment of Southern Shelf Demersal Stocks	Steve Flatman		x
Chair, Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak	Martin Pastoors		x
Chair, Working Group on the Assessment of Mackerel, Horse Mackerel, Sardine and Anchovy	Dankert Skagen		x
ICES Fisheries Adviser	Hans Lassen	x	x
ICES Fisheries Assessment Scientist	Henrik Sparholt	x	x
ICES Scientific Secretary	Mette Bertelsen	x	x

A, Plenary sessions, 13–16 October; B, Subgroups, 8–11 October.

May/June 2004

Affiliation	Participant
Chair	Poul Degnbol
Chair, Resource Management Committee	Dankert Skagen
Chair, Baltic Committee	Brian MacKenzie
Chair, Consultative Committee	Jake C. Rice
Belgium	Willy Vanhee
Canada	Denis Rivard
Denmark	Holger Hovgaard
Estonia	Toomas Saat
Finland	Ari Leskelä
France	André Forest
Germany	Tomas Gröhsler
Iceland	Sigfus M. Schopka
	Einar Hjörleifsson[1]
Ireland	Ciaran Kelly
Latvia	-
Netherlands	Frans van Beek
Norway	Reidar Toresen
Poland	Jan Horbowy
Portugal	Manuela Azevedo
Russia	Yuri Efimov
	Vladimir I. Shlibanov
Spain	Carmela Porteiro
Sweden	Massimiliano Cardinale
UK	Carl M. O'Brien
USA	Gary Shepherd
Observer, Commission of the EC	Peter Hopkins
Observer, Greenland	Jesper Boje
Observer, Faroe Islands	Jákup Reinert
ICES Head of Advisory Programme	Hans Lassen
ICES Fisheries Assessment Scientist	Henrik Sparholt
ICES Advisory Services Officer	Mette Bertelsen

[1]Attended part-time.

October 2004

Affiliation	Participant
Chair	Poul Degnbol
Chair, Resource Management Committee	Dankert Skagen
Chair, Living Resources Committee	David Reid
Belgium	Wim Demaré
Canada	Denis Rivard
Denmark	Morten Vinther
Estonia	Toomas Saat
Finland	Jari Raitaniemi
France	Alain Biseau
Germany	Christopher Zimmermann
Iceland	Einar Hjörleifsson
Ireland	Colm Lordan
Latvia	Maris Plikshs
Netherlands	Martin Pastoors
Norway	Knut Korsbrekke
Poland	Jan Horbowy
Portugal	Fátima Cardador
Russia	Yuri Efimov
	Vladimir I. Shlibanov
Spain	Carmela Porteiro
Sweden	Joakim Hjelm
UK	Carl M. O'Brien
USA	Steven X. Cadrin
Observer, Commission of the EC	Kenneth Patterson
Observer, Greenland	Jesper Boje
Observer, WWF	Espen Nordberg
Observer, North Sea Commission Fisheries Partnership	Doug Beveridge
Observer, Policy and Knowledge in Fisheries Management Project	Douglas Wilson
ICES Head of Advisory Programme	Hans Lassen
ICES Fisheries Assessment Scientist	Henrik Sparholt
ICES Advisory Services Officer	Mette Bertelsen

May/June 2005

Affiliation	Participant
Chair	Poul Degnbol
Chair, Consultative Committee	Harald Loeng[1]
Chair, Resource Management Committee	Dankert Skagen
Chair, Living Resources Committee	David Reid
Belgium	Willy Vanhee
Canada	Denis Rivard
Denmark	Fritz W. Köster
Estonia	Tiit Raid
Finland	Eero Aro
France	André Forest
Germany	Tomas Gröhsler
Iceland	Björn Steinarsson
Ireland	Ciaran Kelly
Latvia	Maris Plikshs
Netherlands	Frans van Beek
Norway	Reidar Toresen
Poland	Jan Horbowy
Portugal	Fátima Cardador
Russia	Yuri Efimov
	Vladimir I. Shlibanov
Spain	Carmela Porteiro
Sweden	Massimiliano Cardinale
UK	Carl M. O'Brien
USA	Steven X. Cadrin
Observer, Commission of the EC	Eskild Kirkegaard
Observer, Greenland	Jesper Boje
Observer, Faroe Islands	Jákup Reinert
Observer, WWF	Charlotte Mogensen
Observer, Baltic Fishermen's Association	Michael Andersen
Observers, Norwegian Fishermen's Association	Jan Ivar Maråk
	Jan Birger Jørgensen
Observer, Northern Pelagic Working Group of EAPO	Christian Olesen
ICES Head of Advisory Programme	Hans Lassen
ICES Fisheries Assessment Scientist	Henrik Sparholt
ICES Advisory Services Officer	Mette Bertelsen

[1]Attended part-time.

