

COOPERATIVE RESEARCH REPORT

No. 106

REPORTS ON DIALOGUE MEETINGS, 20-21 MAY AND 4 OCTOBER 1980

International Council for the Exploration of the Sea
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DIALOGUE MEETING, 20-21 MAY 1980

Introduction

1. Following the demise of the North-East Atlantic Fisheries Commission, the International Council for the Exploration of the Sea has in recent years been concerned about the lack of an effective dialogue between fishery scientists, responsible for assessment of the fish stocks in the North-East Atlantic on one side and national authorities responsible for the management of the stocks on the other side. The matter has for some time been under discussion within ICES, and at the Statutory Meeting in October 1979, and through subsequent discussions, it was agreed that ICES should take the initiative to convene a meeting, with the purpose of promoting a dialogue between science and management, focussing on the nature of the scientific advisory role of ICES in the fishery management field, and with the intention to agree on arrangements for a continuing dialogue.
2. The meeting was held at the Council's Headquarters in Copenhagen, 20-21 May 1980. It was chaired by the Council's President, Professor G Hempel. The Council's General Secretary served as Rapporteur.

The Council's "customers" for scientific advice on fishery management had been invited, e.g. its Member Governments and NEAFC, IBSC and the Commission of EEC. In addition, FAO, NAFO, ICCAT and IOC were invited to be represented by Observers. A list of participants is given in Annex 1. A list of relevant acronyms is given in Annex 2.
3. The Council had made available to the participants as background documents the following reports:

Cooperative Research Report, No.62: "Report of the ad hoc Meeting on the Provision of Advice on the Biological Basis for Fisheries Management", and

Cooperative Research Report, No.93: "Reports of the ICES Advisory Committee on Fishery Management, 1979".
4. The meeting was opened at 16.00 hrs on 20 May by the President. He welcomed representatives of fishery administrations and research of 16 Member Governments and of international organisations, some representatives of fishing industries, members of the ICES Bureau and Secretariat, the past President of ICES and the Chairman of ACFM. The President outlined briefly the development of fishery management and its biological background in the Council's 80 years' history. Present day needs for complex management of ecosystems shared by several nations gave science a great responsibility for the survival and development of fisheries. Short-term sacrifices in the hope for long-term gains as well as options regarding mass production of small fish versus lower production of highly priced fish are issues in which fisheries biology, socio-economics and politics are intimately linked. In the long run, the dialogue between these sectors should address these basic questions of fisheries management. However, the present meeting will mainly deal with practical problems of improving the flow of information and advice between science and administration, between ICES and the Member Governments, as well as NEAFC, IBSC and EEC.

5. The President's address was followed by three introductory lectures:

"The scientific basis for fish stock management", by the Council's immediate past President, Mr B B Parrish (Annex 3);

"A survey of the structure and functions of ICES", by the President, Professor G Hempel (Annex 4);

"ICES' procedures for provision of advice on fishery management", by the Chairman of the Council's Advisory Committee on Fishery Management (ACFM), Mr A Saville (Annex 5).

After the presentations there was a general discussion, which aimed at identification of questions to be discussed further the next day.

6. On the morning of the 21 May, statements were presented by a representative of Norway, as the only country in the Northeast Atlantic present, which is not a member of any of the regulatory Commissions, which receive advice from ICES (Annex 6), and by a representative of the Commission of EEC (Annex 7). Further statements were presented by a representative of FAO (Annex 8), by a representative of IOC (Annex 9), and by USSR participants. Those annexed were subsequently submitted in writing.

The President read the following statement received from Dr Hütte, Chairman of the International Baltic Sea Fishery Commission, who was unable to attend the meeting:

"I can assure you that the Baltic Sea Fishery Commission highly appreciates the scientific work of ICES and its scientific advice on fishery management. The recommendations from ICES concerning TACs for herring, sprat and cod are an important basis for the Commission's decisions concerning TACs and for dividing them among the national fishing zones of the Baltic coastal States.

I cannot see any open, unsolved problems concerning the cooperation between ICES and the Baltic Sea Fishery Commission and I want to express my request to continue the approved forms of cooperation. I speak on behalf of all members of the Baltic Sea Fishery Commission when I express my thanks for it to ICES. I wish the Dialogue Meeting a good course."

The FAO representative presented the printed Report of the ACMRR Working Party on the Scientific Basis of Determining Management Measures (Hong Kong, 10-15 December 1979), FAO Fisheries Report, No.236; and the participants from USA presented a printed document entitled "Northeast Fishery Management Task Force, Overview Document, Phase 1."

Summary of Proceedings

The following paragraphs summarise the discussions that followed the presentations:

7. There was general agreement about the need for a continuing dialogue between the scientists working under the auspices of ICES and the authorities (national and international) responsible for management. It was also generally agreed that this ought to take place in one or

more joint fora, so that all Parties interested in fisheries in an area would take part jointly in it. Several participants expressed the hope that NEAFC in its new form would constitute a suitable forum for future discussions. In the meantime, ICES should see to it that a dialogue of the kind initiated at the present meeting would be continued. The meeting noted that for the Baltic, IBSFC currently provides a suitable forum.

8. In this connection the question was raised, if there should also be dialogues between the ACFM, on behalf of ICES, and individual "customers". It was generally felt, however, that this would not be advisable; since advice has to be given on the basis of stocks, not national zones, at least all "customers" interested in the same stock should be involved in the same dialogue.
9. Reference was also made to the recent request by the EEC Commission for an extra meeting of ACFM to review its advice on the state of certain stocks, with the possibility that the current year's TAC might be amended. Several participants regretted that this had been found necessary. They considered that if requests for ICES advice outside the agreed ACFM time-table were asked for, they should be "cleared" with all of the "customers" interested in the stocks in question. This applies especially to shared stocks.
10. The question about possible duplication of work between the Working Groups and ACFM of ICES on one hand and the Scientific-Technical Committee of the EEC (STC) was raised. It was explained, however, by the EEC representatives that there was no such overlapping. The STC was concerned with advising the EEC Commission about the contents and effects of the advice received from ACFM, in the same way as national scientists were advising their own authorities. Also, the STC assisted the Commission in the formulation of meaningful questions and requests to ICES.
11. The importance of the internal dialogue within ICES between the various sections of marine science was underlined. The fact that ICES was able to adopt effectively its scientific advisory role on fishery management matters, and to give comprehensive advice, was largely because it embraces a full set of marine sciences, and is, therefore, in a position to analyse the situation in the sea with contributions from a wide range of relevant scientific studies. Attention was drawn to a series of ICES-sponsored Symposia, where problems of a general character directly relevant to resource conservation and management could be, and were, thoroughly discussed.
12. From the scientific side it was stressed that no advice could be better than the available data would allow. Attention was drawn to some major deficiencies in the data supplied by countries. For example, whilst some important items of information, such as data on discards, had just started to become available, the information on the amount and composition of by-catches still falls short of requirements. Attention was also drawn to the problem of the reliability of the officially reported statistics, which seem to have deteriorated in recent years. In some cases it had been necessary for the scientists, when making assessments, to make informed guesses about the amounts actually caught, since these were known to be significantly greater than those reported. This introduces an uncertainty in the assessments, which it would be in the interest of all parties concerned, including the administrations and the fishing industry, to

remove. It was agreed that this is a problem, which national administrations must urgently take up for serious consideration.

13. There was some complaint from the side of administrators that the reports of ACFM were presented in too technical a language, which is not always easily understood by non-scientists. They urged that in the future the reports be written in a more clear language. It was also suggested by one participant that the workload of the Council could be reduced, and hence the time taken to issue the ACFM's recommendations, if instead of issuing a separate report ACFM merely attached a note giving its views to each of the various Working Group reports which it considered at its meetings.
14. There were a few statements which might be taken to suggest that the members of ACFM might not always be as independent of national interests as might be desired. This was, however, firmly rejected both by the Chairman of ACFM and by the President. The members do not work in a vacuum, and one cannot expect unanimity of scientific opinions on all matters. But there is no reason to feel that they consider themselves national representatives rather than objective scientists, responsible to the Council as a whole.
15. In a similar context the question of allowing observers from "customers" to take part in, or attend, meetings of Assessment Working Groups was briefly touched on. It was stressed that since these Groups are jointly approaching impartial objective scientific solutions to the questions put to them it is important that their work is not influenced in one way or another by participation by representatives of one or more "customers".
16. There was a long discussion about the desirability for ACFM to present its advice in the form of management options. It was recognised by all participants that there are instances - for example in the case of a collapsed stock - when a single recommendation is highly desirable and it was also agreed that the ACFM cannot be deprived of its right to state its preference for one option and to give its reasons for that. But the importance of "customers" being given the possibility to choose between biologically acceptable alternatives, with information about the consequences of the option they select, was also recognised. It was said that in too many cases had there been no real choice, and that the administrators sometimes had the feeling of being faced with a fait accompli. The Chairman of ACFM said that his Committee had realised this, and that its next report would offer management options where possible. It was, however, not easy to do this in all cases, since the quality of the available data would also have an influence.

It was also said that the scope for options in advice is more limited than often realised. It was stressed that the effectiveness with which the advice could be given in the form of options was heavily dependent on managers posing specific questions, based on clearly formulated management objectives. If this is not done, managers should not criticize biologists for not giving sufficient options. It was at the same time realised that in many cases it would be difficult for management to agree on objectives, since social, economic and political conditions may be very different in the various countries that are interested in one and the same species or stock.
17. Some scientists said that in their day-to-day national work they are in close contact with their management authorities and they also have an understanding of the needs and difficulties of the fishing industry. On the other hand, it was their responsibility to make clear, if a stock

is in difficulties or threatened with a collapse; they were in some respects to be considered the representatives of the fish, and this task should not be taken from them. They realised that, at least for most demersal species, one cannot achieve a biological objective of fishing at some defined exploitation rate, for each stock separately, it will be necessary to aim at some level of exploitation for the mixture of species in an area as a whole. The choice of this level will to some extent depend on economic and political considerations, as well as on biological ones.

18. In cases where the managers do not act on the basis of the scientific advice given, they should give reasons for their choice. This would be an important part of the dialogue between scientists and managers in the future.
19. Several speakers mentioned the growing importance of a multi-species approach to fishery management. From the scientific side it was stressed that although multi-species modelling had now advanced to a stage where one could see in which direction one would have to move, and what sort of models would be applicable, there was still some way to go before the input data necessary for the use of the models in assessment and hence in the provision of scientific advice on multi-species management would be available. It was recognised at the same time that when that stage has been reached, and scientists would be asked to give advice based on multi-species assessments, the formulation of management objectives would be both more important and more difficult than at present. It would then be necessary to reach agreement at international level about the use to be made of stocks which interact biologically. With different social and economic interests in the different fishing communities, this would not be easy. That situation, when it arises, will also place added responsibilities on those giving scientific advice, to ensure that it is given in such a way that the "customers" will know the likely consequences of making their choices.
20. The question of short-term versus long-term advice was thoroughly discussed. The biologists stressed the enormous variability between recruiting year classes in some stocks and that this in conjunction with a high exploitation rate produced great instability in catches in the short term. Moreover, to advise in the medium term, say three to five years ahead, would demand some knowledge of what the management practice would be in the intervening period. Under these circumstances, forecasts of three to five years ahead would not be of much value. The Chairman of ACFM, however, said that management bodies might find advice on long-term average sustainable yields of value in planning fleet structure and shore-based facilities. After discussing this with some of his colleagues, he thought that such advice could be provided if the fishery management policy to be adopted was stated.
21. From the management side, the importance of achieving the highest degree of long-term stability possible in the fisheries was stressed. It is easy to expand fisheries rapidly when the resource potential justifies it, but extremely difficult to cut down the effort when the resources decline. In order to achieve such stability, a society has a whole series of economic and political alternatives available, but in order to choose among them, a better knowledge of the long-term possibilities for stock exploitation is needed. Thus, the biologist

has a key role to play in a close and continuing dialogue with other groups of experts involved in management (economists, lawyers, technologists, administrators). The biologists should not, however, be expected to assume the role of the other participants in the decision-making process.

22. In this respect, attention was drawn to the different levels of current knowledge of the way different exploited stocks would be expected to respond to changes in fishing intensity (fishing mortality rate) resulting from management actions. For some stocks, for which the long-term statistical and biological data series cover the exploitation levels and stocks sizes likely to be encountered in a management regime, reasonably confident predictions of the average stock situation may be possible. For others, however, the available data refer only to periods when the level of exploitation has been far in excess of that corresponding with the management objective (e.g., the $F_{0.1}$ or the F_{max} levels). In such cases, much greater caution is needed in making predictions. This has an important bearing on the choice of the time period for achieving a stock management objective.
23. A special problem in the southern part of the ICES area was pointed out. There are fisheries there for certain species (e.g., hake, Nephrops), but a series of other species (sea-breams and conger among others) are caught, partly as a by-catch in such fisheries, partly by directed fisheries. Advice is now needed as to how these fisheries should be managed, in order to make the best possible use of available resources. It was realised, however, that in order to give such advice, the scientists would need data about catches and their composition, as well as better knowledge of the biology of the species concerned.
24. A further important purpose of the Dialogue should be to make evaluations of the results and effectiveness of the implementation of management measures. Such evaluations would be important for the formulation of requests to scientists, and also for formulation of possible new or modified management objectives. One should seek institutional arrangements, which would make this possible, and it was hoped that the present meeting would be a forerunner of more permanent arrangements.

Arrangements for Future Dialogues

25. The discussion then turned to consideration of an annual time-table for such arrangements.

At present, the Assessment Working Groups meet in March to May, and ACFM holds its mid-year meeting at the beginning of July. It was pointed out that the time interval between the Working Groups and ACFM meetings is necessary for the production and advance circulation of the assessment reports to the members of ACFM. Some representatives of management said that they considered the beginning of September an appropriate time for receiving the ACFM report, since it would give more time for consideration in national fora before the international and bi-lateral negotiations start. These should preferably be concluded around 1 November, since two months would be needed for implementation of decisions. The possibility was mentioned that the Assessment Working Groups and ACFM meetings could be held later in the year so that more up-to-date data would be available for the assessment and the calculation of TACs. With such a schedule, the ACFM advice would be available in January-February the year when

the management advice would be implemented. Several managers said, however, that such a schedule would be unacceptable. It was further suggested that due to the different biology of species, it might in the future be desirable to hold two main meetings of ACFM during a year; this might, for example, improve the basis for assessment of short-lived species, such as sprat.

26. The overall consensus of opinion from the discussion was that taking all factors into account, the present arrangements and time-table for Working Groups and ACFM meetings should not be changed, at least for the time being. It was agreed, however, that they should be supplemented by a Dialogue Meeting between ACFM and representatives of its "customers", to be held after the ACFM report is available and before the Statutory Meeting session of ACFM. It was recognised that this requirement is already met for the Baltic fisheries by the IBSEFC, and that the supplementary Dialogue Meeting should therefore deal with the ACFM advice for the fisheries in other parts of the Northeast Atlantic. However, this would not preclude representatives of the Baltic countries (and IBSEFC) attending the meeting should they wish to follow and take part in discussions of general aspects of the scientific advice.

It was also stressed that the Dialogue Meeting would not be a forum for negotiations of re-assessments, but for exchange of views, explanations and clarifications. At the same time, it would provide an important input to the planning meeting of ACFM at the end of the Statutory Meeting.

27. After considerable discussion, it was agreed that the first such Dialogue Meeting should take place this year immediately before the ICES Statutory Meeting in Copenhagen. ICES will seek the approval of its Delegates to host this meeting, which should either be a one-day meeting on Saturday, 4 October, or, if ICES considers it necessary, a two-day meeting on 3 and 4 October.
28. There was some discussion about the need for all of the present Assessment Working Groups. It was agreed that this is an internal ICES problem, which should be kept under continuing review.
29. At the end of the discussion, the President thanked all participants for their contributions to what he considered a very useful dialogue which had highlighted some important matters and provided a clearer understanding of the kind of future cooperation that is needed and the fields which a continuing dialogue should cover. It had been a good start, and plans had been made for a continuation of the dialogue, for the time being under the auspices of ICES.

The meeting was closed at 17.00 hrs on the 21st May.

ANNEX 1

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ANNEX 2

ACRONYMS APPEARING IN THE TEXT OF THE REPORT

ACFM	Advisory Committee on Fishery Management (of ICES)
ACMRR	Advisory Committee on Marine Resources Research (of FAO)
CEC	Commission of the European Communities
EEC	European Economic Communities
EEZ	Exclusive Economic Zone
FAO	Food and Agriculture Organisation of the United Nations
IBSFC	International Baltic Sea Fishery Commission
ICCAT	International Commission for the Conservation of Atlantic Tunas
ICES	International Council for the Exploration of the Sea
ICNAF	International Commission for Northwest Atlantic Fisheries
IOC	Intergovernmental Oceanographic Commission (of UNESCO)
LOS	Law of the Sea [Convention]
MSY	Maximum Sustainable Yield (see page 14)
NAFO	Northwest Atlantic Fisheries Organization (replacing ICNAF)
NEAFC	North-East Atlantic Fisheries Commission
STC	Scientific-Technical Committee (of the EEC)
TAC	Total allowable catches

ANNEX 3

NOTES ON THE SCIENTIFIC BASIS FOR FISH STOCK MANAGEMENT

by

B B Parrish
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Introduction

My understanding of the purpose of this contribution to the proceedings of this meeting is to give a brief outline of the basic scientific principles, concepts and criteria which have formed the basis of the scientific advice provided hitherto by ICES to international fishery management bodies in the North-East Atlantic, NEAFC and IBSFC, and their Member Governments.

