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REPORT OF THE

ICES/NSCFP Study Group on the incorporation of additional information from the fishing industry into fish stock assessments

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International Council for the Exploration of the Sea

Conseil International pour l'Exploration de la Mer

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1 SUMMARY

The study group (SG) met in good spirit and openly and constructively discussed many of the problems/conflicts arising as a result of the most recent developments in the management of the North Sea fisheries. The SG developed its recommendations from discussion about ongoing initiatives in countries around the North Sea, many of which are aimed at improving communication between scientists and fishermen and improving data collection and sampling. The SG thought that most of the TOR were closely linked and were best dealt with in conjunction. The SG came also to the conclusion that some aspects of the TOR were ambitious and too far reaching to be satisfactorily addressed during this first meeting. It was not clear to the participants exactly what information was required or might be available from the fishery at this stage. For this reason none of the parties were in a position to bring specific data to the meeting or to offer internally approved positions.

It was generally recognized by the group that the process of incorporation of additional information from the fishery into fish stock assessment should be viewed as a process rather than an act. From the discussions early in the meeting it became evident that the TOR did not consider the fishermen's concerns about the stock assessment process, such as the need for greater transparency and their need for greater participation in the setting of objectives and management aspects. In this respect the TOR were felt to be unbalanced in favour of the current science based paradigm. The SG attempted to redress this balance and achieve a better mutual understanding, and increase the 'give and take' between the fishery and the science. The SG agreed that it would be better to work towards a mutually agreed strategy rather than to initiate specific actions with regard to collecting data from particular fleets. To embark on the latter course of action at this stage would certainly have been premature.

The discussions were wide ranging but several central themes and issues emerged. Of particular importance and interest was the scientific and fisheries management structure operative in the Community. The request from the fishing industry for more participation in the decision-making process is long standing and is specifically addressed. Equally long standing is the scientists' request for better and more accurate data on e.g. catch for stock assessments. It was not explicit in discussions but it was clear that it will only be possible to achieve this when the basis of trust and cooperation between fishermen and scientists has improved. It was emphasized that this would take time and good will on both sides. However, this would not be achieved by just waiting for things to improve. Positive action is required. It was agreed that progress could be made through initiatives which bring fishermen and scientists together and provide incentives for them to work constructively together. Common projects and funding to underpin these, were considered a good means of building up working relationships.

The SG discussed future changes in how scientific and management advice on the fisheries might be formulated and used. There was a view that the creation and use of science should not be separated from the overall management system. **No firm recommendations were proposed in relation to this**, because it lay out of the SG TOR. However, a possible future framework for how science would be related to the overall management system was outlined.

Greater participation of the fishery in the management decision process may soon be achieved through the establishment of the Regional Advisory Councils (RACs), proposed by the Commission. RACs are intended to bring fishermen and other stakeholders together with fishery managers to provide management advice. The RACs will potentially be able to take a more integrated, sensitive and responsive approach to the management of the fisheries than the current system.

A RAC for e.g. the North Sea could be charged with both defining management objectives and recommending management measures for North Sea fisheries. The objectives could be much wider than those currently adopted. New management objectives might include economic and social targets and subsequently could take wider account of the needs of the ecosystem, markets for fish, and consumers. The RAC would need to interact closely with ICES to ensure that stock assessments from ICES were relevant to the agreed management objectives, were of appropriate quality and transparency and utilised the full range of information available. ICES could refer any deficiencies in information or data back to the RAC. It is possible that a North Sea RAC might become the main source of management advice on fisheries to the Commission and Norway. ICES' role would then be to provide stock assessments and management options to the RAC, to the countries involved in the fisheries and to the Commission.

The SG was of the opinion that there was insufficient time at the meeting to fully develop proposals put forward by the group and that to do so would be premature and not appropriate. All participants recognised that the SG was just starting its work, but hoped to get continued support from ICES and the North Sea Commission Fisheries Partnership.

To embark on improving communication and the involvement of the fishing industry in fisheries science/stock assessment the **SG recommends** the development of **generic documents**, describing the principles of stock assessment, how management advice is formulated and which and how biological advice is turned into a TAC. A **non-technical**

summary of the state of each stock should be included at the beginning of each stock assessment WG report and/or in each section of the ACFM report. Sea-going observers should be briefed on the outcomes of recent stock assessments so that they can better communicate with fishers. Observers should undergo **training** to enable them to communicate more effectively with fishermen.

Moreover, it is recommended that **national meetings** between fisheries assessment scientists and the fishing industry should be held to consider the inputs and results of stock assessments. **More data should be collected in collaboration with the fishing** industry. In the future joint working groups of scientists and fishers should develop strategies for **improving data quality**. ICES assessment WGs should be asked to make a thorough assessment of the feasibility and utility of using the most **up to date information** on catch and landings in assessments and stock projections. This shall explicitly include **testing alternative assessment models and/or to modify the existing models**. Information on major changes in **fishing patterns** (to include changes in areas fished, gears used, fleet structure, changes in target species) should be presented by national fishing industry representatives for discussion with scientists prior to stock assessment WG meetings. This information should be incorporated in WG reports. **Regional and/or stock specific project groups**, consisting of fishermen and scientists (and possibly including fishery economists or social scientists), can be established to develop a common perception of the fish stocks in certain areas. These actions could provide additional information for the stock assessments by ICES and should improve the transparency of the entire assessment process and promote mutual understanding.

In addition, attempts should be made to make greater use of **commercial cpue** data in assessments. Scientists and fishermen should work together to evaluate survey strategy and design, and develop working procedures for **joint abundance surveys, involving both** fishing vessels and research vessels. Finally, the results of the "North Sea Stocks Survey" ("**questionnaire**") which has been carried out by Europêche should more fully evaluated and the results should be compared with research vessel surveys and stock assessment.

1.1 Participants

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1.2 Acknowledgements

The study group is grateful to the North Sea Commission Fisheries Partnership for hosting this meeting and wishes to acknowledge the excellent meeting facilities provided in Newcastle.

1.3 Terms of Reference

At the Annual Science Conference in September/October 2002 Copenhagen it was decided that a Study Group on the Incorporation of Additional Information from the Fishing Industry into Fish Stock Assessment should be established and to meet for 2.5 days in Newcastle, England, with the co-chairs of Hugo Andersson (Sweden) and Adriaan Rijnsdorp (The Netherlands). Due to personal circumstances of the latter, the co-chairmanship was transferred to Cornelius Hammer (Germany).

The Terms of Reference were to:

a) review relevant ongoing projects;
b) identify additional information that can be obtained directly from fishers on stock status and trends;
c) investigate the potential for these new data in fish stock assessments;
d) decide on the kind of information from fishing fleets which would be most valuable to the Assessment Working Groups;
e) consider how best such data and information could be collected, both from external sources (log books, satellite data) and from fishers themselves;
f) begin the collection of these data for the North Sea demersal fisheries through national agencies, in particular fishers' associations.

2 TOR 1: REVIEW RELEVANT ONGOING PROJECTS

2.1 Belgium (Daan Delbare, SFD)

Research on fish population dynamics at the Sea Fisheries Department is aimed at ensuring the sustainable exploitation/management of fish stocks that are of major economic importance to the Belgian sea-going fishing fleet These are primarily sole, *Solea solea*, which represents over 40% of the gross revenue to the fleet, and plaice, *Pleuronectes platessa*. Research activities are mostly focused on gathering fishery dependent data (market and onboard sampling) and fishery independent information (research surveys) on stock size and composition (in terms of length and age) of a number of key species, all in support of the European Common Fisheries Policy.

Routine sampling of the landings by the Belgian fleet is carried out in the main Belgian fishing harbours, Zeebrugge and Oostende. Because of the fleet's flexibility and area of operation, several species and areas need to be monitored: rays (Rajidae), cod (*Gadus morhua*), turbot (*Psetta maxima*), brill (*Scophthalmus rhombus*), plaice, sole and lemon sole (*Microstomus kitt*) in the North Sea; rays, anglerfish (Lophiidae), plaice and sole in the Irish Sea and Celtic Sea; plaice and sole in the Eastern English Channel; and sole in the Bay of Biscay. Port sampling is complemented with onboard sampling of the catches or discards (also length and age), particularly of the flatfish directed beam trawlers operating in the Eastern Channel, the Irish Sea, the Celtic Sea and the Bay of Biscay.

The Sea Fisheries Department – CLO conducted a small-scale experiment to examine the feasibility of improving the market-sampling program, and to obtain better information on the length frequency of the catch.

Five ship owners were contacted and asked to co-operate in the project SAREMI (Co-operation between ship owners and Ministry of Agriculture), with sole as the target species. They were asked to set aside 30kg of unsorted sole per haul and to provide exact landing data. Three different methods were compared with each other. In Method 1 a sample of 30 kg sole (unsorted) was measured and length data and the actually landing data were used to estimate the length frequency. In Method 2 length samples were measured after sorting (sorted) and the actual landing data were used to estimate the length frequency. In Method 3 the present sampling method was used – length samples were measured after sorting and the length frequency was estimated using the official landings data (official).

