Fol. 41 Assess

This report not to be quoted without prior reference to the Council*

International Council for the
Exploration of the Sea

C.M.1993/Assess:8

REPORT OF THE PLANNING GROUP FOR THE DEVELOPMENT OF MULTISPECIES, MULTIFLEET ASSESSMENT TOOLS

Copenhagen, 29 January - 1 February 1993

This document is a report of a Planning Group of the International Council for the Exploration of the Sea and does not necessarily represent the views of the Council. Therefore, it should not be quoted without consultation with the General Secretary.

*General Secretary
ICES
Palægade 2-4

TABLE OF CONTENTS

1 INTRODUCTION

1.1 Participants

R. Cook	UK
W. Dekker	Netherlands
H. Gislason	Denmark
L. Kell	UK
P. Kunzlik	UK
P. Lewy	Denmark
B. Mesnil	France
D. Skagen	Norway
P. Sparre (Chairman)	Denmark
K. Stokes	UK
L. Thomsen	Denmark
M. Vinther	Denmark
R. Bailey (part-time)	ICES
L. Pedersen (part-time)	ICES
H. Sparholt (part-time)	ICES

1.2 Terms of Reference

1) Plan and coordinate the development of new software packages to extend multi-species, multi-fleet assessment tools to area-based assessment Working Groups in "user-friendly" form;

2) Recommend appropriate fleet definitions, data formats and analysis software to allow consistent catch and effort analysis for stocks which are the responsibility of area-based Working Groups;

3) Report to the Working Group on Methods of Fish Stock Assessment, the Multispecies Assessment Working Group, and the area-based Working Groups.

1.3 Background to the Planning Group

At its 1992 meeting, the Multispecies Assessment Working Group (MSAWG) discussed the need for new software to run the multi-species model (Anon., 1992a). In particular, it was considered necessary for the model to be extended to account more explicitly for spatial differences and technical interactions. In addition, the current software can be run by relatively few people owing to its complexity and lack of documentation and, although the original program has been extended in several ways, it was thought necessary to rewrite the program using modern tools and techniques rather than attempt to modify the existing software. The MSAWG proposed two versions of the new software; one for 'public' distribution to the ICES assessment working groups and ACFM, and a second 'developers' version for use within the MSAWG. The former would allow only some of the current options to be run and would constrain users in their use of the model. It would also comprise the full range of features used in the standard ICES working group methodology and be 'user-friendly'. The latter would allow the behaviour of the multi-species model to be evaluated over a broader range of options and would permit further development of the model itself. The MSAWG, therefore, recommended that a Planning Group should be established to coordinate development of the new software and documentation (Anon., 1992a). The participation of members of the area-based working groups and the new Working Group on Long-term Management Measures (LTMWG) was envisaged in the proposed Planning Group.

Subsequently, the new area-based assessment working groups identified certain needs regarding their duties. As, in part, the motivation for the new area-based groups was to address technical interactions more easily, it was necessary to reconsider existing fleet definitions and to integrate fully the data from them (Anon., 1993a, 1993b). It was suggested that data would be structured in a more relevant way if they were held by fleet rather than by stock (Anon., 1993b) and that, once the relevant structure had been defined, a common data exchange format should also be defined to facilitate the transfer of data both to the coordinators within the working groups and to ICES. A Study Group was proposed (Anon., 1993a) to coordinate this work between the area-based assessment working groups. Subsequently this proposal was subsumed into the Planning Group proposed by the MSAWG as it was felt, clearly, that there was an overlap in interests between them.

As the Planning Group arose from the requirements of the MSAWG and the new area-based assessment working groups (North Sea and Skagerrak Demersal, Southern Shelf Demersal and Northern Shelf Demersal), its discussions have been specifically orientated to these groups and geographical areas. Consequently, the Planning Group is aware that it has not taken account of the interests of other regions and groups. Nevertheless, it is likely that some of the general points raised within this Group are relevant to a wider audience.

1.4 Emphasis of the Planning Group

The Planning Group started with a general discussion on the needs of the area-based working groups and how these could be best served by the new multi-species, multi-fleet package proposed by the MSAWG and exemplified by the package currently being developed by the Danish Institute for Fisheries and Marine Research (DIFMAR). This package is described in outline in Section 6. During this discussion, however, it became clear that the Chairmen of the area-based assessment working groups did not see themselves as the primary users of the new package. Although the motivation for the establishment of these groups was, in part, to address technical interactions more easily, it was apparent from their first meetings that there was only sufficient time

and personnel available to produce the standard ICES assessments. In these circumstances, the area-based groups will only be able to deal with occasional and general questions dealing with technical interactions within their groups and they viewed the Working Group on Long-term Management Measures as the primary customer for the new package. This is discussed in more detail in the following sections. Nevertheless, it changed the emphasis of the early discussions of the Planning Group from a technical discussion on the specification of software and documentation (as envisaged by the Chairman and, perhaps, the MSAWG) to a more general discussion on the allocation of duties between the various working groups. Within this framework it was then possible to define the data and software requirements of the Working Groups considered. In subsequent discussions, it emerged that the fundamental issue to be addressed by the Planning Group was the basic data structure required by the various working groups. Once this was resolved, and with sufficient design flexibility and modularity of programming within a package such as that described in Section 6, then its use by a variety of working groups would be feasible.