It is necessary at the outset, to recognise the obvious but important fact that fishing as a commercial enterprise is dependent for its raw material on natural animal populations. Each of these populations has become adapted, through evolutionary processes to fill a "niche" in the total ecological system of which it is part, and each possesses its particular innate biological properties and susceptibilities to changes in its environmental milieu, which together govern its distribution, behaviour and productivity - and their variability. Except for the few cases such, for example, as the salmon and some shellfish species in which significant changes in one or more of these properties can be brought about through deliberate modifications or manipulation of the natural environment (eg for salmon through improvements in their migration paths and/or spawning beds) or of one or more of the natural biological processes (eg by egg or fry stocking programmes) these properties and susceptibilities are not directly controllable by man. This is likely to remain the case for the major exploited marine resources in the Northeast Atlantic area in the foreseeable future.

It is this fundamental feature which lies at the root of the conservation and management problems which have faced fishing industries, governments and international fishery management bodies for many years and still remain with them today. They stem from the fact that the productivity of each exploited resource has an upper limit, determined by its biological properties and processes, and hence it is vulnerable to overexploitation, leading to decline if fished at too high a rate.

Scientists have, of course, been aware of these general features of exploited fishery resources for a long time. But, it was not until some of the consequences of fishery expansion had been observed following the major growth in commercial fishing, starting with the development of steam propulsion towards the end of the nineteenth century, and accelerating rapidly during the interwar years and again after 1945, that their full implications were recognised and became subject to detailed scientific study. These studies established at an early stage a number of important common changes in the features of expanding fisheries, the most important of which were a downward trend in catch per unit fishing effort (which provides an index of exploited stock abundance), a decrease in the average size (and age) of fish in the catch and in some fisheries a reduced total

catch. The studies also embraced the elucidation and measurement of the main dynamic parameters and processes involved in fishery production systems, and the development of mathematical models combining them, to provide quantitative descriptions of these changes, and the means for establishing a basis for the rational exploitation of the resources. While some very important pioneer work in these directions were taken during the interwar years especially by Hjort, Baranov, E S Russell and Graham, the main advances in the development of this quantitative methodology, and its use as a basis for establishing conservation and management policies and measures, have taken place since the second world war, notably by Beverton and Holt, Schaeffer, Ricker, Gulland and others. It is important to note, in fact, that this branch of science is relatively young and still developing fast.

Fishery Assessment Models

I will not attempt here to describe the formulations of these various analytical methods and models (a list of references is given on p. 19 for those wishing to study them in detail). Instead, I will confine myself to a brief consideration of the main parameters incorporated in the models governing the nature of the changes in fishery catches (yields) and exploited stocks* in relation to changes in the pattern and intensity of fishing.

The parameters of the system which determine the production and size of an exploited stock and the catch taken from it are as follows:

- (1) the recruitment (R) of young fish to the exploited stock
- (2) the growth (G) of the individual fish within the stock
- (3) the deaths occurring in the stock due to natural causes (eg predation, starvation, disease etc., termed natural mortality (M))
- (4) the deaths occurring in the stock due directly to fishing, termed fishing mortality (F), which constitute the catch. This parameter is directly proportional to the fishing intensity (fishing effort) generated by the fishery.

The first three factors together determine the natural production and size (biomass) and composition of a fish stock and its natural rates of increase or decrease, and the fourth, the fishery production, or catch.

The models which have been developed to describe and evaluate these processes can be divided for convenience into two main groups. One group, often called logistic type models, treats the natural production in weight of a fish stock as a direct function of stock size (biomass), in the

* The term stock (often called unit stock) is used here to describe the assemblage of fish which is more or less self contained biologically and can be treated as a separate exploitation or management unit in which the effects of fishing can be treated separately from those of other groups (stocks) of the same species. In some instances it will comprise the total population of a species, and in others a geographical sub-group of a species population - while in others it may comprise the members of more than one species having similar biological characteristics which are exploited together by a fishery.

same general way as the classical studies of human population growth. It postulates that at any stock size between zero and its highest attainable level, it will have a net rate of natural increase. The rate will approach zero at very small stock biomass, and again as the stock approaches its highest attainable saturation (ie virgin stock) level, and reaches a maximum value at an intermediate biomass level. Since the increased biomass at each stock size constitutes "surplus natural production" in the sense that it is not required for maintaining the stock at that level, and hence is available for fishing, it follows that the potential sustainable catch (yield) from the stock will also have a maximum value, associated with an intermediate stock biomass level.

A general representation of the form of the relationship between sustainable yield and stock size, obtained from Schaeffer's (1954) formulation of the model is shown in Figure 1 (p.20).

The maximum shown in this curve constitutes the well known Maximum Sustainable Yield (MSY) from the stock. The value of MSY, together with the fishing intensity required to achieve it, can be determined for any exploited stock from time series data on catch and fishing effort for the fishery exploiting it. A stock can be regarded as biologically over-fished when the average stock biomass has been reduced by fishing to below the MSY level.

While the logistic type model has been shown to describe the changes in stock biomass and catch which have taken place in a number of fisheries in different parts of the world, and makes a relatively small demand on data in its application, (eg it can be applied using reliable time series data of catch and fishing effort for a fishery at different levels), it does not allow for the analysis of the individual biological factors governing total production and fishery yield within the system. This is possible with another type of model commonly termed the "dynamic pool" model. This type of model, of which the formulation by Beverton and Holt (1957) has formed the basis of most of the ICES assessment work hitherto, describes stock biomass and fishery yield as functions of the rates of the individual natural and fishery production parameters, recruitment, growth, natural mortality, and fishing mortality (which as indicated above is proportional to fishing intensity). Its general basis is illustrated by the following, simple formulation specified by Russell (1931):
$$P_2 = P_1 + (R+G) - (F+M)$$
, where P_1 and P_2 represent the stock biomass in two consecutive years.

Per-Recruit Analyses

In applying this type of model, it is possible, and appropriate, at least as a first step, to consider the effects on fishery yield and stock size of changes in the amount and pattern of fishing in relation to the growth and recruitment parameters separately. This can be done for the growth parameter by examining the relationship between yield and stock biomass and fishing mortality rate (fishing intensity) on a per-recruit basis. This relationship will be governed for any particular exploited fish stock by the nature of the growth characteristics of the individuals in the fish stock and the natural mortality rate applying within it. Two hypothetical examples of the kinds of relationship between equilibrium yield per recruit and F applying to stocks exploited in the Northeast Atlantic (assuming no changes in the growth and natural mortality rate parameters with changes in F) are shown in Figure 2 (p. 21).

Although as these two examples show, the precise forms of the equilibrium yield per recruit/ F curves are not the same for all fish stocks, due to

differences in the growth characteristics of the individual fish in the stock and the natural mortality rate, they are all characterised by increasing equilibrium yield per recruit with increasing fishing mortality rate to a more or less well defined maximum at a specific value of F . This is the value of F , known as F_{max} , at which, at equilibrium, the yield per recruit from a stock is maximal for a given pattern of fishing. In the example given in Figure 2a, which is reasonably representative of a number of the demersal fish stocks exploited in the ICES area at the present time, the position of F_{max} is well defined and occurs at a relatively low level of F (fishing intensity) and relatively high level of stock biomass per recruit. On the other hand, in the second example shown in Figure 2b which is representative of many of the pelagic fish stocks, it is much less clearly defined, and occurs at a relatively much higher value of F and much lower stock biomass level per recruit. A situation in which the observed level of F generated by a fishery having a particular fishing pattern is in excess of F_{max} defines a state of growth overfishing. In such a situation a reduction in the level of F , and hence fishing intensity to, or towards F_{max} would, given constant parameters, result at equilibrium in a higher stock biomass (and catch per unit effort) and yield per recruit.

The yield per recruit/ F curves shown in Figure 2 describe the changes in equilibrium yield per recruit resulting from changes in F (fishing intensity) for a given age (size) at which the individuals in the fish stock recruit to the fishery. The form of the curve will also be affected if this age changes. This may happen as a result of economically generated changes in the "pattern" of a fishery (as occurred with North Sea herring with the development of the industrial fishery for juveniles in the 1950s), or as a result of a change in the fishing characteristics of fishing gears, such, for example, as a change in trawl mesh size. An illustration of the kind of effect that changes in recruitment age can have on the yield per recruit/ F relationship is given in Figure 1 on p.4 of the Report of the ad hoc Meeting on the Provision of Advice on the Biological Basis for Fisheries Management (ICES, Coop. Res.Rep., No.62). In fact, separate analyses can be made of the relationship between equilibrium yield per recruit and recruitment age, at given values of F . Figure 3 (p. 22) illustrates this relationship for two different F values ($F_2 > F_1$). The important feature of each of the curves shown in Figure 3 in the context of stock and fishery management is the occurrence of a recruitment age (size) at which the yield per recruit is at a maximum. There is, in fact, a corresponding "optimum" recruitment age for each level of F , and vice versa.

Recruitment

The results of analysis of changes in yield per recruit in relation to changes in fishing mortality rate and age of recruitment are applicable to the total yield from a stock if the level of recruitment is constant. It is well known, of course, that this is not the situation in practice; in fact, as illustrated by data on observed changes in the strengths of successive year classes of North Sea haddock in Figure 4 (p.23), the recruitment parameter exhibits wide short-term variability for virtually all exploited fish stocks. These are due principally to environmentally induced, density independent changes in the survival of early life history stages (eggs and larvae). This variability generates short-term fluctuations in stock size and composition, and in fishery catches (and catch per unit effort), especially in heavily exploited and short life-span species, in which the recruit age class constitutes a major component of the exploited stock.

This feature of exploited fish stocks does not by itself invalidate the results of "per-recruit" analyses as a basis for the establishment of stock management objectives. What is of particular importance in this context is whether, and if so, the extent to which the level of recruitment is also directly dependent on the size of the parent spawning stock over the range of stock sizes likely to be encountered in fishery situations. The main requirement is, in fact, knowledge of the form of density dependent relationship between recruitment level and parent stock size. Owing to the complexities of the biological processes involved and the extent of the random variability in recruitment due to density independent factors, the relationship is very difficult to determine and is not known for the main exploited stocks in the ICES area with any degree of certainty. The available evidence suggests, however, that for most fish species it is likely to be of a form described by the illustration in Figure 5 (p.24). The very important feature of this representation is the descending left-hand limb, which signifies that below some level of stock size, which I have called in Figure 5 the critical zone, recruitment becomes strongly stock size dependent and will decrease, leading to rapid stock decline. Such a situation constitutes a state of recruitment overfishing, the fishery effects of which are likely to be severe. There are, fortunately, as yet few established cases of recruitment overfishing in North Atlantic fisheries. The best known example in the ICES area are the North Sea and Atlanto-Scandian herring, the stocks of which were reduced by rapid, large increases in fishing intensity during the mid-1960s.

Although, as indicated in Figure 5, at stock sizes above the critical zone, the relationship is uncertain (it probably differs between stocks) the available evidence suggests that for teleost fish species (having high fecundity) it is mostly "flat-topped" over a considerable range of stock sizes. Over this range it has been generally assumed, for assessment purposes, that average recruitment is independent of stock size. In this situation, the value of F_{max} giving the maximum equilibrium yield per recruit, corresponds with the F value (F_{MSY}) giving the maximum sustainable total yield (MSY) from the stock.

The Need and Options for Management

The above brief and highly simplified summary of the factors governing production in exploited fish stocks and of the relations between changes in the intensity and pattern of fishing and fishery yields demonstrates that rates of fishing above certain definable and measurable levels will result in smaller, average yields than the stocks are capable of sustaining, together with higher short-term variability in stock biomass, catch and catch per unit effort and, in extreme cases the severe depletion of the stock and collapse of the fishery. These are the bases on which the stock conservation and management objectives have been chosen and appropriate fishery regulations have been worked out and developed for the Northeast Atlantic fisheries during the past 30 years.

In the early stages of their development and application by the Permanent Commission of the 1946 Overfishing Convention, and its successor the North-East Atlantic Fisheries Commission (NEAFC) in the years before the main post-war escalation in fishing, these developments were centred on improving the pattern of fishing through recruitment age controls - eg by minimum mesh size and/or fish landing size controls. It soon became evident, however, that although desirable and beneficial such measures were insufficient by themselves as a management objective aimed at preventing or curing growth or recruitment overfishing. Apart from the practical difficulties in applying the "best" mesh size or equivalent measure for each species in

many fisheries - especially the mixed species demersal fisheries in areas such as the North Sea, they did not provide any control of the intensity of fishing, and hence fishing mortality rate on the exploited part of the stock. Indeed, as pointed out by a number of fishery economists the benefits in stock biomass and catch per unit effort accruing from them provided encouragement for increases in fishing intensity. It was clearly necessary to include the control of fishing mortality rate as well as, where appropriate, recruitment age within the management objectives. To make this possible the NEAFC Convention was amended in 1977, to allow for the consideration and implementation of such measures within the European fisheries. Since then measures controlling F , through TAC and catch quota regulations, have become a major element of the management regime for them. An alternative method, not as yet applied in the management of the main international fisheries in this area, would be by the direct regulation of fishing intensity, either alone, or in association with catch regulations.

The choice of the precise management objectives, policies and measures to be applied for any fishery will be governed by a large number of technical and socio-economic factors, as well as the biologically based ones, dealt with above. An important element affecting this choice is the actual states of the fisheries and exploited stocks at the time when conservation/management policies and actions are first considered. For most of the major fisheries in the ICES area since the war they have been developed in a situation of biological overfishing and stock depletion (in some cases severe) in which the fishing mortality rate (fishing intensity) has been far in excess of the values corresponding with the maxima on yield curves. In such a situation, management objectives based principally on biologically based criteria such as moving towards the achievement of MSY , F_{max} , etc., resulting in stock improvement and maintenance at a more satisfactory and "stable" level, and increased (if not maximal) average yield of fish, with less effort (and fishing cost) seems appropriate at least as an interim step, even if they fall short of the economic "optimum" situation for the fishery.

Of the two forms of overfishing, the one which has the most damaging fishery effects is recruitment overfishing, which if not detected and dealt with promptly through conservation/management action may lead to complete stock and fishery collapse. Its avoidance or, if occurring, its early detection and cure by prompt fishery control action is therefore of major importance. In its consideration of this important requirement the ICES ad hoc Group on the Provision of Advice on the Biological Basis of Fisheries Management (Coop.Res.Rep., No.62) pointed out that the maintenance of the spawning stock at a satisfactory, safe level above the critical zone, should constitute an essential objective in the formulation of management advice (eg. on TACs). It pointed out that the situations in which measures based on the "achievement of F_{max} " objective run the greatest risk of failing to avoid recruitment overfishing occurring, arise from fish stocks having more or less flat-topped yield per recruit/ F curves, in which the F_{max} value may be high - and hence be associated with a low average spawning stock biomass. In such situations, it recommended a somewhat lower value of F than F_{max} , as a safer objective. A value of F , termed $F_{0.1}^*$, which has been proposed as an alternative to F_{max} for such stocks (perhaps for all) is shown in Figure 2.

* $F_{0.1}$ is defined as the fishing mortality rate at which the slope of the yield per recruit curve is one tenth of the slope of its origin.

Although management at the $F_{0.1}$ level would be at the expense of a small loss in yield per recruit relative to that at F_{max} , it would result in a substantial increase in stock biomass (and hence in catch per unit effort) and greater stock stability. It also has the advantage of being closer to the F value corresponding with the estimated economic "optimum" exploitation, which occurs at a lower level of fishing intensity and higher stock biomass than that corresponding with F_{max} (F_{MSY}). As pointed out by the Ad Hoc Group, the establishment of an appropriate fishing pattern through, for example, the control of recruitment age, can also contribute together with control of F in achieving the desired, safe level of spawning stock. This should, therefore, be taken into account in the choice of management measures for any fishery in the light of the practical fishing conditions applying within it.

Mixed Species Problems

In the above brief survey the considerations of possible biologically based management objectives and measures have been made in terms of individual fish stocks and of physical yields. No attempt has been made to consider, for example, economic factors except in so far as they are reflected in the increases in physical yield for less effort, or specific problems associated with mixed species fisheries which exploit a number of stocks in a given fishing area (which is a common feature of many demersal fisheries in the ICES area), or with biological interactions between stocks inhabiting the same area.

In mixed species fisheries it may be very difficult, or indeed impossible to achieve the "best" predicated combination of F value and pattern of fishing for each stock treated separately. It may, in fact, lead to growth or recruitment overfishing of one or more of the mixed stocks in the course of achieving "optimum" management for another unless safeguards against this are embodied in the management system. The actual management objectives and measures to be adopted in such situations will be governed by the detailed nature of the fisheries and relative sizes, biological properties and dynamics of the individual stocks, and by economic factors. The latter will be of major importance, for example, in situations where the market values of the different species exploited in a mixed fishery differ significantly. In such cases, it may be advantageous economically and/or politically, to gear the management objectives and measures to maximising the sustainable yield of one species, even if it generates a degree of biological overfishing of some or all of the others, and incurs a loss in total yield of all species combined. In other situations, where a target species is less well defined, an objective aimed at achieving the highest attainable sustained average catch of all species combined, whilst safeguarding against severe recruitment and growth overfishing of all of them, may be appropriate. The two-tier, catch quota management system adopted by ICNAF for the fisheries on Georges Bank (ICNAF Subarea 5) was based on this broad objective.