Landings from the five ships in the study were very different in composition and were sampled at different times. There was no significant difference between Method 1 (random sampling + actual landing data) and Method 2 (sampling after sorting + actual data), indicating that the additional effort involved in taking and storing the random samples is not necessary. The difference between Method 2 and Method 3, however, showed a significant improvement in length frequency, indicating that with Method 3 there is an underestimation (approximately 15% overall) of the landing for certain length categories. This is reflected in the absolute and relative total length frequency. These data are used to estimate the age-length distribution in the catch and used in fish stock assessments. The amount and the size of fish taken from the market varies between ship owners, and it is highly possible that this will also change according to the season (demand of certain lengths of fish). However, these conclusions are preliminary, because the scale of the experiment was very limited and took place over a short period of a few months.

However, from this test it was evident that exact landing data from fishermen would improve market sampling, without any additional labour for the fishermen. Furthermore, data on by-catch would be helpful, since SFD needs this information for the National Data Gathering Program (NDGP). This is carried out by a person on board commercial vessels in all area where the Belgian fishing fleet is active except the North Sea. To further improve the marketing sampling, it would be helpful if landings from different ICES areas were recorded separately. At present, it is often the case that some landings can not be used for market sampling, because they have been taken from two or more ICES areas. Furthermore, the scientists of the SFD would welcome any information about the most recent situation on the fishing grounds.

2.2 Denmark

2.2.1 Denmark (Henrik Degel, DIFRES)

The cooperation

In 1995 a formalised cooperation between Danish Fishermen's Association (DFA) and the Danish Institute for Fisheries Research (DIFRES) started with the aim of improving the collection and use of commercial fisheries data. The intention of the cooperation was a common desire to improve the data basis for biological advice. From the very beginning it was realised that, given the historical differences, it was necessary to formulate a set of rules. Therefore a memorandum of understanding was drawn up.

The co-operation comprised the planning and coordination of DIFRES' collection of biological data onboard Danish commercial fishing vessels, as well as quality assessment of the collected data.

DIFRES has the overall responsibility for the cooperation project, including reporting of all project activities, to call for meetings and to produce minutes for all meetings. DIFRES covers all expenses associated with the cooperation agreement.

As data might include sensitive information and given that the project can only be completed if the necessary trust between biologists and fishermen is present, it has been of paramount significance to establish a working procedure, which not only prevents a breach of confidence but also ensures that the involved parties are supplied with necessary information. Data collected under the cooperation agreement may not be traceable by outsiders to individual fishermen and may not be used for surveillance purposes. It is important for the confidence between the fishermen and the scientist that collected information cannot be used for fisheries control purposes and prosecution.

The overall coordination of the cooperation projects is supervised by a steering committee with the following members:

DIFRES: Research Director and two scientific officers.
DFA: President of DFA and two fisheries consultants with expertise in fisheries biology.

Any use of the data, including the publication of results thereof, can only occur when the quality of the raw data is agreed by the steering committee. Should the steering committee find that the data were not collected in accordance with the approved plans, or that the data quality is insufficient, the steering group may decide to carry out supplementary collections before the data are used. It must be emphasised that this procedure was not approved to enable the project participants to repress any controversial information, but was decided on solely to ensure that the data base is not encumbered with errors, and also that it covers the fishery in question sufficiently to make further use and publication meaningful. Observations that are excluded from the calculations can only be excluded by circumstance alone and not because of the results.

DIFRES and DFA cooperate at present on a number of projects such as:

- **Discard sampling**. Observer programme monitoring discard rates in the Danish fisheries.
- **Technical measures.** Changes in fishing behaviour caused by implementation of technical measures.
- **Monitoring of incidental by-catch of sea bird in gillnet fishery.** By-catch monitoring.
- **Monitoring of incidental by-catch of marine-mammals in gillnet fishery.** Trials of devices that prevent by-catch.

- **Gear selectivity trials.** Trials of new gears/gear-devices that reduce by-catch and discards.

- **Management of mussels stocks.** Cooperation on data collection for the assessment of the stocks.

- **Miscellaneous smaller projects.** Sandeel and sprat sampling on fishing bank and haul levels.

The largest of the cooperation projects is the so-called discard-project. It has been active since 1995 and formed the basic for the formalised cooperation between DIFRES and DFA.

The discard project

The aim of the discard project is to estimate discard rates and amounts by species in the Danish fisheries in order to provide basis input data for the discarded part of the catches to the various stock assessments work.

The sampling of discards by scientific observers was integrated as a part of the national routine sampling scheme for biological catch information performed by DIFRES. From the very beginning, the sampling schemes have been prepared and organized in a close cooperation between Danish Fishermen's Association and DIFRES. All Danish marine waters have been included in the observer schemes.

Currently 25 persons employed at DIFRES are working fulltime on data collection, either as scientific observers onboard commercial fishing vessels, or by collecting biological information on the landings in ports. The tasks involving scientific observers have gradually changed from solely being discard sampling, starting in 1995, to presently a wide range of fields as outlined below.

To plan and coordinate the actual monitoring of the fisheries two working groups have been established: the Western working group, covering the North Sea and Skagerrak, and the Eastern working group, covering Kattegat, the inner Danish waters and the Baltic Sea. Members of the two working groups are representatives from DFA as well as fisheries scientists from DIFRES. In addition, the working groups are responsible for the quality assurance of the collected data and consequently report the status of the data to the steering committee for final approval.

The individual vessels that are sampled are selected from a larger number of vessels who have stated a prior willingness to host scientific observers onboard. Within a given stratum (fishery, quarter, area) the vessels are to a certain degree randomly selected, taking into consideration the practical limitations.

On selection of fishing trips an attempt is made to include vessels from all important fishing harbours, that all vessel types within a given fishery are represented, and that all fishing patterns are covered (e.g. both short and long trips).

On each trip, all relevant information is recorded about the vessel, the gear and the circumstances surrounding the fishing operation, such as position, depth, divergent behaviour/accidents, etc. In addition, for each station (trawl haul/net haul) the amount, species composition and overall size distribution of the catch is registered. There is a separate registration of the fraction of the catch that is landed and that which is discarded.

Meetings are held between DFA and DIFRES on a regular basis with the purpose of ensuring the quality of the collected data. Only data, which is assumed to be representative of the respective fishery, possibly in combination with already-collected data, is used in further work. It must be strongly emphasised that only objective criteria underlie the control, and not e.g. the amount of discards.

The control of the data is completed in two steps:

Processing and quality assurance of each individual trip, hereby ensuring that the data is correctly sampled and that there are no recording of errors etc.

Evaluation of whether the valid trips can be considered as representative of the respective fisheries in that period and area.

Extent

In the period 1995-2001, 1138 observer trips with commercial vessels were completed and the catch was measured at 4388 stations altogether (trawl hauls and net sets). The duration of the trips vary by area. Thus, in the North Sea an

average of 11.4 stations per trip were sampled, while the corresponding figure for the Baltic Sea is 2.4. Altogether there have been observers aboard vessels for app. 2200 fishing days.

Table 1. Number of discard trips completed in the period 1995 to 2001 aboard commercial fishing vessels, and number of stations from which the catch has been raised.

Area	No. trips	No. stations
North Sea	152	1733
Skagerrak	118	709
Kattegat	212	378
Baltic Sea	656	1568

The observer trips only cover a small fraction of the overall commercial fishing trips that Danish fishermen complete in a year. For instance, about 60,000 trips were registered in the Baltic Sea alone in 1999 while scientific observers sampled only 122 trips. Coverage in this case is thus 0.2 per cent.

A total of 11 biological assistants plus two scientific officers are associated with the project. In addition there are two fisheries consultants (biologists) from DFA. The joint annual expenses associated with the project are estimated to app. 1 million EUROs

A prerequisite for the completion of the project has been the financial support from the European Commission and the Danish government.

Experiences

The intensive data collection has enabled the calculation of discard rates for 23 out of the 24 sampled sub-fisheries, which the Danish fishery is divided into. To this can be added an additional 14 sub-fisheries that were not sampled given that they either incur no discards (small-meshed fisheries) or that they do not normally incur significant discards (e.g. seine fisheries for herring and mackerel). The data can thus be incorporated as part of the basis for the biological advice.

For the vast majority of the fisheries and fishing periods there have not been any problems getting scientific observers onboard. Only for short periods there have been minor problems in this respect. In these cases the problems have been solved, either by having the fishing organisations' representatives convince the skippers in question of the usefulness of participating, or by finding alternative vessels in the same fishery.

One of the side effects of the cooperation is that it now is possible to put forward informal comments and have discussions in a non-political forum, to exchange ideas of how to design projects, to communicate fishery science to the fishermen in a popular form and to be able to create person to person contacts more easily. Furthermore, the cooperation has resulted in more support from the fishermen and acceptance of the results and findings obtained during sampling and trials.

2.2.2 Denmark (Michael Andersen on behalf of the Danish Fishermen's Organisation)

In 1995 DIFRES and Danish Fishermen's Association, started operating a discard sampling programme in the eastern and western sectors of the North Sea. The system was voluntary and involved semi-random sampling of both catch and discards, including length and biological sampling. The programme was intended to replace port sampling (of catch) totally but a mixture of port and on board sampling is still currently practiced. The on board discard sampling involves the skipper agreeing to the sample, and a working group looking at the data to identify normal / abnormal data.

Within Denmark there has been science and industry co-operation on a number of other interrelated projects, including the investigations aimed at "improvement of stock assessment methods". Recent events in the fisheries and restrictions have destroyed much of the good will but not at individual level. Fishermen believe that 'the system' is not using the data correctly, and point to a lack of agreement between the results of assessments and their evaluation of the state of the stock. They raised the question why the data are used against them when, alternatively, they could for instance be used to identify areas where discards of cod are not significant.