October 2005

Affiliation	Participant
Chair	Poul Degnbol
Chair, Consultative Committee	Harald Loeng[1]
Chair, Resource Management Committee	Dankert Skagen
Chair, Living Resources Committee	David Reid
Chair, Working Group on Elasmobranch Fisheries	Maurice Clarke
Member, Fisheries Technology Committee	Norman Graham
Belgium	Wim Demaré
Canada	Denis Rivard
Denmark	Morten Vinther
Estonia	Toomas Saat
Finland	-
France	Alain Biseau
Germany	Christopher Zimmermann
Iceland	Einar Hjörleifsson
Ireland	Colm Lordan
Latvia	Maris Plikshs
Netherlands	Martin Pastoors
Norway	Knut Korsbrekke
Poland	Jan Horbowy
Portugal	Manuela Azevedo
Russia	Yuri Efimov
Spain	Valentin Trujillo
Sweden	Joakim Hjelm
UK	Carl M. O'Brien
USA	Gary Shepherd
Observer, Commission of the EC	Peter Hopkins
Observer, Greenland	Jesper Boje
Observer, Faroe Islands	Jákup Reinert
Observer, WWF	Charlotte Mogensen
Observer, Europêche, COGECA	Michael Andersen
Observers, Norwegian Fishermen's Association	Jan Ivar Maråk
Observer, University of Copenhagen	Jette Broch Jacobsen
ICES Head of Advisory Programme	Hans Lassen
ICES Fisheries Assessment Scientist	Henrik Sparholt
ICES Advisory Services Officer	Mette Bertelsen

[1]Attended part-time.

May/June 2006

Affiliation	Participant
Chair	Martin Pastoors
Chair, Consultative Committee	Harald Loeng[1]
Chair, Resource Management Committee	Dankert Skagen
Chair, Living Resources Committee	David Reid
Belgium	Willy Vanhee
Canada	Denis Rivard
Denmark	Fritz W. Köster
Estonia	Toomas Saat
Finland	Ari Leskelä
France	André Forest
Germany	Tomas Gröhsler
Iceland	Björn Steinarsson
Ireland	Ciaran Kelly
Latvia	-
Netherlands	Mark Dickey Collas
Norway	Reidar Toresen
Poland	Jan Horbowy
Portugal	Alberto G. Murta
Russia	Yuri Efimov
Spain	Pablo Abaunza
Sweden	Massimiliano Cardinale
UK	Carl M. O'Brien
USA	-
Observers, Commission of the EC	Peter Hopkins
	Stefanie Schmidt
Observer, Greenland	Jesper Boje
Observer, Faroe Islands	Jákup Reinert
Observer, WWF	Carol Phua
Observer, Baltic Fishermen's Association	Michael Andersen
Observer, Icelandic Fishing Vessel Owners	Kristján Thórarinsson
Observer, Northern Pelagic Working Group of European Association of Fish Producers Organisations	Christian Olesen
Observer, European Association of Fish Producers Organisations	Andrew Tait
ICES Head of Advisory Programme	Hans Lassen
ICES Fisheries Assessment Scientist	Henrik Sparholt
ICES Advisory Services Officer	Mette Bertelsen

[1]Attended part-time.

October 2006

Affiliation	Participant
Chair	Martin Pastoors
Chair, Consultative Committee	Harald Loeng[1]
Chair, Resource Management Committee	Dankert Skagen
Chair, Living Resources Committee	David Reid
Belgium	Wim Demaré
Canada	Denis Rivard
Denmark	Morten Vinther
Estonia	Toomas Saat
Finland	Eero Aro
France	Alain Biseau
Germany	Christopher Zimmermann
Iceland	Einar Hjörleifsson
Ireland	Colm Lordan
Latvia	Maris Plikshs
Netherlands	Frans van Beek
Norway	Asgeir Aglen
Poland	Jan Horbowy
Portugal	Fátima Cardador
Russia	Yuri Efimov
Spain	Valentin Trujillo
Sweden	Massimiliano Cardinale
UK	Carl M. O'Brien
USA	Gary Shepherd
Observer, Commission of the EC	Kenneth Patterson
Observer, SAFMANS Project	Tim Daw
Observer, European Association of Fish Producers Organisations	Sean O'Donoghue
Observers, North Western Waters Regional Advisory Council	Julien Lamothe
	Luc Mallaerts
Observer, Pelagic Regional Advisory Council	Christian Olesen
Observer, North Sea Regional Advisory Council	Michael Park
ICES Head of Advisory Programme	Hans Lassen
ICES Fisheries Assessment Scientist	Henrik Sparholt
ICES Advisory Services Officer	Mette Bertelsen

[1]Attended part-time.