Similarly, biological interactions between exploited fish stocks within the same ecosystem cannot be ignored in the establishment of management objectives and measures. Their possible effects can arise in a number of ways. One of the most important is the impact of a significant change in the biomass of one stock, resulting from management action, on the natural production parameters, recruitment, growth or natural mortality of others, through changes in predation pressures, competition for food or favourable spawning grounds, etc. Such changes, if significant, would clearly influence the results of yield assessments based on treating the individual stocks as independent with respect to their production parameters. In particular, they raise important questions regarding the capacities of

individual ecosystems to maintain the average biomasses predicted from single stock models of all of their constituent exploited species at levels corresponding with MSY, or lower (eg. $F_{0.1}$) levels of exploitation. Because of the complexity and natural variability of marine ecosystems these effects are difficult to identify, measure and, especially, predict. These interactions, especially of the predator-prey systems, are currently a very important focal point of multispecies assessment model development and biological research in the ICES area. Pending more definitive and usable results from this research, it is necessary to continue to base management aims on the results of single species stock assessments, but taking due account of any known or strongly suspected species interaction effects in the establishment of the precise objectives for individual stocks or groups of stocks.

As its title indicates, this contribution is concerned almost exclusively with the scientific (biological) principles and factors which have been used hitherto in the ICES area in guiding management bodies in their choice of possible management objectives and policies. It must be emphasised, however, that economic, social, legal and political factors are also of major importance and must be taken into account in framing them, and in the choice of measures to implement them. Fishery economists have repeatedly emphasised this need for a number of years, and it is re-emphasised in the report of a recent FAO Working Party on "The Scientific Basis of Determining Management Measures". It stresses the need to treat fishery management as an integrated system, involving information inputs and expertise from different disciplinary sources. It points out that as in other business management systems successful fishery management depends on the decision maker making sure that all relevant information and viewpoints are represented in a balanced way in arriving at management decisions. Hitherto, such a fully integrated systems approach to management in the ICES area has been made particularly difficult by the complex international nature of the fisheries, but it has been facilitated at least to some extent by recent changes in the Law of the Sea regime. It must be emphasised, however, that such an approach does not reduce the importance of the biological data inputs and the role of the fishery biologist within the system. The need for cooperative research and collective analysis and assessment of pooled scientific data on the fisheries and exploited stocks within their total range of distribution as undertaken hitherto within ICES for the Northeast Atlantic fisheries, remains an essential requirement for the future.

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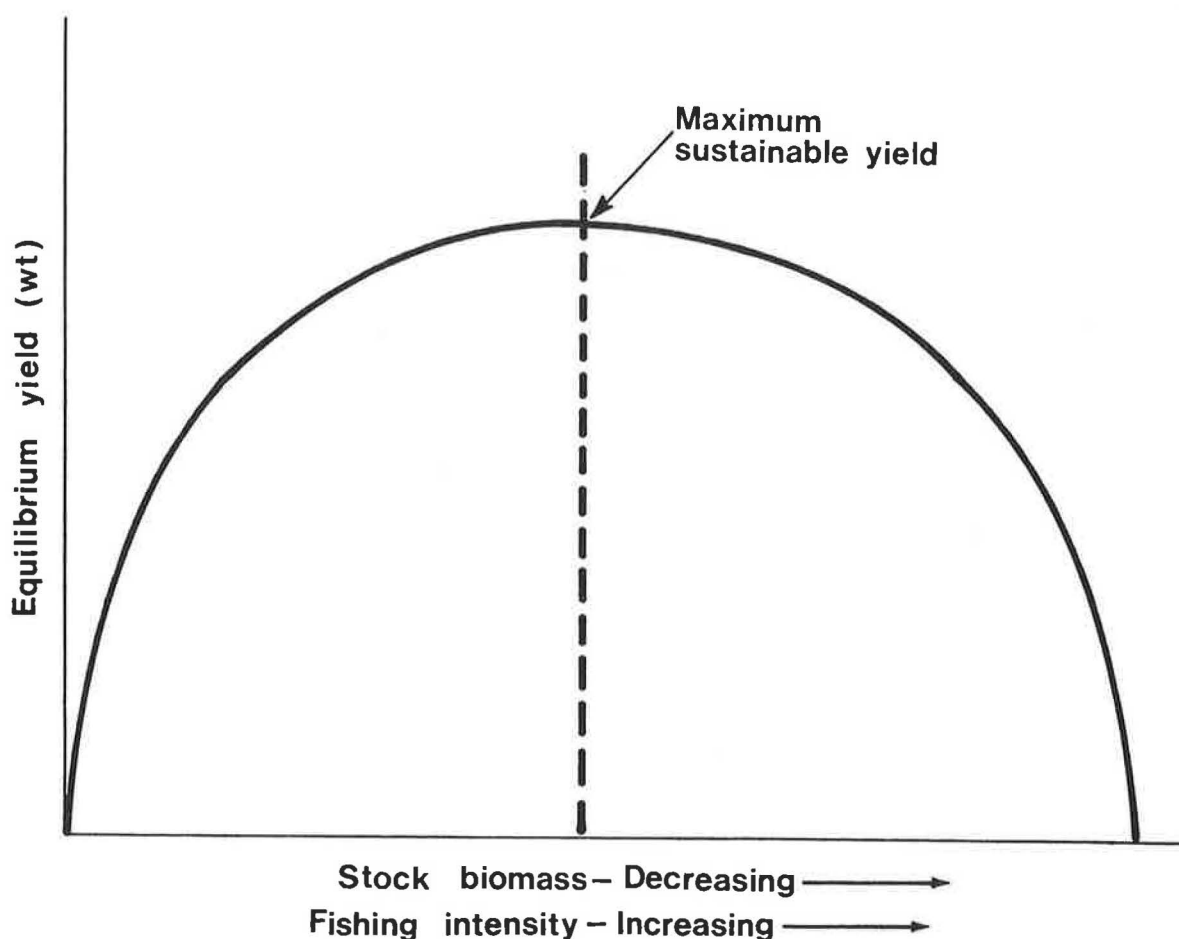


Fig 1 Relationship between EQUILIBRIUM YIELD, STOCK BIOMASS and FISHING INTENSITY

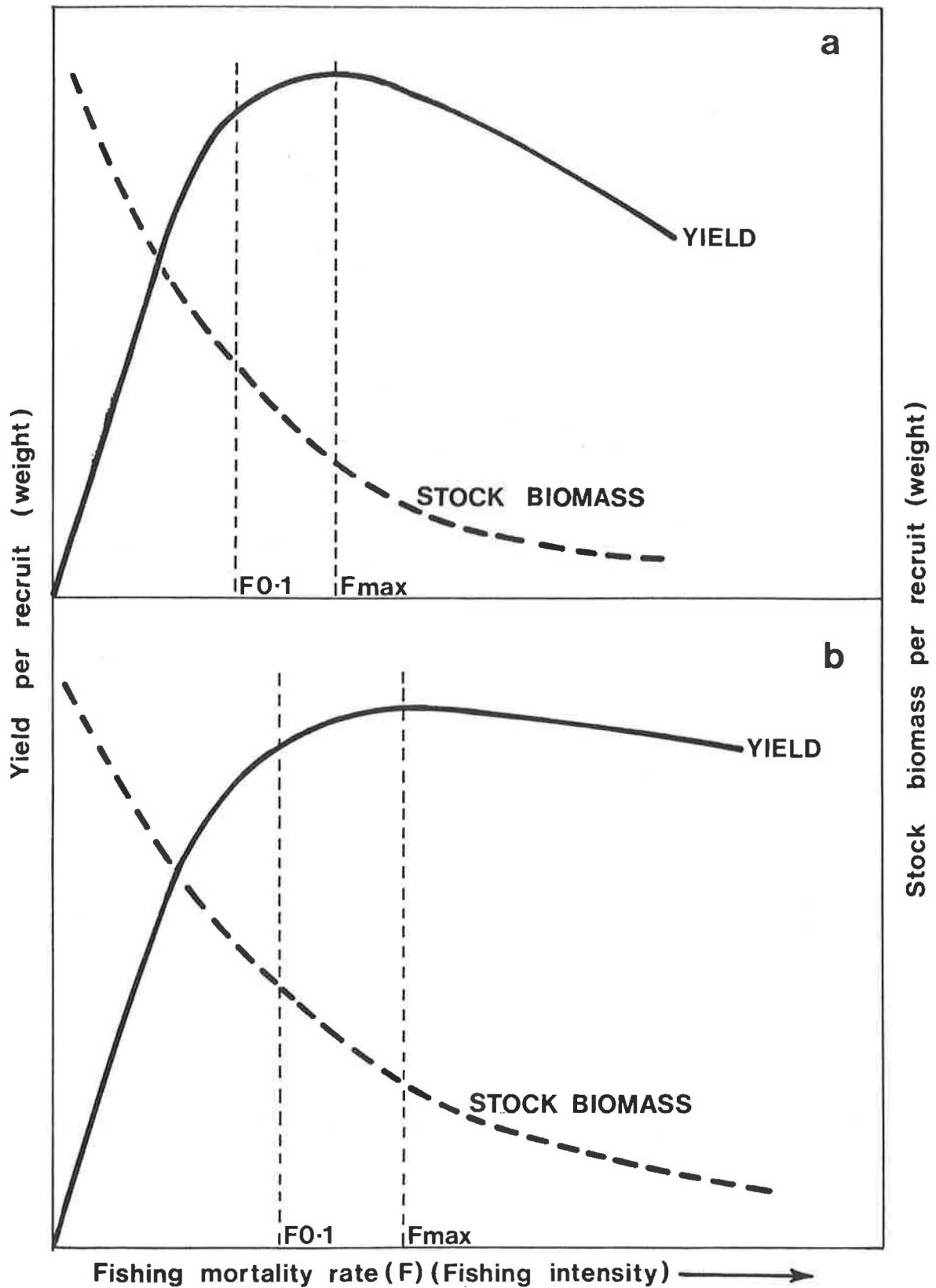


Fig 2 Relationship between EQUILIBRIUM YIELD, STOCK BIOMASS per RECRUIT and FISHING MORTALITY RATE

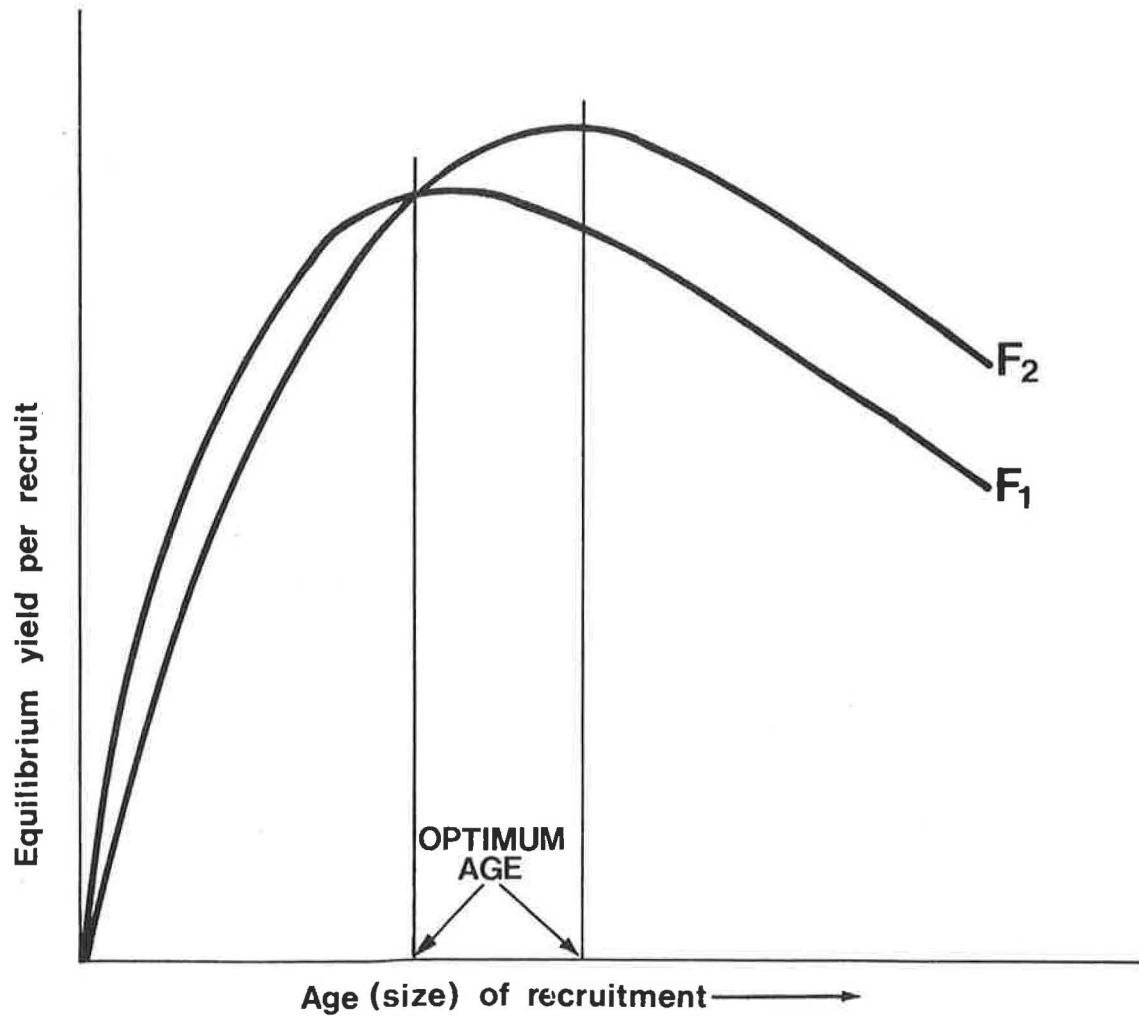


Fig 3 Relationship between EQUILIBRIUM YIELD per RECRUIT and AGE of RECRUITMENT

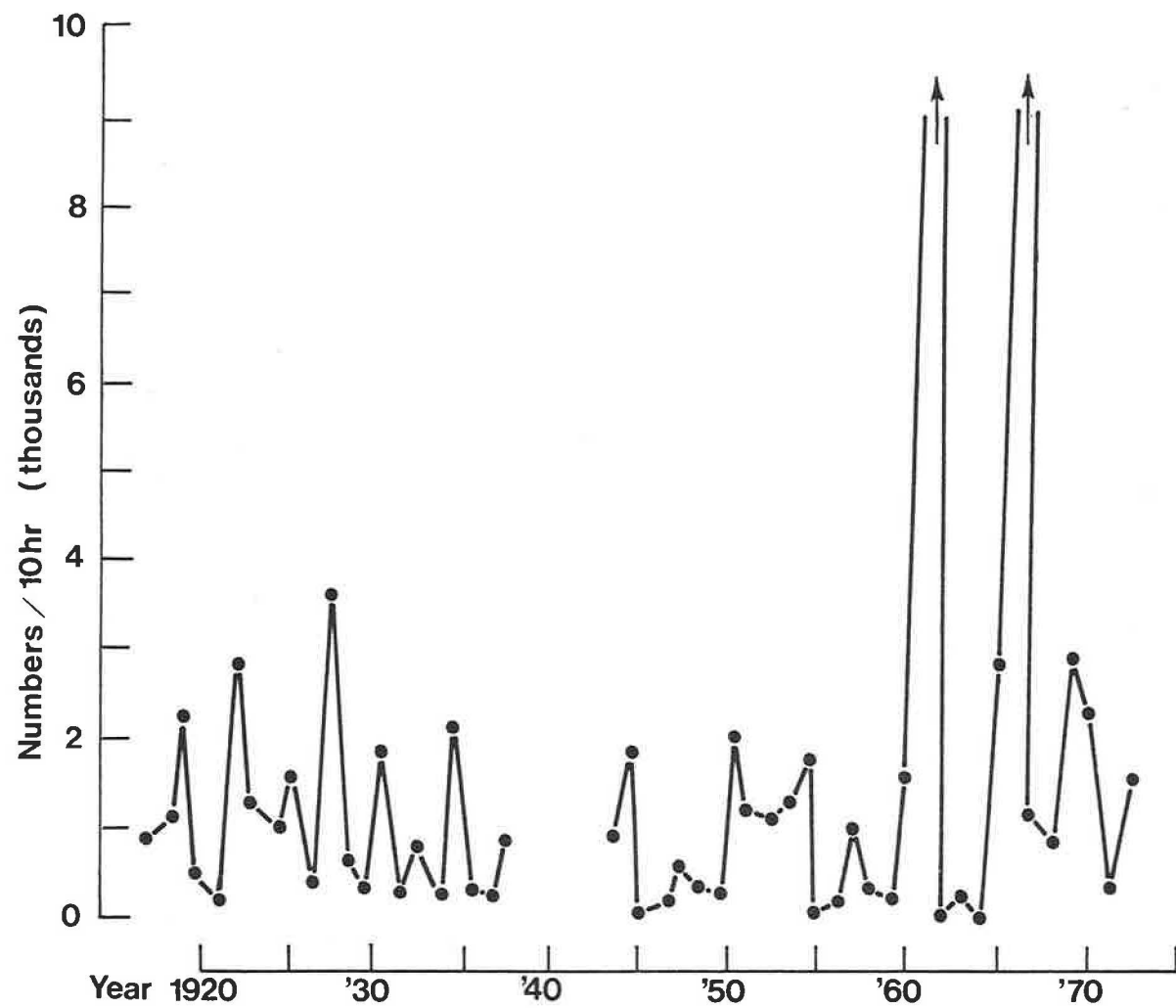


Fig 4 N. SEA HADDOCK, YEAR-CLASS STRENGTHS based on numbers of 1+ fish caught per 10hours' fishing by Scottish research vessels