2.2.3 Denmark (Doug Wilson on behalf of the Institute for Fisheries Management)

Experiences with Collaboration between Fishermen and Scientists

1. Types of Fishermen / Scientist Collaboration

In this short presentation I will try to summarize and draw some lessons from a great many experiences with attempts to gain knowledge about fisheries through cooperative work between fishermen and scientists. Research collaboration between fishermen and scientists has a long history, back to the beginnings of fisheries science. One way of understanding these collaborations is to suggest that there are four basic types or models of collaboration (Wilson 1999). These models are cumulative in that each one incorporates the basic perspective of the earlier ones.

	Model Basic Assumption
The Deference Model:	Scientists are the experts and the best way to get an accurate picture of nature is to rely on their professional judgement.
Local Ecological Knowledge:	Scientists and fishermen see the world differently because of differences in training, experience and culture. Science can be improved by listening to what fishermen have to say about the resource.
Competing Constructions:	Scientists and fishermen collaborate within interest groups to create pictures of the resource that reflect particular concerns.
Community science:	Collaborative fisheries science done in the context of fisheries co-management and/or community development.

The Deference Model

The deference model is the most widely accepted "common sense" idea of science as a social process. Scientists are the people that society has trained and given the institutional and physical tools to decide what is true about our natural environment. That is their job and they are the best ones to do it. The most widespread of this type of collaborative work is data gathering for scientists in which fishermen and others act as research assistants; a very common example is tagging studies. Other common activities include fishermen participating in research through providing research platforms, logistical support and at-sea collaboration.

The Local Ecological Knowledge Model

The local ecological knowledge (LEK) model both incorporates, and is a challenge to, the deference model. No one claims that LEK includes generalizable, scientific information. The emphasis is on finding local information that can supplement research-based knowledge. In this sense the LEK model builds upon the deference model. However, the LEK model makes two important claims. The first is that LEK reflects the thinking of fishermen is critical to producing a picture of nature that will be accepted. The second is that LEK, while not generalizable, is just as valid as that produced by formal science: the scientist is no longer assigned the role of the gatekeeper who has the final word on what is or is not known to be true about nature.

The Competing Constructions Model

Scientists are increasingly working with fishermen, and other interest groups within fisheries, in pursuit of particular policy objectives. People select different facts from fisheries science to put together an overall picture of the resource that fits their needs. In spite of the insults about "disinformation" that get bandied about when tempers flair over management disagreements, there is *usually* not anything sinister about this. The scientific questions that people ask, and the answers that they find useful, are always related to some agenda. This is true in the highest scientific ivory tower; it is certainly true throughout fisheries science. Asking different questions and using facts in different ways build different pictures of the resource. This, however, *does not mean* that there is no such thing as an objective fact and *it does not mean* that all descriptions of the resource are equally valid.

Because they are confronted with different questions and problems, each of the major players in fisheries management, and the scientists that work with them, tend to construct a version of nature that fits their needs. This means, to put things as simply as possible:

a) scientists working in or in the service of management agencies tend to construct a picture of nature that is more amenable to bureaucratic management than it really is.
b) environmentalists, who always have to solve the problem of mobilizing their constituents, tend to construct a picture of nature that is more threatened than it really is; and,
c) fishermen tend to construct a picture of nature than can sustain more fishing than it really can.

Honest collaborations often happen between scientists and fishermen working toward particular policy objectives. In most cases these groups are convinced that their case has merit and are prepared to do what it takes to convince others of their point of view. This means selecting the most defendable scientific facts that suit their goals. This model of collaboration between fishermen (and other interested parties) and scientists is perhaps the most common kind of collaboration of all. It happens every day wherever a group or agency that has an interest in fisheries employs scientists.

Community Science

Many people involved in fisheries are creating innovative institutions to bring about collaborations in science that recognize that these differences are going to exist and use open communications to try to move beyond them. They are bringing the dynamics of "community" into the fisheries science process. There are many examples of these efforts, especially in the USA and Canada. One of the oldest examples is the Fishermen and Scientist Research Society which began in 1993 in Nova Scotia. It is a partnership between 156 fishermen and 42 scientists that emphasizes participating in and enhancing stock assessments where fishermen and scientists work together to identify hypotheses and design the research agenda.

These collaborative efforts incorporate the other three models. They defer to the expertise of the trained scientists and give them the leadership roles in the collaborative process. They respect the importance of LEK. They realize and take into account the fact that different understandings of the resource, and different ideas of what should be done, are going to reflect the practical problems in people's fishery-related lives. It is noteworthy that most of the programs emerged in areas with serious resource depletion problems, and that some of them were a response to intense conflict between stakeholders.

2. Problems with Fishermen / Scientist Collaborations

The Status of Fishermen's Information. One common set of problems that emerges in fishermen /scientist collaborations is related to the status of the information produced. From the perspective of the scientists, the problem is how to assign a level of validity to the information. Most of the information produced by fishermen is not gathered systematically, and is difficult to quantify or rigorously evaluate. This makes the information difficult to interpret or to use in conjunction with other kinds of data.

From the fishermen's perspective the problem is the ownership of the information and how it will be used. Information about fishing is fishermen's property, it is an important part of their livelihood and they do not want to release it in a way that will give economic advantages to other fishermen. They are also concerned that the information not be used against them and that not be penalized by the management system because increased information about their particular situation leads to their being restricted more than their competitors are. These are very serious problems that are based on real experiences that fishermen have had, not on unfounded fears about what might happen.

This has important implications for the nature of collaborations between fishermen and scientists. The deference model described above has often been too inflexibly applied. Scientists have made use of fishermen as providers of research platforms, research assistants or sources of data without the fishermen having any input into the formulation of research questions or decisions about the use to which the data will be put. This has led in some circumstances to the collapse of programs and long lasting distrust of science and its value by fishermen. While helping to gather data should not necessarily give anyone veto power over its use in management, it is necessary to recognize that collaborative work can lead to destructive results if it is conducted through a relationship based on a hierarchy of superiors and inferiors rather than on authentic give and take. In fisheries management knowledge is power. That a good deal of their knowledge is tacit and difficult to articulate, as discussed below, is to the fishermen's great disadvantage. This sort of collaboration not only can empower fishermen by making their own knowledge more useful to them, it can incorporate them more fully into the management enterprise and channels this empowerment to aid sustainability.

The form of fishermen's information. Another set of problems is related to the form of fishermen's information. Fishermen's knowledge is knowledge of fishing itself. Fishing involves a different set of problems than management and to be made useful for management fishermen's information almost always to be translated into another form. This is often done by other people, often social scientists or biologists, and these changes can turn fishermen's knowledge into something that they don't recognize as their own.

One part of this problem is the fact that much of the knowledge that fishermen possess is tacit (Pálsson 1995). Tacit knowledge is knowledge that people have but that is not (easily) expressed. Skippers often find it hard to explain why they know things because their knowledge comes from emersion in the everyday world. The metaphors of knowledge as a sort of mental script or something "sitting in on a shelf" in someone's mind are not accurate. Fishermen's knowledge is part of their overall fishing skill and the knowledge that underlies a skill is intuitive and not easily articulated or even necessarily understood well by the possessor. New fishermen learn these skills by imitating the actions of others and many of these practices are learned without ever involving discussion or even consciousness that the transfer of information is going on.

Fishermen's knowledge, therefore, is not always in words, let alone numbers. Even fishermen's recorded information, however, such as log book data, will require translation to make it useful for management. While this is much less of a problem than translating tacit knowledge into a useful form, this can still be a difficult practical problem. Fisheries management agencies, for example, have convinced fishermen to provide them with log book data and then discovered that they did not have the manpower they needed to put the information into a useful data base.

Fishermen's observations also take place at different spatial and temporal scales than the observations of fisheries science. The tendency of fisheries science over the past century has been to pay more and more attention to ways of estimating averages over large scales (Degnbol. 2003). This directly contradicts the fishermen's perspective which places greater emphasis on local scales and on variation rather than averages.

Differences in knowledge cultures. Another problem widely recognized in the literature is differences in "knowledge cultures." The basic argument is that because of differences in experience and training fishermen simply see the resource in a different way that scientists do. Such differences take many forms. One common observation is that fishermen distrust the use of statistics as the primary way to understand a stock (Roepstorff 1998). Another is that fishermen tend to see the fishery as a chaotic system and distrust simplifications. They often see fisheries as systems in which small perturbations may have substantial future consequences (Smith, 1990). Fishermen often focus much more on habitat changes rather than population dynamics. Sensitivity to how small differences in the environment determine the abundance or lack of abundance of fish is a critical part of the fishermen's skill. The experience of tracking down fish leads to an emphasis on these factors, while the idea of predicting future populations based on present number can be seen as absurd or even arrogant (Paolisso, 2002).

This idea of knowledge cultures should not be overemphasized, however. Many modern fishermen share basic presuppositions about common sense reasoning with scientists and their ways of understanding the stock are often fairly similar. It is more accurate to argue that there are many 'knowledge cultures,' both within the fishing industry and within scientific communities (Wilson, 2003) and that gaps in understanding can are often overcome through thoughtful dialogue.