2 NEEDS OF AREA-BASED ASSESSMENT WORKING GROUPS

2.1 Analytical Software

Customer demands have meant that the work of area-based working groups has increasingly centred on the estimation of the present state of stocks in relation to historical trends and short-medium-term forecasts. These tasks utilize standard procedures involving conventional single-species VPA and age-structured catch forecasts. The core calculations for these tasks are already catered for by existing ICES software. Experience in the Multispecies Assessment Working Group suggests that, for the retrospective reconstruction of population change, there is little difference between single and multispecies VPA (except perhaps for short-lived species) provided typical M2 values from MSVPA are used in conventional VPA. Thus, the development of a user-friendly version of MSVPA for area-based working groups is not a priority. Indeed, the Northern and Southern Shelf Working Groups would not be able to implement it anyway due to lack of necessary stomach data.

MSVPA should not be seen as a routine replacement for single-species VPA. This is because the present single-species approach is more easily modified and developed to incorporate new methodology. In addition, where a working group does not have responsibility for the assessment of all stocks in the MSVPA, absence of certain data may prevent a complete analysis. However, these potential problems need not preclude running MSVPA alongside single-species assessments in order to refine M2 estimates.

Although area-based working groups and their predecessors have engaged in long-term analyses, these have tended to be of the yield-per-recruit type whose relevance is in decline. This has come about to a large degree as a result of multi-species developments. However, the increased workload of these working groups and the creation of the Long-Term Management Measures Working Group means that long-term software is not a major requirement of area-based working groups.

Part of the rationale for setting up area-based working groups was to provide a forum for the consideration of technical interactions. This requires a rather different view of handling data; i.e. by fleet or métier, as opposed to the present stock-orientated databases. Present analytical software needs to be modified as a result. For example, the present assessment tools do not readily allow the estimation of partial Fs by fleet from VPA results, which is a pre-requisite for undertaking an analysis of technical interactions, either in the short or long term. For the same reasons discards are not easily handled with present software because there is no straightforward means of partitioning discard mortality rates from total F.

Many fisheries have a seasonal component and this means that technical interactions also may have a temporal aspect. This means that analytical software should be capable of dealing with seasonal data. The obvious area where this is already in demand is for the industrial species where no standard ICES seasonal VPA or catch prediction software is available.

2.2 Data

Most data used by assessment working groups consist of catch at age and mean weight at age by stock. Typically, data are annual although some industrial species and flatfish data are stored by season. In some working groups the data are disaggregated down to fleet level where "fleet" may be a nation/gear stratum. Often, where effort data are available, these fleets may be used in tuning.

It is clear from the previous section that, in order to address the question of technical interactions, there will be a need to create data structures which are at the very least fleet-based and preferably "métier"-based [see Long-Term Management Measures WG report (Anon., 1993c) for a working definition of métier]. Furthermore, a seasonal, preferably quarterly, disaggregation is needed. Highly detailed data are potentially more time-consuming and difficult to produce and this is an important constraint in the execution of working group tasks. Clearly, the more disaggregated the data, the more information there is to be used. However, if data cannot

be delivered to working groups by necessary deadlines as a result, the working groups' principal tasks may be impaired. The choice of disaggregation, therefore, needs to be considered very carefully.

It could be argued that some of the existing stock-based data could be reconstructed into fleet-based data structures with appropriate software routines. Retaining a stock-orientated database has the advantage of making it simpler to add a new species to the database. However, this approach would require great care since it would be important that fleet definitions across stocks were consistent. It seems that in general it will be simpler to create the new databases from scratch since there is a need to define fleets more rigorously and store quarterly data rather than annual data. This, of course, means that there will be a need for software to aggregate data to stock level for conventional assessments.

An important consideration in the design of data structures is that they should allow new software routines and analytical methods to be implemented so that working groups can keep abreast of new developments in assessment methodology.

3 NEEDS OF MULTISPECIES WORKING GROUPS

3.1 Needs for Analytical Software

The Multispecies Assessment Working Group has developed, over a number of years, software and methods of assessment which take into account biological interactions between fish stocks. To assess historic trends and estimate interaction parameters the Group has used Multispecies VPA (MSVPA), which is a quarterly extension of conventional VPA in which changes in natural mortality due to predation are taken into account. To predict the consequences of chosen exploitation scenarios a number of different models have been used. All of these models depend on input derived from MSVPA results.