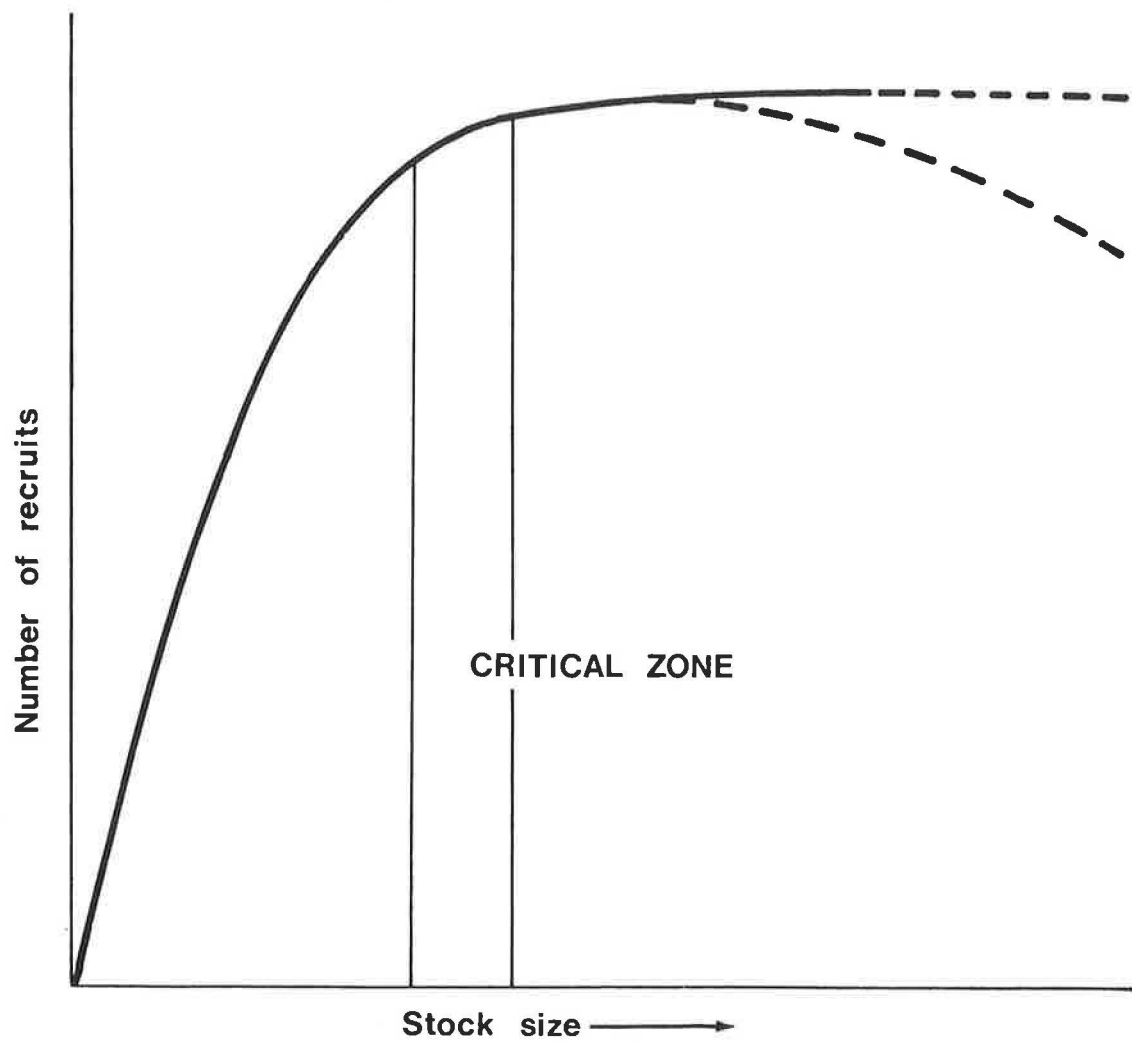


Fig5 Generalised schematic representation of likely relationship between RECRUITMENT and STOCK SIZE

ANNEX 4

A SURVEY OF THE FUNCTIONS AND STRUCTURE OF ICES - WITH SPECIAL
REFERENCE TO ITS ROLE FOR FISHERY MANAGEMENT

by

G Hempel

President of ICES

1. Evolution of the Functions and Structure of ICES

The creation of ICES is the direct consequence of the drastic increase in the fisheries of the Northeast Atlantic in the last quarter of the 19th century when the motorization of the European fishing fleets together with the food demands of the new industrial centres resulted in an enormous expansion of fishing effort and of governmental and scientific interest in fisheries. The need for better knowledge of the biology and dynamics of the fish stocks became obvious. The investigation of the fish populations and of their marine environment and the provision of advice for protective measures became tasks far beyond the capacity of a single laboratory. In 1899 the new concept of an International Council for the Exploration of the Sea was developed. A programme of cooperative studies at sea and of statistical analyses was outlined. Right from the beginning ICES had two goals:

- Good science for the better knowledge of the physics, chemistry and biology of European waters, and of their living resources.
- Good advice to fishery management.

The belief that those two aims are linked was expressed in the preamble of the founding recommendation of ICES:

"Considering that a national exploitation of the sea should rest as far as possible on scientific enquiry, and considering that international cooperation is the best way of arriving at satisfactory results in this direction, especially if in the execution of the investigations it be left constantly in view that their primary object is to promote and improve the fisheries through international agreements....."

Those principles were adhered to in the following decades and the structure of ICES evolved as a consequence of the changing needs. Advice on fisheries management was given to member countries on the basis of scientific reports produced by individual scientists and later by the Council's Standing Committees.

The first major change in the Council's advisory functions occurred when the Permanent Commission of the International Fisheries Convention became operative in 1953 (followed by NEAFC in 1963). By this, the responsibilities of the Council regarding fisheries management had to be re-defined.

In general, the major steps in preparation of regulatory measures in fisheries are (Table 1, p. 30):

- 1) Exchange of statistical data and scientific results, planning of joint exercises (cruises, data collection).
- 2) Evaluation of the results and assessment of the present state of stocks and communities.
- 3) Proposals for regulatory measures.
- 4) Adoption of regulatory measures.
- 5) Implementation and control of regulation.
- 6) Evaluation of effects of regulation (feed back to 1) and 2)).

Before the creation of the Fisheries Conventions in the Northeast Atlantic steps 1-4 and 6 were within ICES, although the adoption of the regulatory measures was formally a matter of Member Governments concerned. Then the Permanent Commission respectively NEAFC took over from ICES step 4. ICES became a statutory scientific advisory body to NEAFC and since 1973 also to the newly established fishery commission for the Baltic (IBSFC).

The Permanent Commission at its establishment in 1953 considered itself as "the body for the application of scientific knowledge in the management of fisheries - through internationally agreed measures and policies". In those days the introduction of regulation of minimum legal landing size of fish and of minimum mesh size were adopted as a means of preventing "growth overfishing".

The Council created a Liaison Committee in order to link ICES activities of step 1 to 3 with the work of the Commission. Members of the Liaison Committee were the Chairmen of the relevant Committees of ICES; they were assisted by coopted members who used to be experts in population dynamics.

Another major change occurred in the 1960s and early 1970s with the increasing concern about marine pollution. International conventions and commissions were established. A situation has gradually developed where particularly through the efforts of the Council's General Secretary, ICES now plays formally or informally a key role in the scientific advice for the various Pollution Conventions in the North Sea and the Baltic. Structural adjustments were the formation of a Standing Committee on Marine Environmental Quality and of an Advisory Committee on Marine Pollution.

During recent years, the activities and responsibilities of ICES have changed with the further development of marine science and fisheries as well as with the expansion of its membership and the new Law of the Sea.

Ecosystem modelling and remote sensing are just two of several key words indicating the new development. Now virtually all fish stocks in the ICES area seem to require some kind of management. Problems of multi-species management of entire systems like the North Sea came into focus. "Recruitment overfishing" and "ecosystem overfishing" are in the center of concern of many fishery biologists, who also worry about the multi-purpose exploitation of several fishing areas which are now also used for gravel extraction, dumping and oil and gas exploitation.

USA and Canada joined the Council. Hence the geographical area of interest expanded to the western North Atlantic, i.e. into the area where ICNAF was the official body for stock assessments and regulatory measures. The American members and participants of ICES meetings contributed greatly to marine science in general but they were not interested in detailed debates on management of certain fish stocks, e.g. in the North Sea.

The extended national jurisdiction over most of the fishing areas was not the end of international advice to fish stock management. Most of the stocks cross the national borders and within much of the waters under the jurisdiction of EEC a common fishing policy has to be agreed upon by the EEC countries. Therefore, a system of catch quota had to be developed along with other regulatory measures. That means more work for ICES through more detailed and frequent advice.

2. The Present Day's Functions and Structure of ICES

2.1 The functions of ICES

The list of functions of ICES includes the following activities (Table 2, p. 31):

ICES serves as a forum for scientific discussions and for the presentation of scientific papers.

ICES plans cooperative studies, expeditions, and data analysis.

ICES advises member states on matters concerning marine research (e.g. standardisation of methods, compilation of data, etc.) and other marine matters (e.g. introduction of non-indigenous species, statistics, data exchange).

ICES advises member states and international commissions on the management of exploited fish stocks and marine communities and on matters related to marine pollution and its monitoring.

ICES through its Secretariat serves as a data center for oceanography of the Northeastern Atlantic and as a center of fishery statistics. Apart from data storage and retrieval, the ICES Secretariat assists Working Groups and individual scientists in the use of the data files, it provides processing facilities and it has a very extensive library on marine sciences and fisheries.

ICES is a publishing house for most of the proceedings of ICES-sponsored symposia (Rapports et Procès-Verbaux), for one of the best marine journals (Journal du Conseil), for annual reports of fishery statistics and of the biology and hydrography of the North Atlantic as well as for reports of cooperative studies and advisory reports.

Within the ICES machinery data are compiled on marine fisheries, pollution, descriptive oceanography, and plankton distribution in the Northeastern Atlantic. They are also jointly analysed, brought into context and are discussed in the light of old and new scientific concepts. Finally they get published and are used for the advice for regulatory measures, pollution control and further scientific action.

The unique combination of a wide scientific community gathered at the Statutory Meetings and in the Working Groups and of a Council of governmental representatives gives ICES both strong scientific competence and the political weight of a governmental organisation. The Council's work in marine sciences and in fisheries research pro-

vides a sound and broad basis for management advice. On the other hand, the advisory role of ICES helps to promote international and national projects in marine sciences.

2.2 The present structure of ICES

The presentation of scientific papers and the scientific discussions take place in the Standing Committees and interdisciplinary General Sessions of the annual Statutory Meetings with the participation of 300 - 400 scientists. Each year one or two symposia on selected subjects are being held outside the Statutory Meetings. They are often cosponsored by other international organisations and draw in scientists from all parts of the world.

Statutory meetings of the Standing Committees and symposia provide also the forum initiating cooperative studies. Any recommendation particularly those concerning actions (e.g. expeditions, meetings, publications) which involve the finance and Secretariat of ICES or might bind member states has to be confirmed by the Consultative Committee before it goes to the Council of Delegates for final approval.

Detailed planning of international expeditions and experiments as well as the subsequent analysis of data and the preparation of symposia is rather time consuming. It cannot be done at the meetings of the Standing Committees, but it is delegated to Working Groups or to individual scientists. On a purely voluntary basis, laboratories of ICES member states have always assisted the Council by providing skilled manpower and technical facilities.

The steps from data compilation through analysis and stock assessments leading to the preparation of advice for fish stock management are mainly carried out by about 30 Working Groups in cooperation with the relevant sections of the Secretariat. The Council's premises and some laboratories of member states host at least 3000 man-days of Working Groups mainly on stock assessments every year. The reports of the Working Groups go to the Standing Committees and to the two Advisory Committees on Fishery Management and on Marine Pollution respectively. Membership is different in the two Committees. In analogy to the Standing Committees and the Working Groups, the Advisory Committee on Fishery Management (ACFM) consists mainly of national members nominated by Delegates and appointed by the Council, under an independent Chairman. The Advisory Committee on Marine Pollution (ACMP) is mainly a body of independent experts.

The scientific and advisory functions are closely linked. In the Consultative Committee the Chairmen of the Standing scientific Committees and of the two Advisory Committees discuss the optimum input of science into the advice of ICES. Nevertheless, neither the Consultative Committee nor the Delegates change the advice given by the Advisory Committees, which act on behalf of the Council. (See diagram, p. 32.)

The administrative part of ICES consists of a governing body of the Council of Delegates from all 18 member states under the Council's President and of an executive Secretariat under the General Secretary. The Bureau, consisting of President and 6 Vice-Presidents, meets together with the General Secretary and the Chairman of the Consultative Committee and is allotted some tasks specified in the Council's Rules of Procedure.

ICES has a tradition of close cooperation with other international governmental and non-governmental organisations in the marine field and in fisheries which were created in post-war years. The links are particularly close to the Fisheries Department of FAO, ICNAF (now replaced by NAFO), SCOR, IBSFC, Baltic Oceanographers and Baltic Marine Biologists as well as to various Commissions on Fisheries and Marine Pollution.

3. Recent and Future Adjustments of the Council's Structure

The increase in scientific functions due to the Council's broadened membership, its growing interest in pollution and mariculture research and the higher sophistication and complexity of fishery assessments is reflected in some new structures of ICES. Attempts were made to reduce the number of Standing Committees and their administrative activities in order to allow more time for scientific discussions, particularly on an interdisciplinary level. To my mind, this course should be continued in order to make ICES attractive to a great number of excellent scientists. This seems particularly important in view of the need for complex multispecies models aiming at the management of ecosystems rather than of single stocks.

The advisory machinery has been streamlined through changes in the composition of the Advisory Committee and the system of reporting. Further improvements might include the reduction in the number of Working Groups and standardisation of their approaches of stock assessment and advice. This would facilitate the work of ACFM in compiling the findings of the Working Groups.

The Dialogue Meeting aims at improvements in the communication between ICES and its "customers" (member countries and organisations) for the advice on fisheries management. Although there are also other important tasks of ICES, Member Governments and fishing industry will measure ICES with the yard stick of timely, sound, comprehensive and comprehensible advice on TACs.

There is the well known complaint, ICES being too slow and therefore not able to advise on short notice. We will have to look into the structure of ICES whether we can adjust it even further to the present day's needs for a quick reply. On the other hand, the experts in fish stock assessments in ICES would like to receive clear questions from the administrators. There is little sympathy for requests which are produced by political or economic pressure groups rather than because of apparent changes in fish stocks. Furthermore, the better and up to date data sets and our knowledge about the dynamics of the populations are, the easier it is to come up with good and quick answers with a range of options for the politicians to choose from.

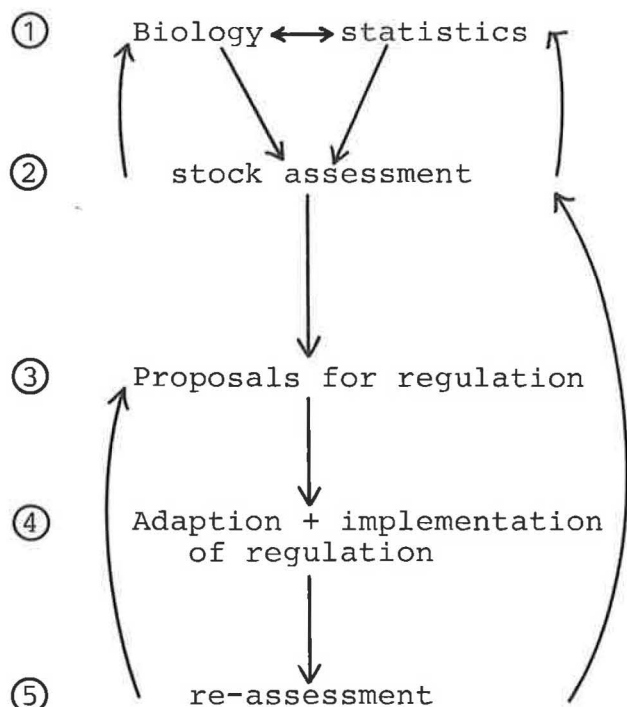
Functions and structure of ICES are geared towards advice in biological terms only. The political and economical arguments have to be added by Governments and fishery organisations. It seems advisable to stick to the present separation of objectives by which ICES confines itself to the provision of the best possible scientific advice, stating at the same time where the limitations lie in terms of statistical data and unpredictable fluctuations. It would be useful if the biologists and statisticians in ACFM and in the Working Groups would know some of the political and socio-

economic implications. This should not change the advice but ensure that the advice is presented in a form which is useful to the "customers".