Institutional blocks to using fishermen's information. Institutional problems with the use of fishermen's information are often a more serious problem than difference in knowledge cultures (Wilson, 2003). Even in situations where scientists and fishermen basically agree about the condition of the stock, the ways management is organized and rules governing the process may make the use of fishermen's information difficult or even impossible. Management structures in many, if not most, cases are designed around the assumption that research science is the only source of valid knowledge about fish stocks, hence making it difficult to include information from other sources. This is particularly egregious where parameters of particular kinds of population models are identified as the legal basis for management decisions (Wilson and Degnbol, 2002).

Protections against undue influence of the industry on management decisions may also lead indirectly to the exclusion of fishermen's information. This reflects a very serious consideration. Any rule changes opening up the use of information from fishermen will also have to be applied to other stakeholders, such as environmental groups and recreational fishing groups. No particular group of fishermen should view the opening up of the scientific process in management as an unalloyed good from their own political perspective.

Good institutional models for the inclusion of fishermen's information in management currently exist (Wilson 1999). All of them, however, are operating on medium to small geographical scales. They also exist within management programs that include some kind of authentic 'co-management' arrangements in which fishermen have a role in

management decision making. In the final analysis, the question of how to include fishermen's information in management cannot be separated from overall questions of how management decision making is organized.

2.3 England

2.3.1 (John Cotter, CEFAS)

A number of smaller initiatives are presently ongoing in England:

1. Regional meetings:

CEFAS fisheries scientists organise regional meetings with representatives of the fishing industry annually prior to ICES assessment working groups to learn fishers' views on the state of the stocks, the strength of current year classes, and changes in fishing effort.

2. Log-book schemes

CEFAS operates log book schemes whereby skippers send their confidential catch and effort logs to CEFAS in exchange for payment of expenses. The schemes cover flatfish, bass, and shellfish. Approximately 20 to 30 skippers co-operate with each. The main purpose is to get data for vessels under 10 m length which are not covered by the CFP log-book scheme.

3. Meetings with National Federation of Fishermen's Organisations (NFFO)

CEFAS scientists meet the NFFO and other fishers' organisations on an ad hoc basis or on request to discuss topical fisheries science and management issues. The NFFO has in the past sent a representative on a CEFAS ground fish survey to assess the relevance and quality of the work.

4. Annual advisory meeting

CEFAS stock assessment scientists and UK administrators (DEFRA) meet representatives of the English and Northern Irish fishing industries annually following the ICES ACFM meeting. This is to communicate and explain the most recent ICES advice to the industry prior to the Council of Ministers at which TACs and other measures are decided.

5. Fisheries Conservation Group

This group includes representatives of the fishing industry and of CEFAS and meets in London and Edinburgh several times a year to discuss fisheries management issues that are live in the context of national and EU policy negotiations.

6. Catch sampling at sea

CEFAS now has a formal discard sampling programme funded under the EC Data Collection regulation (EC 1639/2001). Observers based at CEFAS and the ports select commercial fishing vessels and go to sea to sample and estimate the quantities of fish discarded and retained. The scheme relies on the voluntary co-operation of the industry. Small payments are made to cover subsistence only at sea. The sampling target in 2003 is for 800 observer days at sea. Regional groups involving industry and scientists will meet regularly to discuss the programme, review results and agree that the data collected are representative of the fishing pattern of the fleets sampled.

7. Charter surveys

CEFAS charters small numbers of fishing vessels for fish surveys. They supplement surveys undertaken by CEFAS's two research vessels.

2.3.2 England (Doug Beveridge on behalf of NFFO)

Although there have been some changes in recent years, historically, at both European and UK level, interaction between fishermen and fishery scientists has been at a minimal and superficial level. Institutional and cultural constraints have created an artificial divide between science and industry.

However, Federation (NFFO) policy since the late 1990s has focused on increasing the interaction of the fishing industry with the fishery science community and processes. A number of initiatives, both formal and informal have been, and are in the process of being, developed. An example of the latter is the provision of dedicated regional contacts within the principal fishing areas to allow CEFAS fishery scientists and fishermen direct access and dialogue and to develop productive relationships.

More recently, and whilst not the ideal context, the introduction of fish stock recovery programmes has led to increased dialogue and interaction between fishery managers, fishery scientists and fishermen. Problems undoubtedly exist, but initial results demonstrate greater chance of successful measures when the fishing industry is directly involved in discussions and a partnership approach is adopted.

A significant development in January 2003, arising partly as a consequence of the cod recovery programme, is the introduction by the UK Government of an aid package to fund projects in which fishermen and scientists work in partnership. This is an important initiative, as limited resources and funding have previously constrained progress. This is new and unknown dimension for the fishing industry and ideas for project(s) are at an early stage. Appendix II outlines initial research areas considered a priority by the fishing industry. The principal objective is to produce parallel time-series of industry survey data, to compare and contrast with research vessel data.

Overall, it should be acknowledged that the input of fishing industry information into both stock assessment and fisheries management is at a relatively low base level.

2.4 Germany (Cornelius Hammer, Fed. Res. Centre for Fisheries)

For at least 10 years, scientists have met regularly twice a year to exchange information with fishers' representatives. These meetings serve the purpose to inform and to discuss the outcomes of the recent ACFM meeting. On that occasion the underlying concepts (PA concept etc.) are also explained and discussed. Other topics of relevance are dealt with on request (e.g. wind-farms). In addition, the fishery informs the scientists about their perception of the state of the stocks and ongoing processes on the market, e.g. new vessels, import and export developments etc.

Scientists have been sampling on board fishing vessels for at least 15-20 years. They frequently sail on a number of larger vessels fishing for red fish or saithe, as well as on smaller vessels in the North Sea and Baltic and on coastal brown shrimp cutters. This cooperation is based on established personal contacts which have developed over the years. However, in some fleets problems regularly occur. On a number of occasions the scientists are, at very short notice, not allowed on board, allegedly due to a lack of space.

Over the years a quasi symbiotic relationship has developed between some of the researchers and skippers. The scientists gain a lot by listening to the fishers and regularly bring home very important information about the behaviour of the fleet, the abundance of the stocks and the actual fishing situation. Some of the fishermen on the other hand benefit from discussions with the scientists and learn about fishery biology and what the data collected are used for.

2.5 Ireland (Ciaran Kelly, Marine Institute)

The Irish fishing industry is represented by predominantly regionally based representative organisations. Enforcement, control, and management of the national quotas is effected at governmental level by the Department of Communications and Natural Resources (DoCaNR). There are two state agencies; BIM who work with marketing, fisheries and fleet development, and the Marine Institute with responsibility for resource assessment and advice provision.

Two years ago two regionally based pelagic management committees were established. The DoCaNR endorsed these committees. The membership of these committees is composed of representative fisherman's and producers organisations, staff of the DoCaNR and in an advisory capacity, the Marine Institute. In the cases where the Irish quota represents >90% of the TAC, these committees have fishery management scope. The committees can effect fishery management decisions through voluntary measures and through invoking national bye laws.

These Regional Pelagic management committees have achieved the following over the past 2 years;

- **The formulation of management objectives**

The Southwest regional pelagic management committee have endorsed the following text for the Celtic Sea Herring stock ; *"…to maintain the stock at a level whereby it can sustain annual catches of around 20,000t. In the event of the stock falling below the level whereby these catches can be sustained the committee will take appropriate rebuilding*

measures. The committee will also introduce such measures as are necessary to prevent the landing of small first time spawning herring, including closed areas and/or appropriate time closures." In addition the committees have implemented the following operational measure, that landings should contain at least 50% of individuals >23cm. This measure led to the closure of an area in the Celtic Sea by national statute and a closure of the fishing season two weeks early (by voluntary measure) in 2002.

- **Additional research programmes**

Frank discussions on the performance of assessments on which the advice is based has led to the Committee recommending areas for additional research. These recommendations have produced extra financial contributions from both the fishermen's organisations and the state to effect the necessary research.

- **Consensus**

The development of a working relationship between the members of the group through regular briefing and debriefing meetings has led to the improvement of catch and landing statistics, which in turn has improved the accuracy of the assessments. Achieving consensus at critical periods in the assessment and advisory process has encouraged trust levels to be built up between the members of the group.

The regional pelagic management committees aim to promote sustainable fisheries management through consensus. In Ireland these committees are now functioning as pro-active instruments to focus research and encourage dialogue between the industry, scientists and managers.

2.6 Netherlands (Fenneke Brocken, Floor Quirijns, Wim van Densen)

Participants from the Netherlands presented information on the F project, the overall objective of which is to improve mutual understanding between fishermen, scientists and fisheries managers, by stimulating communication and collaboration between fishermen and fisheries scientists. The project focuses on the beam trawl fishery for plaice and sole in the North Sea and started in 2002. It is funded by the Dutch government in collaboration with the fishing industry and carried out by the Netherlands Institute for Fisheries Research (RIVO). The project co-ordinator is responsible for overall project management and communication with the Steering Committee, which comprises representatives of the fishing industry (Fish Product Board and Fishermen Organisations) and the Directorate of Fisheries of the Ministry of Agriculture, Nature Management and Fisheries (LNV).

The projects consists of three interrelated work packages

Work package 1: Improvement of stock assessment of plaice and sole

WP1 is primarily concerned with the technical aspects of assessments. It seeks to improve their quality by:

- Ensuring input data is representative
- Examining uncertainty and bias in the stock assessments and the short-term prognosis
- Reviewing biological reference points
- Producing a quality assurance manual and
- Exploring alternative assessment methods

The work is being carried out in collaboration with the ICES Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak (WGNSSK) and results will be presented at relevant ICES Working Groups Meetings and at the Annual Science Conference.