May 2007

Affiliation	Participant
Chair	Martin Pastoors
Chair, Resource Management Committee	Dankert Skagen
Chair, Living Resources Committee	David Reid
Belgium	Willy Vanhee
Canada	Ghislain Chouinard
Denmark	Morten Vinther
Estonia	Tiit Raid
Finland	Eero Aro
France	André Forest
Germany	Christopher Zimmermann
Iceland	Björn Steinarsson
Ireland	Ciaran Kelly
Latvia	Maris Plikshs
Lithuania	Sarunas Toliusis
Netherlands	Mark Dickey Collas
Norway	Reidar Toresen
Poland	Jan Horbowy
Portugal	Alberto G. Murta
Russia	Yuri Efimov
Spain	Pablo Abaunza
Sweden	-
UK	E. John Simmonds
USA	Christopher Legault
Observer, Commission of the EC	Juan-Pablo Perteirra
	Lisa Borges
	Stefanie Schmidt
Observer, Greenland	Jesper Boje
Observer, Faroe Islands	Jákup Reinert
Observer, Icelandic Fishing Vessel Owners	Kristján Thórarinsson
Observer, Pelagic Regional Advisory Council	Christian Olesen
	Sean O'Donoghue
Observer, University of Oulu, Finland	Päivi Haapasaari
ICES Head of Advisory Programme	Hans Lassen
ICES Fisheries Assessment Scientist	Henrik Sparholt
ICES Advisory Services Officer	Mette Bertelsen

October 2007

Affiliation	Participant
Chair	Martin Pastoors
Chair, Consultative Committee	Harald Loeng
Chair, Resource Management Committee	Dankert Skagen
Belgium	Wim Demaré
Canada	Denis Rivard
Denmark	Jesper Boje
Estonia	Tiit Raid
Finland	Ari Leskelä
France	Alain Biseau
Germany	Joachim Gröger
Iceland	Einar Hjörleifsson
Ireland	Maurice Clarke
Latvia	Maris Plikshs
Lithuania	Sarunas Toliusis
Netherlands	Frans van Beek
Norway	Sigurd Tjelmeland
Poland	Jan Horbowy
Portugal	Fátima Cardador
Russia	Yuri Efimov
	Yuri M. Lepesevich
Spain	Valentin Trujillo
Sweden	Massimiliano Cardinale
	Michele Casini
UK	E. John Simmonds
USA	Gary Shepherd
Observer, Commission of the EC	Lisa Borges
Observers, North Western Waters Regional Advisory Council	Julien Lamothe
Observer, Pelagic Regional Advisory Council	Christian Olesen
	Sean O'Donoghue
Observer, WWF	Carol Phua
ICES Head of Advisory Programme	Hans Lassen
ICES Fisheries Assessment Scientist	Henrik Sparholt
ICES Advisory Services Officers	Mette Bertelsen
	Barbara Schoute

Annex 2: Advisory Committee on Fishery Management, Chair's goals and objectives (1990)

A. Enhance quality of scientific advice

Improve understanding of fishery systems
Bridge the single species/multispecies gap
Better longer-term advice (even if qualitative)
Incorporate risk analysis/evaluation in advice
Clarify/advise on fishery management objectives/strategies
Provide scientific justification for all advice
Incorporate environment/fishery interactions

B. Enhance productivity/efficiency of ACFM and ICES assessment working groups

Restructure working groups towards area/fisheries basis
Promote research vs. number crunching in working groups
Re-evaluate/improve ICES assessment software
Exchange successful protocols among working groups
Revise ACFM technical review procedures
Invite working group chairmen to participate in ACFM meetings
Develop working group members' handbook
Utilize expertise in ICES subject/area committees
Attempt to reduce assessment demands

C. Enhance ACFM interactions within ICES and with fishery managers

Invite working group chairmen to ACFM Consultations
Encourage working groups to set research terms of reference
Initiate/enhance collaborations with ACMP
Improve coordination with fish committees/Consultative Committee
ACFM members "shadow" working groups
Organize/sponsor joint sessions at Statutory Meeting and NAFO
Share ACFM/management experiences among management commissions
Better publicize ACFM and ICES accomplishments

D. Enhance ACFM/ICES role in providing advice on ecosystem (non-fish) impacts of fisheries

Enhance expertise for assessing marine mammals and reviewing/advising on study group reports
Integrate marine mammal and seabird interactions into multispecies and fishery unit modelling efforts

Increase understanding of fishing impacts on habitat and benthos, including extent of non-yield mortality on target and non-target species

Identify fisheries and ecosystem management conflicts and evaluate options for resolving conflicts

See Section 6.6 for more information.

Annex 3: Recommendation from ACFM to the Bureau (1990)

The standard assessment software currently implemented on the NH computer is several years old and working groups are finding it increasingly restrictive. Working groups are tending to use more of their own software which is not implemented on the ND computer, but generally runs in DOS or Unix environments. Little progress has been made with developing the new ICES Fisheries Stock Assessment Package, despite the fact that the general structure of the package has been decided for some time.

ACFM recommends that ICES, as a matter of urgency, develop the new ICES Fish Stock Assessment Package, either by allocating sufficient staff resources within the ICES Secretariat or arranging for the task to be undertaken elsewhere under contract. Given the imminent installation of a new computer system at ICES and the removal of the ND system after a period, this work must be given high priority.

Annex 4: ACFM recommendation to the General Secretary (1990)

In order to improve communication between ACFM and the assessment working groups, ACFM wishes to have working group chairmen attend ACFM meetings. Generally, the attendance of each chairman would only be required at the occasional ACFM meeting.

ACFM recommends that the Chairman of the Baltic Salmon and Trout Assessment Working Group, Mr C. Eriksson, be invited to attend the May 1991 ACFM meeting for three days at ICES expense.