Governments and organisations will ask their "own" scientists for comments and interpretation of the ICES advice. So far there have been only few cases in which part of the ACFM report has been questioned. Although ACFM and the Working Groups are by no means infallible, it does not seem advisable to duplicate much of ICES efforts on a national or regional level, mostly involving the same scientists who have produced the ICES advice.

Structures and lines of communication in ICES are by no means sacred, they have been changed several times in the long history of ICES. The Council was always interested in serving both parties, the scientific community and the Member Governments. Considerations of internal continuity and stability play a major role in ICES. They have to be weighted against the immediate wishes for adjustments to the present situation and to future trends.

A c t i v i t i e s



E x e c u t i v e s

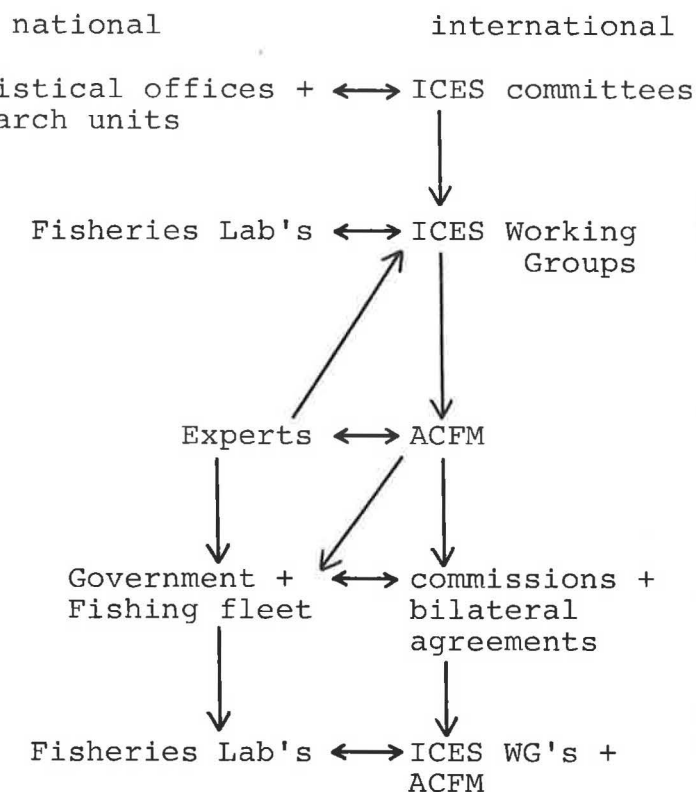


Table 1. Organization of advice to fisheries in NE-Atlantic.

Function	Structure
1) <u>Forum for discussions on marine science</u> Oceanography, biology, pollution, resources, exploitation methods	Committees Symposia
2) <u>Cooperative studies</u> Planning, evaluation, standardization of methods	Working groups
3) <u>Data storage, processing, dissemination</u> Oceanography, fish stock analysis, fishing effort	Secretariat (Service Hydrographique, Statistics unit)
4) <u>Scientific publisher</u> Journal du Conseil, Annales Biologiques, proceedings, reports, compilations, atlases. Exchange of publications	Secretariat (Publication unit, library)
5) <u>Advice</u> Fish stock management, pollution	ACFM, ACMP

Table 2. Main functions and corresponding structure of ICES

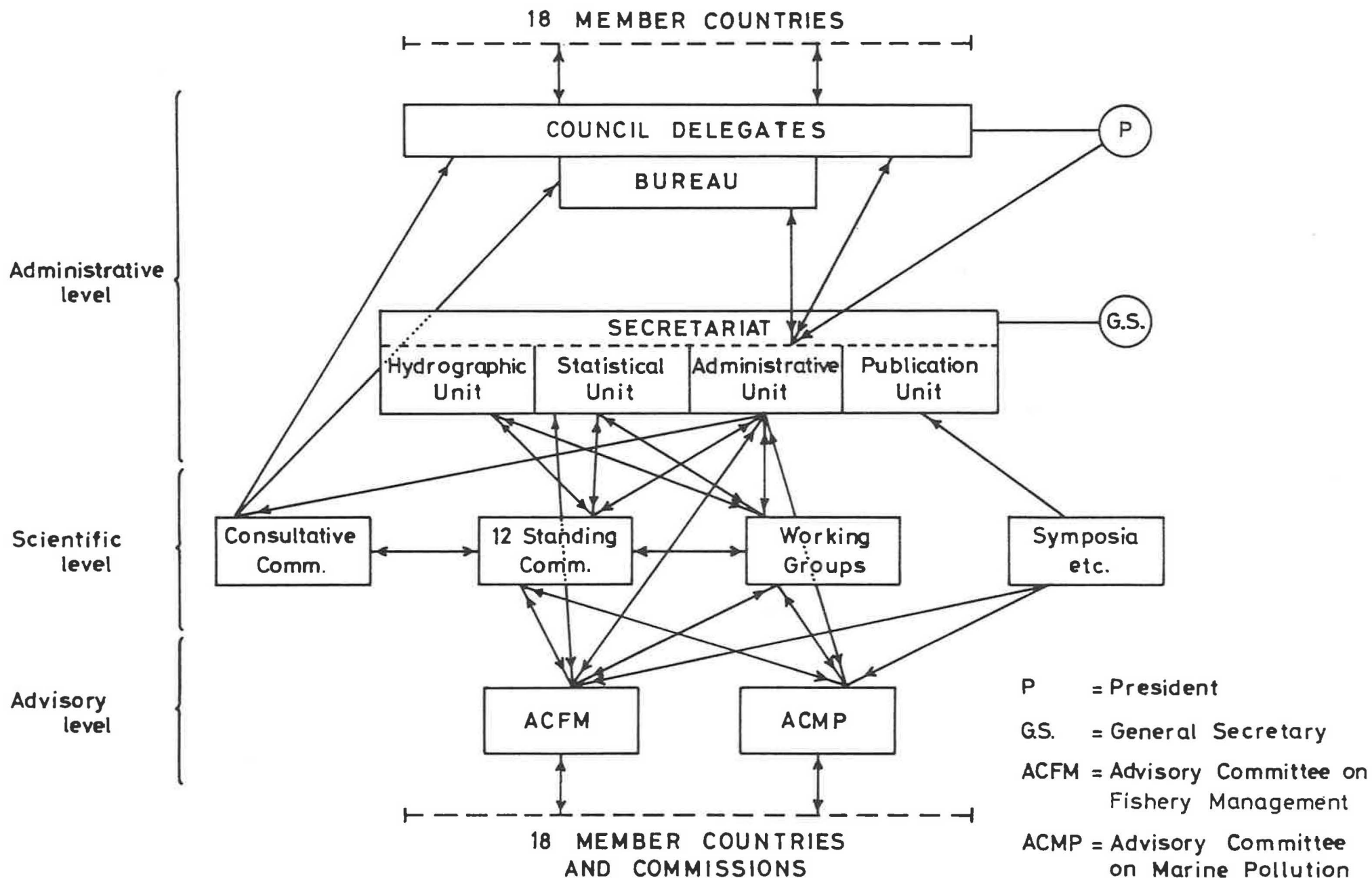


Diagram showing the various components of the ICES' organization and the functional relations between them.

ANNEX 5

ICES PROCEDURES FOR PROVISION OF ADVICE ON FISHERY MANAGEMENT

by

A. Saville, Chairman of ACFM

Introduction

It is clear that from the outset the major objective of the founder members in setting up ICES was to provide a body which 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 organisation this aim is clearly stated in the report where it is said: "... it be recognised 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, and 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 eighty 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's aim, and one would hope that you, as recipient of this advice, would agree this aim has been achieved with considerable success, has always been to supply the most objective scientific advice possible, founded only on considerations of the optimal utilisation 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 last decade, most particularly the extension of national fisheries jurisdiction and the resulting changes in the powers of regional fisheries 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 work load 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.

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 recognised 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 has therefore, in the past, emanated from these 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 potentially 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 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, much 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 coopted because of their special expertise, ACFM consists of one member nominated by each member country, the chairmen of the Standing Fish Committees, plus a chairman appointed 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 these 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 which are 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 these 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 finalised, 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 twenty-three assessment Working Groups so, although all of them may not meet every year, fitting them into a period of ten to eleven 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 exploitation levels, any relatively small underestimation of the TAC in the current year will be recouped, with interest, in the following year(s).

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 Mr 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:

- (a) the exploitation pattern; and
- (b) the exploitation rate to optimise the yield per recruit; and
- (c) 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 optimising 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, 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 over-riding concern for what such a policy will do, in the short term, to the spawning stock size. 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, as 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 which can cope with assessments which 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 are 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 fishing mortality rate 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 parameter, 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 optimising 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.

ANNEX 6

INVITED STATEMENT FROM NORWAY

1. Introduction

We would like to thank the ICES Secretariat for inviting Norway to prepare an advance statement for circulation. We are grateful for this opportunity to present Norwegian viewpoints and hope our statement will help to stimulate and guide the discussions. One should note, however, that there has been little advance formal preparation for the meeting, and the views and opinions expressed here are not made in response to any documentation presented by the Council, since this will only be available shortly before the meeting. The following is in this sense only the start of a dialogue.

We have found it useful to start this note with a look at ICES qua "regional fisheries body" in the context of the new ocean regime. Most of the "new" problems in management and management advice relate to the new regime, e.g. the arrangements and procedures for provision of advice and the relationship between regional advisory services such as those of ICES and the users. The main scientific problems remain largely unchanged, and we propose that the discussion of these should be limited to a few specific items.

2. ICES and the New Ocean Regime

ICES activities in providing advice on fishery management were established and developed to serve the Convention-regimes (Permanent Commission, NEAFC, Baltic Sea Fishery Commission). These were based on a "common property-nature" of the fish resources in the Northeast Atlantic, their management being negotiated and enacted by the countries adhering to the Conventions. Although ICES was formally not the only source of management advice for NEAFC, other sources were not made use of, and the ICES/NEAFC relationship was often quoted as a successful arrangement.

Most of the coastal countries in the Northeast Atlantic have now established EEZs on the basis of the draft text for the LOS Convention, and thereby assumed responsibility for the conservation and rational exploitation of all resources within their zone. Resource units which cover more than one zone are expected to be exploited and managed in cooperation between the relevant countries. By far the greatest part of the fish resources in the Northeast Atlantic are found within the EEZs. The majority of the fish stocks are shared between zones. The management of these are the subjects of bilateral agreements. ICES advisory system has with some minor modifications continued to function as during the former regime, and assessment of stocks and recommendations for management are made available to all member countries as well as to the existing fisheries commissions. The question of the acceptance of the advice is, however, no longer a matter of collective consideration as during the convention-regime.

It is now a matter for each individual country or groups of countries, i.e. those who exercise direct jurisdiction over the fish stocks, to decide whether or not to accept the scientific advice before them.

This shift from a collective or multilateral consideration of the scientific pronouncement to a situation where one or possibly a few states shall consider the scientists' advice has had important consequences for the value and impact of the scientific advice rendered.

We feel that this new structure has in many ways lent increased importance to the scientific advice. In general, the experience of the past three years indicates an enhanced willingness on the part of the users to plan and implement harvesting and management arrangements in accordance with the advice provided by the scientists. We hope that others will take this occasion to offer their views on this aspect of the new relationship between the scientific community and its users.

The fragmentation that we have seen over the past few years of the regional fisheries arrangements as they existed under the convention-regime has not, however, removed a *raison d'être* for a general advisory service under the new management regime. The problems of promoting biologically sound management policies clearly remain appropriate for evaluation by a body of scientists of the parties directly concerned as well as from a wider forum. And apart from its advisory services ICES will of course continue the important role of promoting and developing fisheries science in the region including the scientific basis for fishery management.

3. The Arrangements and Procedures for Provision of Management

Advice by ICES

The assessments of the various stock units - or groups - are prepared in the early part of the year and based on data and information usually up to and including the last full calendar year. This results in a considerable time lag, from one up to two years between the diagnosis of the stock and the consequent regulatory action in the fishery. On a number of occasions advice already submitted has had to be amended in the light of more recent information from the fisheries or from research. This creates confusion and affects the credibility of the advice.

Under the new regime bilateral and other negotiations for stock management do not take place until the last quarter of the year. Submission of the report of the ACFM can thus be delayed until early October following assessment Working Group activities during August-September. We propose that such a time schedule should be seriously considered. It would allow systematic inclusion of fishery- and research data from the first half of the calendar year in which the advice is formulated and thus ensure more reliable and better timed advice.

Since demands on the Secretariat services of ICES may still be severe with such a programme we would further propose that the meetings of the assessment Working Groups could to some extent be decentralised and take place in the fisheries research centers of member countries in accordance with an agreed programme of circulation. This would have the additional advantage of improved contact and communication between the fishery scientists of the region, and also perhaps result in a higher degree of commitment to the findings of the the Working Groups by the parties concerned.

It is realised that this new schedule of work of its fishery advisory services may necessitate a shift in the timing of other important ICES events, notably the Statutory Meeting, and that this shift could only be organised after a certain period of time. We would propose, however, that in this transitional period a re-assessment of certain critical stocks is undertaken in September of each year followed by a consideration of the findings by an extraordinary meeting of the ACFM during the Statutory Meeting in the first part of October.

4. The Future Relationships between ICES Advisory Services and the Users

The system of communication and contacts has not been adjusted to the user-structure under the new ocean regime. The existing arrangements are unsatisfactory particularly with regard to two aspects: the dissemination of the advice merely by the submission of the reports of ACFM leaves no room for consultations, e.g. request for further background information and explanations. This may affect the interpretation of the advice by the various users and also its acceptability. And the arrangements by which any user can request and be provided with advice on an individual basis at any time represents a wasteful usage of the member countries' scientific resources and may create confusion in management systems of shared resources. In this context we refer to the request by the EEC Commission for an extraordinary session of the ACFM to consider possible amendments of advice previously given on some shared stocks in the North Sea, only six weeks prior to the ordinary session of ACFM. Requests for advice on shared stocks should in our view only be submitted in consultation by all the coastal parties concerned.

There is thus a need for new forms of contact and communication between ICES advisory services and the users and we hope that this will be considered an important topic for discussion by the meeting. We are not in a position to propose any definite model or system, but would suggest that a regional or sub-regional structure may have various advantages.

In particular we feel that efforts should be made to improve and strengthen the channels of communication both within regional or sub-regional groupings of states and between such grouping and ICES itself. Here we have in mind the special need for the states most directly affected by the management advice provided by ICES to cooperate amongst themselves and likewise to coordinate their relationship with ICES. And of course in the event of a reactivation of a restructured NEAFC a leading role must be accorded to this organisation to plan and coordinate appropriate cooperation and dialogue between ICES and its different "customers".

5. Scientific and related Problems

We understand that the scientific basis of fishery management is kept in a state of current review by ICES and other institutions concerned with the development of fisheries science and we are looking forward to the report of the Chairman of ACFM on the subject. We will at this stage only draw attention to a few points which we feel are in

need of special attention. One concerns the conservation and management of severely depleted stocks. The principles and criteria to be followed in rebuilding such stocks to a "normal" production level and the amount of fishery which may be allowed in the rebuilding period should be discussed further. Similarly, there may be a need to establish more specific criteria for which rates to choose when reducing fishing mortalities in too intensively exploited stocks. Both of these points relate to the wish of fishery administrators to be presented with alternative recommendations for management within the limits of generally accepted criteria for sound resource management.

A point to which we hope the meeting can give its full attention is the need for an adequate data base for the assessments. Innumerable recommendations and requests have been made for more comprehensive and improved fishery statistics and biological data, but the gaps are still considerable and numerous as evidenced by the latest list from ICES. Inadequate or completely lacking data represent the main obstacle to improved and more reliable assessments. Since the difficulties often relate to lack of funds or to organizational problems, fishery administrators should assume responsibility for improving the situation. In the case of shared stocks the provisions of data should be the subject of negotiations between the parties concerned.

In their assessments and recommendations the scientists at present mostly keep within a one-year future outlook. For purposes of economic planning, allocation of resources between fleets, market evaluations etc. a medium-term and long-term prognosis and management scheme would be highly desirable. This is a field which we hope the scientific community can take up in the near future.

ANNEX 7

STATEMENT BY THE COMMISSION OF THE EUROPEAN COMMUNITIES

The CEC is very grateful to ICES for taking the initiative in calling this meeting. It welcomes the opportunity to participate and looks forward to a fruitful dialogue.