Work package F2: Effective use of fisheries data

WP 2 seeks to make greater use of data from the fishery, particularly data on catch and fishing effort. Specifically the aims are to:

- Collect in a structured manner catch records from representative vessels within the flatfish fleet

- Develop methods to derive unbiased estimates of trends in stock biomass based on commercial cpue

- Compare catch rates of commercial vessels and research vessels

- To collect information on discarding and high-grading

Work package F3: Communication

WP 3 aims to improve the communication between fishermen and government and between fishermen and fisheries biologists about the developments in the stock and the fisheries by:

- Providing clear, more easily understood information about the state of the fish stocks and fisheries

- Helping to improve the capacity of the fishing industry to understand and interpret information on fish stocks

- Providing a structure for meetings between fisheries industry, fisheries scientists, and fisheries managers

Work packages 2 and 3 are closely related but are linked to WP and the aims of improving the assessment and by making better use of cpue information from the fishery.

Progress to date. During 2002, following consultation with the fishing industry, **44** flatfish vessels (10 Euro cutters of 260-300 hp, **34** large beam trawlers of about 2000 hp), willing to take part in the study were identified. These vessels are representative of the fleet in terms of their effort distribution and other flagged vessels are also included. Participating skippers were asked to provide detailed records of their catch of marketable species, their catch composition on a haul-by-haul basis and to provide information on the position, time of haul, duration, depth and other relevant variables. These data have been entered into a purpose built computer programme and sent to RIVO at the end of each fishing trip and used to produce cpue maps of the research fleet activities on a monthly basis.

Setting up the project involved visits to harbours and ports and meetings with fishermen to discuss the aims of the project. Fishermen were consulted about these and the way the data would be collected and analysed. There have also been regular meetings with fishermen to discuss progress and evaluate results. Maintaining close contact with participating fishermen and providing feedback is seen as an important and integral part of the study. This process has in itself understanding and information and exchange and generally improved communication between scientists and fishermen. Some fishermen have, however, withdrawn from the research fleet, some because they had experienced problems with software or disagreed about the way the data are analysed, but mainly because of mistrust of the management system. Further work will be carried out on the software and analytical methods. At the end of the first year the intention is to evaluate information on cpue obtained from the research fleet, to compare it with RV indices and present it to stock assessment working groups.

2.7 Norway (Odd Nakken Institute for Marine Research)

The "Reference Fleet" – Fishing vessels doing biological sampling

To increase the amount of biological information from fish catches, IMR has collected information since 2001 directly from six fishing vessels (the so called "reference fleet". This consists of three trawlers, one long-liner, one gillnetter and one vessel combining long-lines and gillnets. The collected data comprise an extended catch logbook observation scheme, including measurements of weight and length of individual fish. In the future the collected data will include information on maturity stage and otoliths for age determination. The data are recorded electronically and transmitted to the IMR via satellite. In 2002 these vessels provided 2900 samples, including 215,000 length measurements of 18 different species; the majority of observations coming from cod, saithe and haddock.

2.8 Scotland

2.8.1 Scotland (Anne McLay, FRS)

Over the years Fisheries Research Services (FRS) has developed a close working relationship with the Scottish fishing industry and is dependent on the co-operation of fishermen for much of the data used in stock assessment. Contact and collaboration has been maintained in a number of ways.

Catch records. Information on the quantities of fish landed comes from log books and recorded sales slips of individual fishermen collected by fishery protection officers from Scottish Fisheries Protection Agency and compiled by Scottish Fisheries Departments.

Market Sampling. Other information about the fish caught, and changes in exploited fish populations, is obtained from an extensive programme of market sampling. FRS samples landings of demersal, pelagic and shellfish species at ports around the Scotland. Most ports are visited at least once a month. Fish are measured, weighed and otoliths are taken for age determination. Samples are stratified by season, fishing method and gear, and fishing area. This provides information on the size and age structure of the catch and other data which are used in a range of stock assessment procedures.

Observer programme. Regular discard sampling by scientific observers working on Scottish vessels fishing in the North Sea and the West of Scotland started in 1975. The programme is based on stratified random sampling by area, gear and quarter within each year. The stratification was chosen to match that of the Scottish market sampling programme, with the intention of providing reasonable coverage of all areas of discarding activity. Sampling allocation targets those areas with maximum expected fishing activity. Between 60-100 trips are sampled annually, a coverage of 0.1-0.2%.

Meetings with industry. Staff at FRS meet regularly with the representatives of national fishermen's federations / associations, fish producers organisations and other sectors of the fishing and processing industries to discuss stock assessments, management recommendations and other issues. Meetings which take place before and after annual ICES assessment working group meetings, provide an opportunity for scientists to discuss the assessments and for fishermen to put forward their views about the state of the stocks and provide information on most recent developments in the fishing industry.

Co-operative research. FRS also works with the fishing industry on research projects. Previously these have included evaluation of catch data and cpue data based on skippers' individual catch records, tally book schemes, survey design and fishing gear trials. In 2001, FRS was involved in 'The Science / Industry Partnership, a major collaboration in which Scottish fishing vessels were chartered for gear trials, (particularly square mesh panels) and biological data collection programmes. Projects were developed in consultation with industry. Reports are available as pdf files on FRS website (www.marlab.ac.uk)

Fishermen's knowledge. The value of the knowledge and experience of the Scottish fishing industry has long been recognised and FRS has recently started to investigate ways in which this knowledge can be accessed and used in both the stock assessment and management contexts (see below).

It is unfortunate that recent developments in the management of North Sea stocks appear to have compromised the relationship between FRS and the Scottish fishing industry. FRS hope to rebuild this relationship, to improve communication, and to continue to work with the North Sea Commission Fisheries Partnership and others to establish how fishermen's views on the state of the stocks and knowledge can be used in stock assessment and to improve fisheries science and management.

2.8.2 Scotland (Tom Rossiter, University of Aberdeen)

During 2001 and 2002 as part of a new programme of research, researchers at the University of Aberdeen have been working with FRS, interviewing skippers of demersal fishing vessels operating from ports in NE Scotland. This work was part funded under the PESCA-funded initiative, *Scientists and Fishermen: Working Together*. The aims of the work were to identify factors which affect the decisions fishermen make about fishing and fishing effort; to obtain fishermen's views on fisheries management and the state of the stocks; and to investigate fishermen's knowledge of fish biology and ecology.

The project brought together an interdisciplinary team of scientists and researchers. The methodology employed by the research team was both quantitative and qualitative. In 2001 semi-structured interviews were designed, which contained a quantitative questionnaire. The interviews were loosely structured, designed to engage skippers in conversation. The primary objective of the 2001 study was to scope the breadth of fishermen's knowledge. The interviews covered a wide variety of topics including fishermen's motivation to enter the industry, their decision making process whilst fishing, ecological knowledge and awareness, opinion of management and policies and their views on what lay ahead in future.

Following on from the work carried out in 2001, the 2002 project focused more of fishermen's ecological knowledge. ICES grid charts were used to record spatially resolved ecological data from fishermen. In addition fishermen's views were sought on Marine Protected Areas (MPAs) and the European Commission's proposed Regional Advisory Councils

(RACs). A total of 75 fishermen from whitefish and prawn sectors, were interviewed between May 2001 and October 2002 (50 in 2001 and 25 in 2002). Participant observation and group interviews were also tested as methods for collecting fishermen's knowledge.

2.8.3 Main findings

All the fishermen interviewed were very helpful and pleased to have an opportunity to talk about their experiences. Most have similar backgrounds, are part of local communities and have strong family ties to the fishing industry. They commented freely on management, explained how they respond to management measures and described the many changes which have occurred in fisheries and the fishing industry over the years. Fishermen's knowledge and insights are of value and interest to scientists and managers alike. Some of the findings of the study are summarised below.

- Skippers are very independent and this is important to them
- Their decision making process is complex and heavily influenced by personal and financial circumstances
- Management measures, quotas in particular, have become the single most important factor affecting fishermen's decision making
- Fishermen recognise that the effort expended fishing by individual boats has increased and is likely to continue to increase due to technological developments
- Fishermen feel their views and interests are not adequately represented in the management process and this is something they want to address
- Fishermen accept that they are partly responsible for the decline of the fish stocks
- Demersal fishermen dislike TACs and other management measures which lead to discards
- Fishermen would prefer a fairly administered effort control system, such as days at sea, designed to benefit the industry as a whole
- In future, fishermen believe that the demersal fleet will consist of fewer more efficient, flexible vessels, capable of targeting a range of species. Fishermen possess detailed local knowledge of fish distribution and movements and observe short and long-term changes in fish abundance. Much of this information in its anecdotal format is unsuitable for direct inclusion in scientific stock assessment as currently carried out. However, it is nonetheless valid and worthy of inclusion and consideration
- Fishermen's knowledge can contribute to both fisheries science and management.

3 MAIN CONCLUSIONS OF THE MEETING

TOR b-e

b) Identify additional information that can be obtained directly from fishers on stock status and trends;
c) Investigate the potential for these new data in fish stock assessments;
d) decide on the kind of information from fishing fleets which would be most valuable to assessment working groups;
e) consider how best such data and information could be collected, both from external sources (log books, satellite data) and from fishers themselves.