The CEC is very aware that an unsatisfactory situation has existed since 1977 when it assumed management responsibility for the fish stocks which lay entirely within EEC waters and co-responsibility for shared stocks. This unsatisfactory situation exists because no formal link on the provision of scientific advice on fish stock management has been developed between ICES and the CEC, such as existed, and still exists, between ICES and NEAFC and ICES and IBSFC. This has not prevented the CEC relying heavily upon the advice that ICES gives and its proposals on fish stock management have closely followed the recommendations made by ACFM, even when these have resulted in severe restrictions on the fishing industry, such as the bans on fishing for several herring stocks. Unfortunately, the Council of Ministers has not yet agreed to accept the Commission's proposals except for TACs and catch reporting and, in consequence, many of ICES recommendations have not been implemented. The most notable failure has been to get acceptance of increased mesh sizes. Judging from the reports of ACFM, it is a little uncertain whether ICES is aware of some of the constraints under which the CEC works. For its part, ICES has shown itself willing to respond to particular questions by accepting contracts and, on a less formal but equally valuable level, to ask its Working Groups through ACFM, to answer questions relating to fish stock management. The CEC would like to acknowledge its debt to ICES for these services and to thank ICES for all that it has done.

However, this does not mean that the relationship between the two organisations cannot be improved. As the biggest customer of ICES, the CEC certainly wishes to establish a properly defined relationship with ICES and it is clear from the reports of ACFM that ICES also feels the need to do the same.

In this paper the CEC examines how this might be achieved. However, to do this it has been found necessary to look carefully at the part played by ICES in fish stock management and, in particular, the role of ACFM.

A comparison of the reports of the Liaison Committee with those of ACFM shows that ACFM provides much firmer advice to the managers than the Liaison Committee did. Several points are noticeable: the reports of ACFM are much more technical than those of the Liaison Committee; criticisms of the data and reservations about the confidence which can be placed in particular TACs are separated from the TAC recommendations themselves, which are underlined, and fewer management options are considered. Part of the reason for this greater authoritativeness is that ICES is becoming more confident in its assessments, as it gains experience in the methods used, and the data bases on which they depend improve. But, much more importantly, part of the differences between the two reports has arisen because ICES saw the consequences of giving managers a range of option. Invariably, the option which was chosen was that which gave the largest catch in the short term without considering the long-term consequences. In these circumstances and taking account of the state of many of the most important fish stocks, ICES, to its credit, took over a role of management. Indeed, it had to, because its recommendations had

to be based upon assumptions about the way in which the stocks would be fished. Even though the CEC must take partial responsibility for the existence of this situation, it does not consider it satisfactory and it doubts whether ICES does.

One particular outcome of the present situation is that the recommendations of ACFM are becoming, 'de facto', almost mandatory upon the management bodies. There is an inherent danger for ICES in this situation which is that ACFM will be seen as the body in which the final decisions on fish stock management are effectively made. In these circumstances, it is conceivable that an attempt to exert political pressure on members of the Committee might possibly be made, as the report of ACFM for 1979 seems to suggest. The composition of ACFM, which consists almost entirely of national nominees, may not be the best means of ensuring that the advice being given is always seen to be the "best scientific advice"; it could also be seen as "the lowest common denominator of national agreement". The CEC views this with disquiet as it must have available to it a source of universally accepted, unbiassed scientific advice on fish stock management.

The CEC considers that very few organizational changes are needed to protect the situation and to obtain a proper dialogue between ICES and the managers.

The essential first step is for the managers to decide what the management policy is and to inform ICES of it. For those stocks which occur entirely in Community waters this would be the responsibility of the CEC; for shared stocks it would be necessary for the co-managers to reach agreement. The CEC then envisages that there would be a joint meeting between ICES and the managers at which the managers would inform ICES of any change in policy, of the conditions of fishing (e.g. mesh sizes in use) likely to exist in the forthcoming year and to ask questions concerning specific aspects of fish stock management. This meeting would also provide the opportunity for ICES to ask the managers questions about their policies. This meeting would provide the background to the ICES Working Group system. It could conveniently take place about the time of the ICES Statutory Meeting in October of each year. The CEC does not envisage that the Working Group system would be changed, except that it feels it would be mutually beneficial if the CEC had a representative at all Working Groups on stocks which occur in Community waters. ACFM would meet, as it does at present, to consider the Working Group reports and to write their own report. Following the distribution of its report, there would be a meeting between ICES and the managers in order to clarify any issues or problems arising over the report. Unless urgent action were needed on the report, it would probably not be necessary to have this as a separate meeting but to have these discussions at the meeting taking place at the time of the ICES Statutory Meeting. In preparation for these discussions, the CEC would be advised by its Scientific and Technical Committee for Fisheries in exactly the same manner as ICES Member States are advised by their own fisheries biologists. This procedure has to be taken into account in the timing of the ACFM meeting in relation to the ICES Statutory Meeting.

As already stated, the CEC thinks that the reports of ACFM should be considerably different from their present form. The main change that the CEC would wish to see is to have catch possibilities and stock sizes presented in graphical form as functions of fishing mortality rate, as is already done in some Working Group reports. This would present all the options to the managers and leave them to make the decisions. This does not mean that ACFM would be expected to refrain from commenting upon possible options. Obviously, if it is considered that there was little alternative except to

adopt one particular option, then it would have a responsibility to say so. But any such recommendation would be based entirely on biological considerations.

The most likely case is that of a stock which is likely to collapse as a result of recruitment overfishing and on which a cessation of fishing was essential. This report would then be used by the managers as one of the sources of information upon which they would base their management plan for the coming year.

The proposed system does not cover the problem of rapidly updating assessments. The manner in which many stocks are exploited means that it will be necessary to do this until the pattern of exploitation is changed. At present, because ICES advice is the only advice which is generally acceptable, to revise it means calling a meeting of ACFM. This is neither a cheap nor an easy procedure. However, under the system envisaged by the CEC this would no longer be necessary. ICES could supply the relevant data to the managers who would be able to update the assessments and take the necessary action.

There remains one final point, the relationship between ICES and the CEC. The CEC is not a member of ICES and does not contribute to its finances, except insofar as it contracts with ICES for specific projects. It is unsatisfactory from the point of view of ICES not to be paid for services rendered and from that of the CEC not to have a formal commitment from ICES to respond to its queries and provide advice. The CEC therefore considers that there should be a contractual relationship between the two organisations with clearly defined services being provided by ICES for an agreed payment.

ICES has also asked Delegates to this meeting to consider the question of scientific principles, criteria and methodology involved in the formulation of advice on fish stock conservation and the adequacy of the data on which the assessments are based.

Cooperative Research Report, No.62, describes the scientific principles, criteria and methodology which should be used in formulating advice in terms of single species assessments.

The CEC considers that the adoption of these criteria has resulted in a considerable improvement in the Working Group system. The CEC welcomes the fact that most Working Group reports are now written in a standard manner with the data which are required for making assessments properly tabulated.

The point has already been made that advice should be based on biological criteria only and that economic and other considerations, whether explicitly or implicitly expressed, must be omitted unless included in the policy given by the managers to ICES. However, the scientific principles stated in Cooperative Research Report, No.62, are adequate only while management of fish stocks is based upon single species assessments and single species TACs. ICES recognises in Section 5 of this report, entitled "Research Problems" (pages 10-12), that this method of management is inadequate, but that lack of data prevents management by any other method at present. The CEC considers that this problem cannot be ignored any longer. It is already giving rise to management problems in those cases where the recommendations of ACFM in respect of one species conflict with the recommendations for other species caught in the same area as, for example, the recommendation made in the ACFM report for 1979 that an 80 mm mesh size is introduced for the Northern stock of hake.

The CEC wishes to enter into a dialogue with ICES as to how managers could handle these complex problems. The CEC recognises that this will mean that the managers will have to make decisions about the priorities which are to be given to exploiting different species as, for example, whether fisheries for Nephrops should be exploited to maximise the benefits to these fisheries at the expense of possible benefits to fisheries for other species which are caught at the same time. But it will also mean that ICES will have to accept that the concept of exploiting every stock at F_{max} is not tenable and be prepared to give advice on a basis which takes into account these interactions. In the present state of biological knowledge, the advice may be far from perfect but it will be more useful than advice which is impractical in so far as it requires incompatible management decisions to put it into effect.

On the adequacy of the data, the CEC considers that the format it proposes in this paper for the reports of ACFM would enable ICES to be far more openly critical of inadequacies than it is at present. Criticisms of the inadequacies of data would be easier if recommendations were presented in a way which left management options more openly the responsibility of the managers as the CEC suggests. The CEC sees no reason why inadequacies in data collection should not be explicitly described in the reports of ACFM, in the same manner as ICNAF/NAFO identifies such deficiencies. The CEC realises that it has a role to play here by requiring Member States to provide adequate data for stock assessments and can envisage this being made a mandatory obligation.

ICES is already giving a lead as to the additional data which should be collected for making the more complex assessments which are now necessary. The need for these data was noted in Cooperative Research Report, No.62, which was based on a meeting which took place in 1976. Yet, it is only this year that a Working Group will meet to discuss what data should be collected. Again, the CEC would like to enter into a dialogue with ICES as to how these time delays could be shortened.

The CEC hopes that the suggestions in this paper will be found acceptable as a basis for further discussion both to ICES and to other management bodies and states. In putting them forward the objective of the CEC is to ensure that ICES is enabled to play its true scientific role and not be drawn into the policy aspects of fisheries management and to ensure that responsibility for fisheries management is placed firmly on the managing bodies.

ANNEX 8

SCIENTIFIC BASIS OF DETERMINING MANAGEMENT MEASURES: THE NEW SITUATION

by

J A Gulland

FAO

Fisheries management is entering a new era. One new factor is that with the general introduction of exclusive economic zones (EEZs), most fish stocks are coming under the control of the coastal states. This does raise difficult problems of joint control when, as in the case of many stocks in the ICES region, a stock moves between the EEZs of two or more countries. However, even for these stocks there are much greater opportunities for effective management, and for management to take account of a greater variety of objectives and interests than was the case in the past. Previously, when the high sea stocks were accessible to all countries, management had to be by consensus, based on the lowest common denominator of interests.

The other new factor is that it is becoming realised that the simple single species methods of stock assessment, which have served the fishery community well for some thirty years, are not enough. More account has to be taken of the interaction between species, and between the fisheries based on different species. Development of multispecies models has not yet reached the point where they can be used in the same way as the single species models to calculate, for example, TACs for next year. However, enough is now known about the direction of the interactions, and of the general behaviour of ecosystems to know in a qualitative way how the advice based on single species models needs to be modified.

Because of these new factors, and of the urgent need to help developing countries manage their fisheries, FAO's Advisory Committee on Marine Resources Research set up a Working Party on the Scientific Basis of Determining Management Measures. The report of that Working Party has just been issued (FAO Fisheries Report, 236), and much of this report is relevant to the present Dialogue.

The first point stressed by the Working Party is that the process of managing fisheries is very similar to that of managing any other activity and passes through a number of distinct stages, as follows:

- (a) Define objectives. Until the manager has established reasonably clearly what he is trying to achieve - maximum sustained catch, increased catch rates for the individual fishermen, etc. - the scientists cannot advise on what measures are likely to achieve those objectives.
- (b) Establish boundaries. The manager has to be clear what he is managing. The dissatisfaction with single species models shows that a manager who considers only a single species has set the biological boundaries too narrowly. Similarly, if the problem is fishery management rather than resource management, the boundaries need to be wide enough to consider the operations of vessels, and probably also processing and marketing.
- (c) Collect data. Other statements to this Dialogue have stressed the importance of adequate and timely data.

- (d) Extract and interpret information. Data alone, e.g. tabulations of statistics, have little meaning until they have been analysed, e.g. by the application of biological or economic models, to provide information in a form that can be understood and used by those taking decisions.
- (e) List options and formulate action. This is the stage with which the present Dialogue is particularly concerned. The roles of the advisor - in listing alternative actions and their immediate and long-term consequences - and the decision-maker (administrator or politician), who chooses which action to take, should be kept distinct.
- (f) Implement decisions. This is the key stage; until decisions are acted upon, the rest of the process has achieved little.
- (g) Evaluate. This stage is most important. There must be regular evaluations particularly of whether the decisions are having the expected effects, and of the general performance of the management system.

The Working Party also considered the variety of activities, interests and professions involved in fishery management. In doing this, it believed that it was essential to take a wide view of fishery management, to encompass all decisions that affect the harvesting of fish resources, and the extent to which these resources are used to the general benefit of the community. Thus account should be taken of the environment in which the fish live as well as of the fish themselves, and the market that is being supplied. Disciplines involved include not only biology, but also on one side oceanography, and on the other economics, law etc. The decisions that determine how well fisheries are managed range well beyond the setting of TACs and their allocation to different groups, and include for example investment decisions by industry, and Government policies on subsidies or tax rates that influence those decisions.

Not all these matters can or should be discussed at the present meeting, but the Working Party stressed the dangers of only paying attention to part of the whole management system. For example, the new situation in fisheries allows objectives other than gross weight of catch to be considered. The high rates of fishing on most ICES stocks would permit the catches of the individual fishermen to be greatly increased by reducing fishing effort. There could also be great benefits from reducing the costs of fishing, and from increasing the value of the catch (i.e. by concentrating on higher valued species or sizes of fish). Not all the benefits can be achieved at once; much of the excess costs occur because there are too many, and too powerful and expensive boats, and, probably, too many fishermen. The fleet size cannot be reduced overnight, but other elements of the costs, e.g. fuel, could be reduced without discomfort. For example, it is to no-one's advantage that ships fish for 250 days a year when, in many stocks, the same catch could be taken by fishing only 150 or 200 days a year (provided all the fleet reduced activities by the same amount). In the long run, i.e. after enough time to rebuild the stocks and restructure the fleet, the fisheries in the Northeast Atlantic could be in a very much happier situation, with net benefits (higher value and less costs) compared with the present situation of perhaps a thousand million dollars a year. To achieve those benefits requires careful planning of both strategy and tactics.

As seen by an outsider it appears that in the Northeast Atlantic (unlike several other parts of the world) international discussions on fishery management have tended to be concerned almost entirely on tactics, and with the biological aspects of tactics. The recommendations in the ACFM report deal mainly with the level of TACs which should be taken in the following year. In making these recommendations some assumptions are made about the target level of the fishing mortality in that year. This requires some assumptions by the biologists on the strategy that is being pursued, and because the biologists are familiar with fisheries and their practical problems, these assumptions are often reasonable. However, ad hoc assumptions by biologists that, for example, the fishing mortality should be reduced by 10% as an initial step towards reducing mortality to F_{max} do not seem to be a good substitute for proper economic and social analysis of the long-term benefits of fishing at various possible levels.

The present Dialogue should improve the tactics of fishery management, and the communication between the biologists and at least some of the users of biological advice, i.e. those concerned with setting regulations for the coming year. At the same time, if the discussions on fishery management do not include careful studies of the strategy of management - what sort of fishery would we like to have in the long term, and what does this require in terms of rebuilding stocks and restructuring the fishing industry - it is highly unlikely that more than a small proportion of the benefits that could come from managing the fisheries of the Northeast Atlantic will be achieved. FAO hopes that the report of the ACMRR Working Party will help towards these broader discussions of the strategy of fishery management.

ANNEX 2

STATEMENT BY MARIO RUIVO, SECRETARY OF IOC

The future convention on the Law of the Sea calls for management of stocks taking into account associated species and ecological factors. Long-term forecasts as requested by administrators require new models able to take into account new variables. Requirements for data and for surveys are going to increase. As a result of this, improvements in providing forecasts and indications on possible trends resulting from various options are, therefore, dependent on progress in methodology and data gathering and, thus, are part of middle/long-term scientific development.

This process requires a more effective interdisciplinary approach, and a better understanding and knowledge of the oceans and of the environment/living resources interface.

As explained by the Chairman, the traditional approach by ICES which provides general background on the North Atlantic ecosystem is one of the reasons for the successful role ICES plays as a source of scientific advice for management.

The dialogue between scientists and administrators and the discussions on the mechanisms for an effective interface (e.g., between ACFM and users) calls also for other institutional arrangements of the scientific machinery, on one hand, and at national level on the other, so as to promote the negotiations at the interface level to be properly supported by required (data) inputs and also, later on, to ensure effective implementation of the management measures and of the scientific programmes.

In this context, furthering marine sciences in support of national use and management of marine resources is, in my view, an essential step to create favourable conditions for the future preparation of forecasts and trends, as requested by administrators.

DIALOGUE MEETING, 4 OCTOBER 1980

Introduction

1. The "Dialogue Meeting" held at the Council's headquarters 20-21 May 1980 agreed that it would be useful to hold another such meeting after the report of ACFM for 1980 had become available and before ACFM at the 1980 Statutory Meeting would consider the time-table and the terms of reference for the next round of assessment Working Group meetings. The Council of ICES agreed, and the General Secretary issued invitations to the member countries and to the same organisations as were represented at the May meeting, for a one-day meeting at the headquarters on Saturday, 4 October 1980.

A list of participants in the meeting is given in Annex 1.

2. The background documents for the meeting were the ACFM's reports to NEAFC and IBISFC; and written statements were available from the International Baltic Sea Fishery Commission, from Denmark, the Netherlands, Norway and the Commission of EEC. These statements, which were introduced by representatives of the countries and the Commissions, are reproduced in Annex 2.

The Chairman of ACFM presented a time-table of meetings with their terms of reference for assessment Working Groups and for ACFM covering the period January-October 1980 as an example of the machinery that is available within ICES. The time-table is reproduced in Annex 3.

3. The meeting was opened by the President of ICES at 9.30 hrs on 4 October. He briefly summarised the discussions at the May meeting, and outlined problems, which he suggested should be further discussed at the present meeting. The President's introduction is given in Annex 4.