The Study Group thought that TOR b-e were closely linked were best dealt with in conjunction. The SG came also to the conclusion that some aspects of the TOR were ambitious and too far reaching to be satisfactorily addressed during this first meeting. It was not clear to the participants what information was required or might be available from the fishery. For this reason none of the parties were in a position to bring specific data to the meeting or to offer internally approved positions.

It was generally recognized by the group that the process of incorporation of additional information from the fishery into fish stock assessment should be viewed as a process rather than an act. It was thought that the TOR for the group were rather narrow in this respect. Also, from the discussions early in the meeting it was evident that the TOR did not concern the fishermen's concerns about the assessment process, and such as the need for greater transparency and greater participation in the setting of objectives and management aspects. In this respect the TOR were felt to be unbalanced in favour of the current science based paradigm. The SG attempted to redress this balance and achieve a better mutual understanding, and increase the 'give and take' between the fishery and the science.

It was considered imperative to include this step since the reports on the ongoing national initiatives (TOR "a") outlined above had revealed the presently very fragile basis of communication and cooperation between fisheries science and those involved in the fisheries. Recent developments and the imposition of management restrictions have eroded the trust of many fishermen in the scientific programmes, particularly in Scotland, the Netherlands and partly in Denmark

where some fishermen are not cooperating with market sampling and observer programmes. Fishermen think that data they provided or allowed to be collected (e.g. allowing discard to be monitored) are now used against them. They are in effect being penalised for co-operation in the past.

Because of this members of the SG agreed that it would be better to work towards a mutually agreed strategy rather than to initiate specific actions with regard to collecting data from particular fleets (TOR "e"). To embark on the latter course of action at this stage would certainly be premature.

The SG considered and discussed the TOR (b-d), split into fishing industry and scientific and mixed groups, eventually deriving a list of short and medium or long- term "achievables".

The discussions were wide ranging but several central themes and issues emerged. Of particular importance and interest was the scientific advisory and fisheries management structure operative in the Community. The request from the fishing industry for more participation in the decision-making process is long standing and is specifically addressed below. Equally long standing is the scientists' request for better and more accurate data on e.g. catch, for stock assessments. It was not explicit in discussions but it was clear that it will only be possible to achieve this when the basis of trust and cooperation between fishermen and scientists has improved. It was emphasized that this would take time and good will on both sides. Nothing however, would this be achieved by just waiting for things to improve. Positive action is required. It was agreed that the progress could be made through initiatives which bring fishermen and scientist together and provide incentives for them to work constructively together. Common projects, and funding to underpin these, were considered a good means of promoting working relationships.

It was also emphasised by representatives of the fishery that from their perspective, recent initiatives on their part to provide up-to-date information about the state of the stocks had proved disappointing and discouraging. It appeared to them that the information they had provided on stock abundance in the north Sea had little or no influence on stock assessments or the management advice. The conventional assessment procedure is perceived as incomprehensible, slow and clumsy and unable to react to recent changes in the fish stocks and fisheries. This lead to the suggestion that alternative, simpler methods of assessment should be developed and considered in parallel with the established assessment methods. From the fishermen's perspective trust and cooperation can only grow if their input has positive effects.

Fishers or their representatives, are currently excluded from the advisory structure. Trust and cooperation can only be developed if a forum exists where the fishery has a place and is acknowledged as an equal partner. The intention must be to move away from the traditional top-down approach towards a structure of more equality. The Regional Advisory Councils, proposed by the Commission as part of the reform of the CFP, were thought to present an opportunity for greater involvement and would provide a forum where fishery, science and management could meet.

The SG was of the opinion that there was insufficient time at the meeting to fully develop proposals to put forward by the group and that to do so would be premature and inappropriate at this stage. All present recognised that the SG was just starting its work, but hoped to get continued support from ICES and the North Sea Commission Fisheries Partnership.

3.1 Short Term Achievables

It was, however, possible to identify certain tasks or actions which would improve the situation and could be achieved in the short-term. These are listed below. Many relate to improved communication and increasing transparency of the assessment and management process

A.) Generic explanation of stock assessment and advisory procedures

A generic document should be produced describing the principles of stock assessment, how scientific and management advice is formulated and how TACs are set. The document should be in different languages and intelligible to non-specialists. The document should include:

A description of how stock assessments are performed. The assumptions made:

- A description of the input data
- A list of definitions

- A clear description of the respective responsibilities of assessment WGs, ACFM, the Commission and the Council of Ministers. Detailed material should be restricted to appendices and references. This document could be available on the ICES web-site.

B.) Non-technical summary of the state of important stocks

Stock assessment WG reports should include a non-technical summary of the results of the assessment for each stock. Technical jargon such as *F* and SSB, and any Greek letters, etc., should be excluded. These reports should briefly cover:

- Stock-specific assumptions made
- Comments on the quality of the data used
- Difficulties and uncertainties experienced
- Changes from previous assessments
- Significant changes in the fisheries.
- Implications and conclusions about the state of the stock.

The non-technical summary would not include the generic matters referred to in (3.1.A) but would make reference to the existence of that document.

C.) Communication via sea-going observers

As a results of the EC data regulation there are more sea-going observers on fishing vessels sampling catch and monitoring discards. These observers should be briefed on the outcomes of recent stock assessments, surveys, etc. and be able to discuss these with fishers.

D.) Incorporation of information and advice from the fishing industry

The SG agreed that there was a need for information from the fishing industry to be submitted and formally considered by appropriate bodies. Such information or advice could relate to management objectives, information about the state of the stocks, comments on the quality of the data used in the assessments or the assumptions made, or any other relevant issues. In theory, this could be achieved in the short-term. Consideration was given as to how this might be done.

Concerning management objectives, the industry may disagree with management by the precautionary approach currently used by ICES and request instead, for example, that objectives relate to yield or income to the fisheries. It would not be appropriate for ICES, either WGs or ACFM to consider such issues because their remit relates mainly to only fishing scenarios, relating fishing effort to the current and future development of the stock. Industry views on management for a stock should therefore be submitted directly to the European Commission and the Council of Ministers or to the Regional Advisory Councils (RACs) where they could be considered.

In contrast, industry views on the state of the stock, and the quality of the data and assumptions used in the assessment are relevant to ICES who would wish to ensure that the assessments are of the best possible quality. The question then arises how this might be achieved. Some stocks are fished by many countries and industry organisations and collation of all their views could be a large task too great to be undertaken by existing industry organisations. It was assumed that the advice would be in the form of written text, and occasionally reports. RACs are likely to be created in the coming years but this process may not be quick or complete throughout the ICES area.

In the meantime, it was suggested by the SG that: A 'Species Coordinator' for each stock is responsible for collecting data and information on landings, cpue, etc. from a scientist in each country fishing the stock. It would appear to be relatively simple for them to request and collate from national scientists information on their national fishing industry associations. Provided these contributions were in an appropriate format and style (e.g. half a page of A4) they could be merged (without alteration) into a text document appended to the data and be submitted to the appropriate ICES WG. The WG should append this advice to their report and be required by specific terms of reference to comment on it and explain how it was used or not used, whichever was the case.

E.) On-going verbal communication (meetings) between industry and assessment biologists

It is currently the practice in some countries for scientists and industry representatives to meet pre and post ICES working groups to exchange information about the assessment and the state of the stocks. This should adopted

elsewhere. Discussions should include fishers' perception of the stock status and the interpretation of national research vessels' contribution to the stock abundance indices, recruitment indices etc. Meetings immediately after the ICES Assessment WG meetings should clarify all aspects of the particular assessment.

3.2 Medium or Long Term Achievables

Objectives for the advisory process and Regional Advisory Councils (RACs)

The Study Group discussed future changes in how scientific and management advice on the fisheries might be formulated and used. There was a view that the creation and use of science cannot be separated from the overall management system. **No firm recommendations could be agreed**. However, a possible future framework for how science would be related to the overall management system was outlined, and is presented below.

In future, fishermen are likely to participate in the setting of management objectives for the fisheries, the provision of advice on management measures, and in the decisions taken and their subsequent evaluation.

ICES is currently the principal source of scientific advice on fisheries to the Commission. However, ICES' advisory role may change, although its main role of assessing the state of fish stocks is likely to remain. ICES itself may introduce its own reforms, especially in relation to independent peer review of its stock assessments, improvements in quality assurance and retrospective analysis of the assessments. ICES has already accepted that its activities must be more transparent, and that observers, including fishermen's representatives, should be present when advice is being prepared.

Greater participation of fishermen in management may soon be achieved through the establishment of the Regional Advisory Councils (RACs), proposed by the Commission. RACs are intended to bring fishermen and other stakeholders together with fishery managers to provide management advice. The RACs could possibly take a more integrated, sensitive and responsive approach to the management of the fisheries than the current system. There are issues to be resolved over the level of representation of different stakeholders, and over the geographic scope of the Councils. Fishermen are the main actors in the fisheries and deserve and expect to be well represented. A case can be made for an RAC within the North Sea because the distribution of some of the fish stocks corresponds with the area it encompasses.

An RAC for the North Sea could be charged with both defining management objectives and recommending management measures for its fisheries. The objectives could be much wider than those currently adopted. Currently, the latter are expressed in terms of biological targets and are focused strongly on the need to reduce risk to fish stocks. New management objectives might include economic and social targets and subsequently could take wider account of the fisheries in an ecosystem context, markets for fish, and consumers.