Presentation of the ACFM Reports

4. The Chairman of ACFM, Mr A. Saville, then presented his Committee's reports. He said it was not his intention to deal with the individual items of advice presented in the reports, but instead would concentrate on aspects which were particularly relevant in the context of the dialogue. He indicated first that it was with some reluctance that the Committee had in many cases offered TAC option curves, since these by themselves did not give sufficient guidance for judging the longer-term effects of alternative policies. He stressed the desirability of long-term management objectives, and referred to the difficulties caused by year-to-year changes in objectives due to political and economic factors. He also referred to the difficulties in making assessments and providing advice when expected decisions on one or more management measures (e.g., on mesh size) were not in the event implemented. He then referred to some stocks which for various reasons had caused special difficulties. In some cases the advice therefore had to be postponed to the ACFM meeting during the Statutory Meeting, at which time it was hoped one would have access to better and more up-to-date data. This included North-East Arctic cod and haddock, herring in Division IIIa, North Sea sole, North Sea mackerel and the hake stocks.

He referred to the on-going revision of the historical data base for North Sea cod, haddock, and whiting, which had resulted in some changes in the estimated TACs for 1980, which may have an effect on predictions for 1981 and later years.

Mr Saville then said that there had been a deterioration in the reliability and adequacy of statistical data over a wide area in recent years. Reliable catch data are absolutely essential for any meaningful assessment. If manage-

ment wants reliable, accurate, scientific advice, they must take the necessary steps to ensure that the statistical data base is complete and accurate.

He also pointed out that deficiencies in biological sampling are to a very large extent a function of financial restraints and lack of staff.

He referred to the proposed increase in mesh size to 80 mm, in order to save the hake stocks particularly in Divisions VIIIc and IXa, where there is evidence of very heavy depletion. The advice of ACFM had been queried, because of its possible effects on Nephrops fisheries. He said that ACFM had looked into the question again and had found no justification for changing its previous advice; the implementation of it would be highly beneficial for the hake stocks and only on the most pessimistic assumptions would result in any loss to the Nephrops fisheries. The present practice leads to widespread discarding and landing of juvenile hake, resulting in a very large wastage of the resource.

Discussion

5. In discussion, general concern was expressed by a number of participants at the deterioration of the reported statistics used in assessments, and there was full agreement that this situation must be improved. Repeated requests from ICES to its member countries have had little, if any, effect. However, it was stressed that at least for those stocks within an EEZ which are exploited by other countries in agreement with the coastal country, the latter has the possibility to make provision of accurate and timely statistics, as well as a programme of sampling, a condition for permission to fish. Such conditions could be included in bilateral agreements for shared stocks.

It was also suggested that ACFM should specify in its report more clearly the deficiencies in the statistical data base with respect to individual assessments, including the "blacklisting" of member countries which do not fulfil the requirements.

6. There was a discussion about mesh size regulations, and it was asked why a mesh size of 90 mm is proposed for the North Sea, while for the Barents Sea the ACFM advocates a mesh size of 155 mm. The Chairman of ACFM answered that the difference is partly due to different growth characteristics of the fish in the two areas, and partly due to the fact that in the Barents Sea the main target for fishing is the cod while in the North Sea a mixture of species is exploited. In the latter area, one must therefore seek a compromise solution, which benefits some of the important species, without undue damage to the fisheries for others. It is not possible in the North Sea to enforce different mesh sizes for fisheries for different species.

A Norwegian administrator asked what the optimum mesh size would be in an area where one is mainly interested in catches of cod and saithe, and to some extent haddock, but not in whiting and plaice, and the Chairman of ACFM said his Committee would look into that at its next mid-year meeting.

7. One administrator, referring to cases where the data base is totally inadequate, asked if it would not then be better if ACFM did not provide any advice at all. The Chairman of ACFM answered that even in such instances management bodies had asked to be advised. There are for instance cases where areas without a TAC were surrounded by areas for which TACs had been set, and ICES is concerned that this situation should not lead to misreporting of catches with overfishing of the areas subject to TAC regulations. The only advice one could give in such cases would be based on historical catches, and would in fact aim to freeze the catches at the level of recent years. This should

be acceptable in the short term, but if it lasts for years without the requested data being supplied, one would be in a very unsatisfactory situation. It is ACFM policy always to state clearly in its report where the advice on TACs given is based on incomplete data.

8. Some administrators criticised ACFM for being too pessimistic in its statements and advice and drew attention to cases where they felt that the subsequent data and fishery events suggested that more optimistic advice than the one formulated by ACFM would have been justified. It was answered from the scientific side, however, that the ACFM advice was not constantly pessimistic; there were also cases where later data had shown that the ACFM advice had been too optimistic. Also, in cases where stocks have been seriously depleted, it is justified to be cautious, until one has clear evidence of a stock recovery.
9. It was asked if the confidence in the advice given could be graded according to the quality of the background data, but it was agreed that this would not be useful and could be misleading. The advice is given on the basis of the best available data, and the basis on which the advice is given is spelt out in the report. There is no justification for believing that because the data are good or bad, the advice is more or less "optimistic" or "pessimistic". From the administration side it was considered that a "guided guess" is more useful than no advice at all.
10. From the administration side it was stressed that international management by TACs had proved to be difficult. Enforcement of quotas is very difficult, and this underlines the need to seek other and better management measures. It was, however, realised that this is a very difficult question, and that no alternative is readily available at present.

From the scientific side it was said that management by TACs is an indirect way of controlling the effort. If effort could be effectively controlled directly, that would be more satisfactory and probably more efficient. One should aim at that, but there is still a long way to go before effort can be properly quantified, when differences between gears and also the technological development over time are taken into consideration.

In this connection, attention was drawn to the fact that many of the present management problems stem from the fact that there is far too much effort available in relation to the available stocks. A regulation by effort, which would mean a direct cutting down of it, would also most likely lead to administrative and management problems.

11. From the Norwegian side it was asked if ACFM would be in a position to recommend a specific TAC for the Svalbard Fishery Protection Zone, which is outside the economic zones of any country, and it was agreed that the ICES Arctic Fisheries Working Group and ACFM should be asked to look into the feasibility of this during the coming year.
12. There was a discussion about whether ACFM ought to have an established policy on which it bases its advice, and attention was also drawn to the specification of background information in the Danish statement (Annex 2, page 59), which was accepted as a useful guideline. On behalf of ACFM it was pointed out that in the present transitory situation between the former and the new management regimes those now responsible for management have yet to agree on their management objectives. In this situation the ACFM had little choice but to assume that the new management would have broadly the same long-term aims as the former one, that is to move towards a fishery at the MSY level. In most cases, however, to aim at reaching that level in one step would

result in a major disruption of the fisheries. Moreover, a stepwise approach to the MSY level would provide opportunities to monitor whether the effects of a reduction in exploitation rate agreed with the theoretical expectations; or whether these were unrealistic because of the effects of such factors as species interactions at high population levels.

13. The discussion continued on the setting of management objectives, which is clearly the responsibility of the management bodies rather than the scientists. Only when objectives have been defined and agreed upon will it be possible for ACFM to advise on the biological possibilities for reaching them. It was also said that when ACFM has spelt out in its report the objectives on which the assessments and advice are based, it would be very important if there was a response from management bodies, with specified comments on them and with statements of agreement, desirability of revision, or rejection. In order that the dialogue should be complete it is desirable that those responsible for management of international or shared stocks find a forum where they can discuss and agree on the objectives.
14. As at the last Dialogue Meeting it was recognised that it will be necessary in the future to undertake multispecies assessments and management. Some multispecies assessment models are available, but the parameters for using them are not. ICES has, however, taken the necessary steps to have the relevant information collected, and it will be used as soon as it is available and properly analysed. In this connection attention was drawn to the sprat-cod interaction in the Baltic as a relatively simple case, which will be analysed during the coming year.
15. The question was raised about the discrepancies sometimes observed between the conclusions of the assessment Working Groups and the advice given by ACFM. It was pointed out that these could arise from a wide variety of factors, ranging from computational errors by Working Groups to differences in management objectives adopted. ACFM, however, is the only body empowered to give management advice on behalf of ICES, and the role of Working Groups is to provide a basis on which ACFM can do so. It was agreed that in all cases where there are differences, it is important that the reasons for these should be clearly stated in the ACFM report. The Chairman of ACFM said that in the majority of cases this had been done in the 1980 ACFM reports, but that particular attention would be paid to this matter in future.
16. The need for a management system which achieves reasonably stable catches was stressed from the management side, with support from representatives of the fishing industry. The quota regulations have a major disadvantage in that they may lead to interruption of fisheries when the TACs have been exhausted, and that in turn leads to very great difficulties for the industry. They also argued that as soon as it is observed that an overfished stock is increasing, part of that increase should be available for fishing. In this connection the question was raised whether a fixed TAC for a series of years would be an advantage, since it would remove one source of year-to-year variations. It was realised, however, that such a TAC would then have to be set so low that the total catch over the period would most likely be considerably lower than that achieved with year-to-year adjustments. The best approach towards more stable catches would be to improve the exploitation pattern and reduce the exploitation rate, so young fish are spared and allowed to grow, and so that a strong year class recruiting to the fishery would be available over a longer period, instead of being fished out in one to two years. The effect of variations in year-class strength would then, to a considerable extent, be smoothed out for the majority of species.

17. It was agreed that the problem of "unavoidable" by-catches is not principally a biological question. From the management side, it was for example said that by-catches of up to 50% of herring in the sprat fisheries are only "unavoidable" if one accepts fishing for industrial purposes (meal and oil).

It was agreed that the question of reducing by-catches can be approached by imposing closed area or season regulations, but since the distribution of the different species and of fishing varies from year to year, this can often best be handled by national authorities closely monitoring the catches, and closing areas periodically when by-catches become too high.

Future Dialogue Meetings

18. Some participants raised the question about the annual time-table of meetings, and stressed the need for two meetings of ACFM in a year. Most of the stocks can continue to be assessed at a mid-year meeting, but there are important stocks for which the data for the last year's fisheries or from surveys will not be available at that time, either because the main fisheries take place in the spring, or because the biology of the species determines that the relevant surveys have to be made in the summer or early autumn. For these stocks it would be a major improvement if the ACFM could meet at the beginning of November. There was general agreement that an attempt should be made to solve the problems involved (organisational and financial) in such a scheme. It was asked if it would help if meetings of Working Groups were held in national laboratories instead of at headquarters, but it was recognised that while some Groups might at times meet elsewhere, the majority would need to meet at headquarters, where the rapidly increasing data base and relevant computer capability would be at hand. If the number of Working Groups which would meet between the main mid-year meeting of ACFM and the Statutory Meeting was kept small, the organisational problems of holding the meetings at headquarters should not be too severe.
19. This led to a discussion about a further Dialogue Meeting in 1981, and it was agreed that ICES should be asked to convene one around 20 September 1981 at ICES headquarters. It would be desirable if at that meeting the management representatives would, as a feedback, provide specific comments on the objectives that are implicit or directly stated in the reports of ACFM. This would be facilitated if ACFM would in a separate section of its next report spell out the objectives it has accepted as the basis for its advice, and the policy it advocates in order to reach them.
20. Before the meeting was closed, Mr J. Hertoft, on behalf of the administrators, said that the opportunity to have these open and thorough discussions was highly appreciated by them, and he thanked ICES for having taken the initiative, and the President for chairing the meeting so effectively.

The meeting was closed at 18.00 hrs.

ANNEX 1

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ANNEX 2

INVITED STATEMENTS

I. Statement by the International Baltic Sea Fishery Commission

1. What possibilities are there for ACFM to propose TACs for species as variants, which would correspond to a "span of confidence"?

By such TAC recommendations the Commission will get a better possibility for TAC recommendations, which would exclude overfishing of the stocks.

2. Is it possible for the ACFM to pay more attention to the conditions of the ecosystem of the Baltic and especially to the relationship among the species when making the TAC proposals?

The Commission is fully aware of the fact that at the moment there is no basis for a complete solution of this problem. Nevertheless, the present situation shows on the example of sprat and cod that the task of regulation can only be solved when we take into consideration the existing great mutual influence of the species.

3. There is no doubt that the report of ACFM represents the final official opinion of ICES but nevertheless there are sometimes great differences in the result of the ICES Working Groups to this report.

What possibilities are there to reach in future a more complete correspondence between the recommendations of ACFM and the result of the work of the Baltic experts?

II. Statement from the Ministry of Fisheries of Denmark

In a letter of 29 August the President of ICES ask "customers" to draw attention to questions, which they would wish ICES to deal with in the next ACFM report and to suggest any further improvement, which they think could be made in the Council's procedure for providing advice.

We are all aware of the fact that the advice given by ICES on fisheries management and the way this advice is used by the administrations is far from satisfactory as a basis for present and further fisheries policy.

Therefore we would like to suggest that the following questions be discussed at the meeting.

1. Is the data base available and the methods used for assessment of fish stocks sufficiently reliable to ensure that the estimated catch predictions and hence the TACs based thereon will lead to the "agreed" objectives?

- A. Fishery statistics in several countries are rapidly deteriorating, because landings are not reported, or more often are reported as originating from a different area or as being of a different species. Basically the state of affairs is brought about by a quota system with its implicit invitation to cheating. Is there any background for computation of TACs without reliable landings statistics?

Has a fishery policy using TACs any future at all?

Can TACs be replaced by some other management tool?

- B. In recent years there has been a number of "embarrassing" revisions of recently decided TACs.

Is this due to the fact that early estimates of year class strength is much more difficult than it appears to be from the ACFM reports?

When doing catch predictions the scientists have to estimate the present (or recent) fishery mortality rates. Is ACFM confident that the methods used for this are so accurate, that they allow for recommendations often appearing as a single figure TAC?

2. What are the objectives of the regulations introduced for the different fish stocks, and who are setting these objectives?

There seems to be three causes for introducing a TAC of a fish stock as a means of fishery regulations.

- A. To prevent the stock from going extinct and, of course, to bring it back, if it is already going extinct. Under single species management it is an indisputable goal to bring a depleted stock up again. Indisputable, because losses to other fisheries caused by the necessary management measures (mixed fisheries problems) and the conflicts thereby created are often deliberately neglected. This, obviously, should not be so.
- B. To shift the stock size from one steady (or reasonably steady) level to another in order to increase total catch and/or the catch per haul. The ACFM has been taking for granted that this is politically desirable, an attitude already criticised at the previous Dialogue meeting. Alternatives are apparently not much discussed.
- C. As a precaution against a development whose direction is not known. In the absence of data to assess a fish stock the ACFM has sometimes recommended a precautionary TAC computed as the average catch over the last few years. In other words, it is recommended to stop further development of the fishery.

There may be legal reasons for adopting TACs in order to prevent for instance, certain nations who are not allotted quota, to take part in the fishery. However, it cannot be a task for the scientists to recommend precautionary TACs. In doing so, they make pure political decisions with no scientific background.

- D. ICES continue to give advice based on single stock assessment. The fact that effort exerted on one species causes mortality on other species too, and the problem, whether developing and maintaining large stocks of predatory fish is actually in the interest of the fisheries, was never tackled by ACFM. Then administrators are still facing the illusion, that each species can be managed as if other species did not exist.
3. How can the problems mentioned under Items 1 and 2 be tackled?
- There is no straight forward answer to this question. However, it is of outmost importance that the problems are recognised. One way to ensure that this is done may be to ask ACFM for a full specification of the basis of each TAC, which is stated in its report. (An example of a possible "Questionary" to ACFM is shown below.)

If such a procedure is introduced the workload of the scientists will once more be increased. This, however, may lead to a better understanding of the shortcomings in the advice that ICES provides for 80-100 fish stocks and hence lead to considerations of how to put research work needed in order of priority.

Proposed Specification of Background Information in
Relation to TACs

To be given for each stock

1. The objectives on which the TAC is based
2. Evaluation of the data base
 - a) Source of errors
 - b) Magnitude of errors
 - c) Their consequences for the estimation of TAC
3. Insufficiency of the methodology
 - a) Source of errors
 - b) Magnitude of errors
 - c) Their consequences for the estimation of TAC
4. Estimated TAC
5. Summary of ACFM's judgement of the validity of its advice
6. Future research needed.

III. Statement by the Dutch Ministry of Agriculture and Fisheries

Answering the President's letter dated 29 August, no.D.8, we herewith give the remarks and suggestions of the Dutch delegation to be discussed during the next ICES Dialogue Meeting in Copenhagen on Saturday, 4 October:

It is evident that the best available knowledge of the biology of fish stocks in the North-East Atlantic area is concentrated in ICES. Because of this specialisation scientific advice of ICES regarding TAC and closely related subjects must be restricted to the biological aspects of fisheries management.

The advice and information have to be given in such a way that the bodies, responsible for fisheries management, can evaluate the biological consequences of the economic and social objectives they want to introduce in the fisheries management.

Moreover, it is evident that insights in science are changing e.g. a multispecies approach not yet translated into mathematical models versus the calculations based upon the monospecies approach.

From this point of view it is suggested:

- A TAC 0 will be advised in case a stock is in danger by recruitment overfishing.
- In case a stock is in a situation between recruitment overfishing and F_{max} it is not enough that ICES advises on TAC. Information by ICES will be necessary on a range of TAC.