The RAC might wish to draw on advice from natural and social scientists in setting management objectives for the fisheries. These objectives would then have to be agreed with the Commission and Norway. ICES and other bodies providing scientific and technical expertise would need to be notified of the objectives, to enable them to carry out their tasks.

The RAC could also gather information relevant to management of the fisheries, obtaining this from national governments, fishermen, natural and social scientists and others. The information would be very wide in scope, to match the need for the RAC to give full advice relating to the agreed management objectives. The RAC would need considerable capacity and resources to gather this information and present it in a form accessible to fishermen and appropriate for management.

The RAC would need to interact closely with ICES to ensure that stock assessments from ICES were relevant to the agreed management objectives, were of appropriate quality and transparency and utilised the full range of information available. ICES could refer any deficiencies in information or data back to the RAC.

It is possible that a North Sea RAC might become the main source of management advice on fisheries to the Commission and Norway. ICES' role would then be to provide stock assessments and management options to the RAC, to the countries involved in the fisheries and to the Commission.

Integration of Knowledge from the Fishery

Fishers and their representatives often criticise the assessments on the basis that it the process is time consuming, cumbersome and that the data used are out of date. These are inherent features of the VPA type models used in

assessment which are based on catch (mostly landings) data up to and including the year prior to the year in which the assessment is carried out. Assessments also include a 'now cast' for the present year and a forecast for the coming year for which TACs are negotiated. These make various assumptions about levels of fishing mortality and recruitment to the fishery. Fishers consider this to be a very rigid framework one which is too inflexible to react to recent events, such as changes in the fish distribution, catch rates and fishing pattern. This and the limited amount of sea sampling data (data from observers and from the fishers themselves collected at sea) included in the assessments or projections leads to comments that assessments are behind most recent developments in the stock and fishery. In many cases the assessments do not reflect fishermen's experiences which are more related to current catch rates.

To address this it was thought that there is a need to expand the sea sampling under EU sponsored national data gathering programmes and derive some standardised sampling procedures. The key to effective interpretation and utilisation of these data is to ensure input and interpretation by fishers.

To address these two points it is recommended that the timetable for production of data for working groups be revised. The normal cycle of survey and landings data brought to working groups would not be changed. However, data obtained by sampling at sea from the first two quarters of each year (both discard sampling and information from fisher survey data and questionnaires) could be fast tracked and where necessary age estimation from the previous years' age-length keys used. There is a requirement to make better use of both from sampling at sea and fishers' knowledge of the stocks. To obtain fishers' input these data would be described and discussed by scientists at local and national level prior to the working group. Such discussions could include:

- The sampling success in spatial and temporal terms,
- Trends over time,
- Discussion of relationship to market data.

The results of this discussion could be a consensus between the scientists and the fishers before the working group. Where consensus cannot be reached fishers views could still be made available to the working group. Simple analysis for instance on the effects of selective devices (e.g. effect of mesh size changes) could be carried out at local and national level. This would improve transparency.

	Year 1				Year 2			
Data source	Quarter1	Quarter 2	Quarter 3	Quarter4	Quarter 1	Quarter 2	Quarter 3	Quarter 4
Sea sampling							Liaison	Liaison
Market and survey							WG	

Accuracy of data from sea sampling

The availability of accurate data is essential for both parties. The acquisition of better and more reliable data particularly accurate information about catch (both landings and discards) has been a standing request for many years from scientists. However, for many reasons the data quality varies greatly between areas, fleets and years, and this variation can have a significantly influence the assessments. The utilized data are derived from both fishers and observers who sample data during the voyages. The SG considered the issues of data quality and ways in which it could be improved. It was clear that data improvement is to a great extent a matter of trust between the parties and can also only be the result of a definite process.

In the future joint working groups of scientists and fishers could develop strategies for improving data quality. This could ultimately lead to quality assurance protocols for sampling (vessel, trip, haul, method). Sources of control of the information could be fishers, observers and statisticians. To this end the SG should evaluate questions of anonymity and confidentiality of the data. This is expected to be done in close conjunction with the producer's organisations.

Institutional Cooperation and joint Surveys

A framework needs to be set up to facilitate co-operative research between fishermen and scientists and also to investigate funding mechanisms for this research. The availability of research funds for scientific investigations could be coupled with supportive funds for the fishery, compensating e.g. for smaller catches during fishing trips within a framework of scientific investigations.

Ideas for such research presented at the meeting are summarised below:

1. Social science studies to better understand how fishermen arrive at their opinion on the relative state of the stock and also to improve understanding of fishermen's wider knowledge and motivations and investigate how this knowledge can be used in advising management.

Rationale

Fishermen possess wide knowledge of fish stocks. This information should be incorporated into stock assessment. However, to facilitate this, fishermen's knowledge needs to be structured and systematised into a suitable format.

2a. An annual report on the fleet's effective effort containing the following information:

Fleet structure

Fishing methods

Fishing trends

Market structure

This could complement the fishermen's survey on the state of the stocks and could be collected by the industry

2b. A retrospective report on the development of effective fishing effort.

Rationale

The efficiency of fishing fleets is continually increasing. These changes need to be recorded and in some way quantified so that they can be used in stock assessment.

3. Co-operative projects on how to reduce *unwanted catch*

4. Joint abundance surveys

- Icelandic Model (joint abundance survey which will allow comparison of random stratified surveys with biased surveys
- Scientists should be given greater flexibility to investigate new methodologies for abundance surveys (they should try to look at the stocks through fishermen's eyes, example bay surveys)

Rationale

cpue for scientific surveys differ from cpue in the commercial fishery. This creates conflict between fishermen and scientists on the state of the stocks.

5. Other initiatives should be encouraged which help co-operation and communication between fishermen and scientists. Potential sources of funding for joint research projects between the fishing industry and scientists could include:

Research quotas
National initiatives
EU initiatives
Joint industry and scientific funding
Industry funding

Regional projects

Regional or stock-specific project groups, consisting of fishermen and scientists, could be established to develop a common perception of the fish stocks in certain areas and to improve the ICES stock assessment, the transparency of the assessment process and mutual understanding. In these groups the following issues could be addressed:

- distribution of the stock in space and time (migration pattern).
- stock characteristics (length groups, size structure, maturity, spawning time, condition of the fish, diseases).
- the quality of catch data and other information (discards, misreporting).

The Dutch beam trawl fishery could be taken as an example. Members of the associated regional project group to be created should be fishermen related to the plaice fishery plus one scientist. The regional project group should meet each quarter in order to discuss the findings on the issues addressed. The meetings should be organized the first time by representatives of the different regions (fishermen) together with the scientist to sketch the details of the quarterly meetings. The schedule of the quarterly meetings and possibly other issues will be up to the group. The regional project should be evaluated after one year to discuss the effectiveness and in case of success to expand it to other fish stocks and areas.

Effort/cpue

Fishermen are aware that cpue data available for some commercial fleets are no longer used in stock assessments. The reasons for this are numerous, and case specific. There are/ have been problems with recording and accuracy of effort data and with data processing. Using commercial cpue as an index of stock size can be misleading as it can be influenced by a number of factors other than fish abundance (including markets, gear,). Scientists caution that fishermen can maintain catch rates in the face of decline in abundance by concentrating their effort on aggregations of fish. However, given the detailed knowledge fishermen have of catch rates and the need to better quantify fishing effort and relate cpue to abundance there would seem to be scope for joint work in this area. A joint ICES/NSCFP working group should be set up consisting of fishermen and scientist, to work on the definition of fleets, of conversion factors, and reference fleets and to consider setting up a non-national database. This WG should take account of the STECF report on the utility of commercial cpue data and development of fisheries based, as opposed to fleet based forecasts, which may be developed in future.

To come up with reliable and credible estimates/indices of cpue and of total effort, reflecting the variation in fish abundance and in fishing mortality, the following points should be regarded. Catch and effort (for instance, fishing hours in trawl fisheries or length of nets and fishing duration in fixed net fisheries) should be measured per haul and be recorded in the logbook. This information could be linked to information regarding fishing gear, details of which may be derived by questionnaires in order to get an impression of any catchability increase. To be of general use the recording of effort in EU log books would have to become mandatory. It could be initiated as an EU funded concerted action in order to install an EU project. The whole process can be expected to cover three to five years.

Integrating biological, economic and sociological advice

A long-term issue could be to consider multi-annual harvest strategy plans within the framework of the precautionary approach. Due to the interdisciplinary structure of this task and its relationship to the development of management objectives this could be organized by RACs if these are implemented. The process could be started immediately.

4 RECOMMENDATIONS

1. A **generic document** should be produced describing the principles of stock assessment, how management advice is formulated and how TAC's are agreed. This document should be available on the ICES web-site and produced as in a brochure format. (ICES secretariat)

2. A **non-technical summary** of the state of each stock should be included at the beginning of each stock assessment WG report and/or in each section of the ACFM report. This non-technical summary should not include Greek letters or incomprehensible terms like “F”. (ICES secretariat)

3. Sea-going observers should be briefed on the outcomes of recent stock assessments so that they can communicate effectively with fishers, (when asked to do so). Observers should undergo **training** to enable them to communicate effectively with fishers.(next SGFI)

4. The Terms of Reference for the stock assessment WGs should include consideration and comments on **information / observations provided by the fishery**.(ICES secretariat)

5. **National meetings** between fisheries assessment scientists and the fishing industry should be held to consider the inputs and results of stock assessments. (ICES delegates, NSCFPG)

6. **Data be collected in collaboration with the fishing** industry should be reported back to / jointly evaluated prior to use by assessment WGs/ wider dissemination. (next SGFI)

7. In the future joint working groups of scientists and fishers should develop strategies for **improving data quality**. This could ultimately lead to quality assurance protocols for catch and discard sampling (vessel, trip, haul, method). Data quality would be evaluated by fishers, observers and statisticians. The SG will need to consider how to ensure anonymity and confidentiality of those providing data. This would be done in close conjunction with producer's organisations.(next SGFI)

8. ICES assessment WGs should be asked to make a thorough assessment of the feasibility and utility of using the most **up to date information** on catch and landings in stock assessments and projection. This shall explicitly include **testing alternative assessment models and/or modifying the existing models**. This is a complex task. To address it adequately it would probably be necessary to establish a separate ICES study group.(ICES secretariat)

9. Information on major changes in **fishing patterns** (to include areas fished, gears used, fleet structure, target species) should be presented by national fishing industry representatives for discussion with scientists prior to stock assessment WG meetings. This information should be (provided to data Co-ordinators and) incorporated in WG reports. In addition, consideration should be given to extending the collection of such data in the future. Information of this kind is an essential background to the assessment and can be used for management purposes. (next SGFI)

10. **Regional and/or stock specific project groups**, consisting of fishermen and scientists (and possibly including fishery economists or social scientists), should be established to develop a common perception of the fish stocks in certain areas. These could provide additional information for ICES stock assessments and would improve understanding and transparency of the assessment process. In these groups the following issues can be addressed:

    - distribution of the stock in space and time (migration pattern).
    - stock characteristics (length groups, size structure, maturity, spawning time, condition of the fish, diseases,).
    - the quality of catch data and other information (discards, mis-reporting).(next SGFI)

11. Attempts should be made to make greater use of **commercial cpue** data in assessments. Such data are recorded but for a variety of reasons are being used to a lesser extent in assessment. A joint ICES/NSCFP working group consisting of fishermen and scientists should be established to consider this, and how to reduce the potential of varying bias over time in the cpue series and considering how to better define fleets/fisheries, to identify reference fleets and quantify fishing effort.(next SGFI)

12. Scientists and fishermen should work together evaluate survey strategy and design, and develop working procedures for **joint abundance surveys, involving both** fishing vessels and research vessels.(next SGFI)

13. The results of the North Sea Stocks Survey ("**Questionnaire**") which has been carried out by the Scottish Fishermen's Federation should be more fully evaluated and the results should be compared with research vessel survey and stock assessment. This could lead to recommendations about how to proceed with such and improve the quality and utility of such questionnaires in the future. (next SGFI)

5 TOR "E-F"

TOR "e": **Consider how best such data and information could be collected, both from external sources (log books, satellite data) and from the fishers themselves**. It was the opinion of SG that it was not yet possible to consider strategies to collect such data. Any specific attempt into this direction would clearly be premature. The SG decided to recommend that this TOR should be dealt with during the next ICES/NSCFP SG. (next SGFI)

TOR "f": **Begin the collection of these data for the North Sea demersal fisheries through national agencies, in particular fishers' associations**. It was the opinion of SG that it was not possible to begin such collection during the

first meeting of the SG. Any specific attempt into this direction would have been premature. The SG decided to recommend that this TOR be dealt with during the next ICES/NSCFPG SG. (next SGFI)

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APPENDIX I

UK FISHING INDUSTRY : EXISTING INTERACTION

- **Regional Meetings**

Scale	England, Wales, Northern Ireland
Time Frame	1997 onwards
Participation	fishery scientists and industry
Format (s)	regional, port based meetings
	South West (Plymouth)
	North East (Grimsby)
	West Coast (Fleetwood)
	South East (Hastings)
Purpose	Meet with CEFAS scientists prior to relevant ICES stock assessment working groups.

- **Discard Monitoring**

Scale	England, Wales, Northern Ireland
Time Frame	2002 onwards
Participation	fishery scientists and industry
Format (1)	Annual Meeting
Purpose	Reporting and development/future strategy
Format (2)	Regional Steering Groups:
Purpose	Practical aspects and feedback

- **Post ACFM Briefing**

Scale	England, Wales, Northern Ireland
Time Frame	1980s onwards
Participation	fishery scientists and industry (fishery managers – observers)
Format (s)	Annual Meeting
Purpose	Held annually in October, CEFAS provide briefings by individual stock of principal commercial fish stocks.

- **Research Vessel Surveys**

Scale	England, Wales, Northern Ireland
Time Frame	1999 onwards
Participation	fishery scientists and industry
Format (s)	Industry involvement with fish stock assessment surveys
Purpose	Industry representatives sailing aboard research vessel surveys. Benefits are difficult to quantify, but the project provides the opportunity for exchange of ideas and an improved understanding of the different pressures faced. A major constraint is funding; participation by fishermen inevitably impact upon earnings.

- **Gear Technology**

Scale	England, Wales, Northern Ireland
Time Frame	
Participation	fishing industry and gear technologists
Format	Research trips by fishing gear technologist on commercial fishing vessels. Undertaken by the Sea Fish Industry Authority
Purpose	Develop and test fishing gear modifications

- **Fisheries Conservation Group**

Scale	United Kingdom
Time Frame	1996/97
Participation	fishery managers, fishery scientists, fishing industry and gear technologists
Format	approx. 3 meetings per year
Purpose	Consider and discuss practical implementation and development of technical conservation measures.

- **Fishermen's Survey**

Scale	European
Time Frame	2001
Participation	Industry
Format	Annual Questionnaire/Survey
Purpose	Collect and analyse fish stock information from fishing vessel operators

- **Specific Projects (example)**

Scale	England, Wales and Northern Ireland
Time Frame	2000 - 2003
Participation	Industry and Gear Technologists (Sea Fish Industry Authority)
Format	Research Project
Purpose	Monitoring of discarding and retention by trawl fisheries in Western waters by the use of Fisher Self sampling

APPENDIX II

INDUSTRY BASED SURVEY AND RESEARCH FLEETS: NFFO PROPOSAL

There is an emerging awareness of two schools of fisheries science. The first is elitist, remote, patronising when dealing with the fishing industry and keeps the industry at arms length. The second school of thought, whilst emphasising the need for independent, politically neutral science, sees value in a more collaborative relationship between fish stock assessment scientists and the fishing industry. It also believes that fishermen should be involved in, indeed placed at the heart of the scientific endeavour aimed at establishing useful knowledge about fish populations and their habitats.

It will be recognised that these two polar opposites are caricatures, but nevertheless, contain sufficient truth to reflect an uncomfortable degree of reality.

It is also the case that in North America and Australia considerable progress has been made along the continuum from the 'old science' to the 'new science'. The result of this involvement and co-operation is better quality data, better understanding of how fleets operate (who is fishing for what, where, when and with what gear), and a closer working relationship between fishermen and scientists.

NEW OPPORTUNITY

CEFAS are bringing a new research vessel into commission in April 2003 and because research vessels vary, in effect this will be the start of a new time-series. This is therefore an opportunity to influence the shape of stock assessments for perhaps the next 20 years. We have been invited to discuss how existing practices could be adapted.

Whilst this is an opportunity which it would be foolish of the industry to miss, it is our view that the integration of the fishing industry into the fish stock assessment process should proceed in a much more systematic, comprehensive fashion than the opportunity to influence the research vessel assessments, and the odd, slightly artificial, meeting.

NORTH AMERICAN EXPERIENCE

Based initially on the Canadian Sentinel fisheries, efforts have been made in the north east United States to establish two fishing industry based research fleets: these are a study fleet(1) and an industry based survey fleet(2). The aim is to use commercial fishing vessels and their crews to gather scientific information on fish populations, record oceanographic data and collect detailed information on commercial fishing vessels' catch.

Whilst it is accepted that an improvement in the quality of data is a goal common to both scientists and fishermen, it is also recognised that direct payments to the vessels would be required to underpin the research work on commercial fishing vessels, this would involve either a redirection of financial revenues from existing budgets or new finance from national government or European sources.

Proposal

This paper proposes the establishment, as a matter of priority, a government/industry working group tasked with the job of developing a viable industry-based research fleet along the lines, but not necessarily identical to, that being developed in the north eastern USA.

Such an initiative will require the good will of the industry, the support of the fisheries scientists and a solid commitment from Ministers to provide meaningful levels of funding at least in the short-term.

(1) *Study Fleets: A sample of fishing vessels from which high quality data on catch, fishing effort, gear characteristics, area fished and biological observations are collected. These vessels fish in "normal" commercial mode, and are selected to be representative of the larger fleet, over time*

(2) *Industry-based Survey: A scientifically-designed fishery research project to monitor the abundance and biological health of target populations of fish through the use of test fishing with specific gear(s) in specific locations.*

Output

The involvement of the fishing industry in the collation and interpretation of fish stock assessments should be a high priority. The industry contends that the quality of the data on which the assessments are based can be improved through fishermen's direct involvement and that working collaboratively with the scientists provides the strongest base for the emergence of a common viewpoint on the stocks.

Industry based research fleets are only possible if funding is made available either through diversion of existing budgets or 'new money'. This initiative will, over time, pay dividends in terms of improved quality of data, and a stronger working relationship between fishermen and scientists.