For each TAC information on the consequences for the state of the stock in each of the next three or four years is necessary. These alternatives can be presented in an understandable matrix. This information is necessary:

- to evaluate the biological consequences of a fixed TAC during three or four years, which is important for planning in industry;
- to evaluate the possibilities of a slow growth rate of the stock.
- The monitoring of the stocks will be continued to check the earlier made prognosis and to redress that prognosis if necessary.
- In case ICES makes remarks on fisheries management on aspects outside the biological competence of ICES, these remarks should be clearly separated from the official advices, based upon scientific analyses.
- In case ICES advises on by-catches it is important to indicate the percentage of unavoidable by-catches.
- In case a stock, including the closely connected sub-stocks, covers more than one statistical sub-area or division, the advice or information have to be given for the total of these sub-areas and divisions.
- In case advices are given on mesh sizes, clear information on the underlying considerations is necessary e.g.
 - what losses per species and per year will be expected in case of an increase in mesh size and what gains are expected per species and per year later on;
 - what are the results of the calculations per species i.e. what length correlates with 50% retention.

IV. Statement by Norway's Minister of Fisheries

I refer to the President's letter of 29 August.

In response to the request for a statement by Norway on ways of improving the Council's procedures for providing scientific advice on fisheries management, an advance statement has been prepared by the Ministry in consultation with our scientific advisers. Our statement reads as follows:

We would like at this meeting to return to three questions that were raised during the first Dialogue Meeting held in Copenhagen in May 1980.

The first question related to the timing of meetings of the Working Groups and ACFM. In May a new time-schedule was proposed with Working Group activities during August-September and submission of the ACFM report in October to reduce the present time-lag between the diagnosis of the stock, and the consequent regulatory action in the fishery. However, we got the impression in May that it would be difficult to move all Assessment Working Groups to the second half of the year without delaying the submission of the ACFM report to a much later time than we anticipated, and that this would be unacceptable for other managers.

Accepting this, we propose that the suggestion from May of two main meetings of ACFM during a year should be seriously considered. Assessment Working Groups dealing with short-lived species such as sprat, and also Working Groups dealing with certain other critical stocks for which experience during the immediate past years has demonstrated the importance of having more up-to-date information, should meet in the second half of the year with the submission of the ACFM report not later than November.

The rest of the stocks could be dealt with during Working Group meetings in April-May, followed by an ACFM meeting in July as at present.

The second question we would like to revert to concerns the data base for the assessments. Inadequate or completely lacking data represent the main obstacle to improved and more reliable assessments. Repeated requests from ICES to its member countries for improved fishery statistics and biological data have not resulted in any improvement in the officially reported catch statistics. The situation seems in fact to have deteriorated in recent years.

As we pointed out in May, fishery administrators should assume responsibility for improving the situation. Since most of the fishing within the ICES area is conducted within exclusive economic zones under the control of coastal states, the coastal states have the possibility of significantly improving the situation by making fishing rights dependent on both proper reporting (including reporting of discards) and adequate sampling of catches.

In the case of shared stocks the provision of data should be the subject of negotiations between the parties concerned.

In our view it would be an incitement for fishery administrators to improve the situation if ICES could specify some minimum requirements to both the reporting of catch statistics and the sampling of catches. These requirements should then annually be compared with the actual situation in the various fisheries and countries, and the results of this analysis presented in the ACFM report.

The third question that we would like to raise concerns the desirability of ACFM presenting its advice in the form of management options. As will be recalled this question was dealt with at length at the meeting in May. It was then recognised that it was important for the "customers" to be given, whenever possible, the opportunity to choose between biologically acceptable alternatives, and that customers should be provided with adequate data both of the short- and long-terms consequences inherent in the different options available.

The latest report from ACFM does, however, only to a very limited degree contain advice on different management options. Although we recognise that the provision of advice and data designed to cover more than one management option may require additional efforts by the scientists, we urge ICES to make arrangements for the inclusion in future reports of ACFM of the necessary range of scientifically based management alternatives.

V. Statement by the Commission of the European Communities

We refer to the President's letter of 29 August 1980 inviting the CEC to comment upon the ACFM report for 1980. The CEC is very anxious to develop the Dialogue with ICES, on whose advice it relies for the scientific basis of its management policy.

The CEC is very pleased that the ACFM has met its request to give, for as many stocks as possible, graphs of catch possibilities in 1981 and levels of spawning stock biomass at 1.1.1982 for a range of fishing mortality rates in 1981. Although the CEC can understand that ACFM has reservations about presenting advice in this form, it feels that this method of presentation will, in the long term, result in better fisheries management. Because all who are concerned with fisheries managements are fully aware that a range of catch possibilities exists and because the data from which to calculate them are freely available, it would seem, to the CEC, that it is best for ACFM to make the calculations and to present the results so that it can then authoritatively comment upon them, as it has done in the Introduction to its reports.

The CEC would like to suggest to ACFM that the clarity of the reports could be further improved if the following data were presented in tabular form for each stock:

1. F_{\max} for the present exploitation pattern.
2. F_{\max} given in the previous year's ACFM report and the reason for the difference, if any, between the two values of F_{\max} . (For flat-topped yield curves values of $F_{0.1}$ would be given instead of those of F_{\max} .)
3. Mean fishing mortality rate on the most heavily exploited age groups for:
 - 3.1 the last year for which data are available,
 - 3.2 the present year, assuming that the recommended TAC will not be exceeded,
 - 3.3 the present year, for the catch which ACFM expects will be taken,
 - 3.4 the subsequent year, for the recommended TAC.

The corresponding catches should also be shown.

In those cases in which ACFM expects that the TAC will be exceeded, it would also be informative to have the TAC which could have been recommended if it had been adhered to.

If the table showing this information were printed on the same pages as the graph showing catch possibilities, managers would be presented with a complete summary of the main features of each stock. Information which the CEC would wish to see presented on all the graphs is:

1. the position of F_{\max} ,
2. a line from the curve of catch possibilities in the subsequent year to the Y-axis at the level of the recommended TAC,
3. a corresponding line to the X-axis.

In view of the present uncertainty on the mesh sizes in use in many areas, it would also ask ACFM to give the mesh size upon which each assessment is based.

The CEC also asks ACFM that, if it establishes new bases for assessment, as it has done for the relationship for predictions of recruitment of North Sea haddock and whiting based on the IYHS, that it should describe the data base used and the results obtained.

The CEC has the following specific points which it wishes discussed at the Dialogue Meeting concerning the contents of the ACFM report.

Firstly, the CEC would ask ACFM to expand upon its statement on page 3 of its reports to both NEAFC and IBSFC that "in too many cases the estimation of the TAC which can be taken at a given fishing mortality rate has been highly optimistic". What are the stocks and to what extent were the TACs optimistic?

When ACFM is being accused, in some fora, of being over-cautious and pessimistic in its predictions and this accusation is being made the basis of increasing its recommended TAC, it would be useful to have firm evidence that ACFM advice has, in many cases, been the opposite.

Secondly, the CEC would like to discuss some apparent inconsistencies in the reports on how data are presented in terms of ACFM's stated management objectives. For example, paragraph 51 of its report to NEAFC refers to "ACFM's general management strategy to bring fishing mortality stepwise towards $F_{0.1}$ " (for Sebastes marinus), whereas the CEC was under the impression that ACFM's overall management strategy was to achieve F_{max} . The same point occurs in relation to the management of Greenland halibut stocks (paragraphs 58 and 60 of the same report) although it is realised that the yield curves for these stocks may be flat-topped.

The CEC also would prefer to see ACFM recommending TACs strictly in line with its stated management objectives without explicitly referring to socio-economic factors (paragraph 51).

The CEC has asked its Scientific and Technical Committee to comment upon the ACFM reports but as its meeting does not finish until 26 September, it has not yet produced its report. The CEC therefore reserves the right to raise further questions orally at the Dialogue Meeting.¹⁾

1) The statement included some detailed questions as to the understanding of figures in a table on p.3 of the ACFM report to IBSFC. Since the questions were answered at the meeting, they are not included here.

ANNEX 3

ICES TIME-TABLE 1980 FOR ACFM AND ASSOCIATED ASSESSMENT WORKING GROUP MEETINGS

<u>Working Group/ Committee</u>	<u>Terms of Reference</u>	<u>Date</u>
<u>Nephrops</u> Working Group	Evaluate applicability of available models; draw up plans for increased research on growth rates, natural mortality rates and fishing mortality rates, selection factors and mortality of discards; re-consider previous conclusions on effects of mesh size increases in <u>Nephrops</u> fisheries.	15-18 January
Baltic Salmon Assessment Working Group	Provide advice on a TAC for Baltic salmon in 1981; advise on effects of an increase in the minimum mesh size and any concomitant change in the minimum landing size.	10-15 March
North Sea Flatfish Working Group	Assess TACs for sole and plaice in the North Sea and Channel in 1981.	17-22 March
Working Group on Redfish and Greenland Halibut in Region 1	Assess TACs for redfish and Greenland halibut; estimate effective mesh sizes in use for redfish; consider scientific feasibility of producing assessments for these species on a total stock basis in the Iceland-Greenland-Davis Strait area.	18-25 March
Working Group on Division IIIa Stocks	Evaluate any new data available on stock components in IIIa herring; assess TACs in 1981 for cod, whiting, haddock, plaice and sprat in IIIa; examine any data available which might provide estimates of migration rates, particularly of cod and herring, between IIIa and the Baltic	24-28 March
Working Group on Fish Stocks at the Faroes	Assess TACs in 1981 for cod and haddock in the Faroes area.	31 March-3 April
North Sea Roundfish Working Group	Assess TACs in 1981 for cod, haddock, and whiting in Sub-areas IV, VI and VII (excluding Divisions VIIa, VIIf and VIIg); consider what additional data would be required to provide more realistic Sub-divisions of the total TAC for Sub-area VI between Divisions VIa and VIb.	14-19 April
Working Group on North Atlantic Salmon	Pursue further the evaluation of the status of the North Atlantic salmon stocks.	15-18 April

<u>Working Group/ Committee</u>	<u>Terms of Reference</u>	<u>Date</u>
Irish Sea and Bristol Channel Working Group	Assess TACs in 1981 for cod, haddock, whiting, plaice and sole in Divisions VIIa, VIIb and VIIc; continue the examination of interactions between fisheries.	17-25 April
Herring Assessment Working Group for the Area South of 62°N	Re-assess the herring stocks in Sub-areas IV and VII, Divisions IIIa and VIa and the sprat stock in Sub-area IV; consider if the present by-catch limitation for herring in the sprat fisheries is the appropriate one; review the biological criteria for re-opening the herring fisheries in Sub-area IV and Division VIa; establish a procedure for making analytical assessments of sprat stocks and advise on data requirements and logistic requirements for effective utilisation of such assessments.	21-26 April
Saithe (Coalfish) Working Group	Assess TACs for saithe stocks in 1981; advise on management measures necessary to improve the exploitation pattern.	28 April-3 May
Mackerel Working Group	Assess the mackerel stocks in Sub-areas III, IV, VI, VII and VIII; further consider the area and time period during which the fishery in Sub-area VI should be closed to protect the North Sea stock; re-examine the period and area of closure in Sub-area VII to reduce the fishing mortality on juvenile fish.	28 April-3 May
Arctic Fisheries Working Group	Assess TACs in 1981 for cod and haddock in Sub-areas I and II.	5-10 May
Working Group on Assessment of Demersal Stocks in the Baltic	Provide advice on TACs for cod for each stock (fishery unit); assess the effects on cod stocks of fishing with smaller meshed gears than that applied for cod.	5-10 May
Working Group on Assessment of Pelagic Stocks in the Baltic	Assess TACs for the herring and sprat stocks in the Baltic; compile available data on the by-catch of herring in the sprat fisheries and in industrial fisheries; assess the effects of by-catches of juvenile herring in the sprat fisheries and industrial fisheries on herring stocks and consider means of minimising these effects; assess the quantities of	5-13 May

/Cont'd.

<u>Working Group/ Committee</u>	<u>Terms of Reference</u>	<u>Date</u>
Working Group on Assessment of Pelagic Stocks in the Baltic (ctd.)	juvenile herring taken in directed herring fisheries with reference to any proposed minimum landing sizes for herring, proposals of minimum mesh sizes appropriate to these minimum landing sizes and other proposals to protect juvenile herring.	
Blue Whiting Assessment Working Group	Assess the current exploitation rate of the blue whiting stocks and advise on the need for and form of any regulatory action; collate and evaluate the results of the 1979 Blue Whiting Surveys and coordinate the surveys in the remainder of 1980.	5-10 May
Atlanto-Scandian Herring Working Group	Assess the state of the Atlanto-Scandian herring.	12-14 May
Working Group on Assessment of Hake	Assess TACs for hake in 1981; in view of ACFM's recommendation that an 80mm mesh should be introduced for the hake fishery to estimate the effects of the EEC Commission's proposals regarding mesh regulations for both Recommendation 1 and <u>Nephrops</u> fisheries in Region 3.	12-17 May
ACFM	Revision of the TAC for North Sea cod, and North Sea and Skagerrak saithe previously advised for 1980; comment on advisability of re-opening in 1980 herring fisheries currently subject to prohibitions on directed fisheries.	16-17 May
ACFM	Mid-term meeting. Full range of management advice for all stocks in 1981, as normally provided on an annual basis.	1-10 July
Arctic Fisheries Working Group	Reconsider TACs for cod and haddock in 1981 in Sub-areas I and II.	1-3(4) October
ACFM	Provide advice for 1981 for those stocks for which recommendations were deferred at the July meeting; arrangements for assessment Working Group meetings in 1981.	11 October

ANNEX 4

INTRODUCTION TO THE MEETING, BY THE PRESIDENT OF ICES

The report of the first Dialogue Meeting, 20-21 May 1980, is at hand, prepared by the General Secretary in cooperation with the members of the small steering group which gave the introductory talks at the first meeting, Mr B.B. Parrish describing the scientific basis of fish stock management, and Mr A. Saville and myself the structure and functions of ICES, particularly its procedures in providing advice on management. Representatives of FAO and IOC described the new situation regarding fish stock management under the new Law of the Sea regime and the increasing concern about the interaction between exploited species, their food base and predators. Invited statements were presented by Norway and EC.

The main aim of the first Dialogue Meeting was to discuss how to improve the flow of information and advice between science and administration, between the scientists working under the auspices of ICES and the national and international management authorities.

The role of ACFM was discussed in detail, and it was stated that it should serve jointly all customers interested in shared stocks. As long as ACFM sticks to that rule and remains impartial and independent of influences from individual customers, there would be little need for additional advisory activities from other sides, e.g. EC's Scientific and Technical Committee.

The scientists complained about the deterioration of the supply of statistical data on which stock assessments have to be based. Many fishery statistics are now much less reliable than they were decades ago.

A major part of the time of the first Dialogue Meeting was devoted to the question: to what extent ACFM should and can offer options for different management policies or different levels of exploitation. It was stated that at present many stocks are so depleted that there is not much choice than rather rigid reduction of fishing. How far should the biologist take into consideration the social, political and economic aspects of fisheries? The answer was basically that he should mostly stick to the biological issues but he should preferably be aware of the socio-economical implications of his advice. Biologists should state the range of fishing mortality - management should decide which F he would choose in view of the interests of the various sectors of industry and society.

Fishing industry wishes to plan ahead for several years, investments rely on high and stable catches for many years or at least reliable forecasts for a number of years. This seems unrealistic for two major reasons. In most stocks there is no such thing as a stable equilibrium between fishing and fish production. Fish stocks show short-term fluctuations and long-term shifts and fishing effort varies considerably from year to year and decade to decade. With many stocks being shared between various fisheries, there is little hope to predict fishing effort over any period of time.

Difficulties in prediction and management grow with number of years, fleets, nations and species involved in a complex situation as in the case of the North Sea.

I personally doubt that the concept of an average long-term sustainable yield is still meaningful.

If that is so, economists might advocate ruthless fisheries for a couple of years and then turn to another fish stock. This of course seems unacceptable to a biologist, who will notice the up-setting of the entire system.

For the time being, we will have to live with short-term forecasts on an annual basis, or even shorter time frames.

So the time-table for the annual provision of advice by ACFM becomes crucial. We spent considerable time on that matter when participants asked whether ACFM could be shifted to a later date in the year. But finally most people agreed that the present arrangements are presumably the least inadequate ones. However, the time-lag between the meetings of the Working Groups, of ACFM and the circulation of the report should be shortened if at all possible. After the ACFM report is available and before the Statutory Meeting, a Dialogue should be arranged which gives the customers the opportunity to put questions to the Chairman of ACFM and other scientists engaged in the Committee's assessment and advisory functions. In turn, the scientists should receive from the managers information on their fishery policy and other matters which are important for the formation of conservation measures.

To-day's meeting has a trifold purpose.

1. Presentation of ACFM Reports including list of TACs and catches in 1976-79, drawing attention to cases where revisions of TACs proved to be necessary or where provision of advice had to be postponed, but also aspects of a more general nature.
2. General comments by customers - but no prolonged detailed discussions of individual stock TACs.
3. Discussion dialogue between customers and scientists on general and special needs for advice by ACFM in its next year's report, and for other activities by the Council and by the scientific community, including suggestions for further improvements in the Council's procedures for providing advice.

I hope that my outline of the various functions of ICES helps to come up with realistic proposals.