The main multi-species tool used in assessment work has been MSFOR. The MSFOR is the predictive counterpart of the MSVPA and uses exactly the same subroutine for estimating predation mortality. The parameters describing food selection and food intake can, therefore, be directly transferred from the MSVPA. The MSFOR is a multi-fleet, multi-species prediction model which may be used to perform short- and long-term predictions of stock sizes and of catches in weight and value by fleet, separated into landings and discards. The outcome of changes in exploitation patterns may be expressed as percentage changes relative to a *status quo* prediction. The MSFOR also contains options for sensitivity analysis and for stochastic simulation of recruitment. The latter may take the correlation of recruitment to each of the stocks into account.

In addition to the MSFOR the Multispecies Working Group has also used a steady-state model developed by Shepherd in which predation mortality is estimated by multiplying the amount of mortality generated per unit of predator biomass with the equilibrium biomass of the predator. The basic difference between the MSFOR/MSVPA model and the Shepherd model is that the former assumes the total food intake of the predator to be independent of prey biomass whereas the latter assumes food intake to be proportional to prey biomass, but in general the results from the two types of models are similar.

In order to enable ACFM and area-based assessment working groups to explore the likely response of the MSFOR model to changes in effort of the different fleets, the Multispecies Working Group has also derived a simple response surface to describe equilibrium biomass as a function of fleet effort. The response surface was fit to biomass estimates from MSFOR predictions of 50% changes in effort for each of the various fleets.

Finally, there has been some interest in developing models which enable the effects of fishing on overall biomass spectra to be predicted.

The needs of the MSAWG in terms of further development of the MSVPA/MSFOR package is described in their latest report (Anon., 1992a). In short these amount to improvements in the user-friendliness of the program interface, increase in program flexibility by applying a modular program structure, allowance for spatial subdivisions, tuning and increased possibilities for sensitivity analysis.

3.2 Data Needs

The MSVPA needs in the first place all the data used in an ordinary single-species VPA, but on a quarterly basis. In addition, it needs stomach content data and rations for the predators. In MSFOR partial Fs for fleets can be entered.

The data are held in ASCII files in formats specific to these programs. Updating these data is cumbersome, both because of the file structure, and because the level of aggregation is different from that used at present in the area-based working groups, which are mostly using annual data. Furthermore, this data structure is not adapted to many of the extensions of the models suggested by the MSAWG (Anon., 1992a). For example, the present structure is not flexible with respect to area-disaggregated data.

A common framework for data storage and extraction will be advantageous for several reasons. It will ease the updating of the input data for the multi-species programs if the data from the area-based working groups can be accessed directly. A restructuring of the stomach data, particularly if supplied with tools to interface the database with the recently agreed exchange format for stomach data (Anon., 1992b), would ease, not only the updating of the stomach data for the MSVPA, but also the use of the programs in other areas. Finally, a restructuring of the stomach database would make it far easier to apply the North Sea data to other kinds of multi-species models.

4 THE NEEDS OF THE WORKING GROUP ON LONG-TERM MANAGEMENT MEASURES

4.1 Software Requirements

The LTMWG requires tools to perform detailed short- and medium-term analyses of the effects of imposing technical measures (boxes, exploitation pattern changes, but also effort changes). Additionally, tools to assess likely steady-state ("long-term") consequences, of the continued application of technical measures, are required. Questions of a "what if" nature might come directly from managers concerned with possible management measures but also from within the LTMWG itself following analyses that suggest useful management strategies. There is a difference here in that managers might ask questions concerned only with technical measures and be primarily interested in short- and medium-term consequences. The LTMWG, however, might identify desirable strategies (assessment techniques, objectives, management tools and rules), the impact of implementing which need also to be assessed in the short- and medium-term. In the near future, the LTMWG will have to concentrate on extending ABC-type models[1] and will, therefore, be limited to answering short- and medium-term "what if" questions related to technical measures. Using such models, it will also be possible to consider steady-state analyses comparing technical measure scenarios with assumed baselines. In the future, however, tools to assess the performance of strategies will also be required.

The existing ABC-model and program (Lewy *et al.* 1992) already provide a basis for short-term projections and advice. Additionally, however, the LTMWG will need to be able to give advice on the medium-term consequences of adopting any particular measures. For example, there will be a need to examine the consequences of a particular measure for stock rebuilding or for effort reallocation. Medium-term projections of this kind will require an extended ABC-type model that accounts for biological interactions, effort reallocation and migration. Any such model will need to allow an examination of uncertain inputs (structural and data-derived). Programs developed need, therefore, to be flexible but also easy to run both within the LTMWG and at the area-based groups if ever there is a pressing need.

The ABC model developed under EC contract has already been used by the EC STCF Working Group on Improvements of the Exploitation Pattern of the North Sea Fish Stocks (Anon., 1989, 1991). The model is a single-species multi-fleet multi-area prediction program which takes technical interactions into account. Effects of management measures such as box closures, mesh changes by fleet and effort changes, may be evaluated.

The computer program includes spatially-disaggregated predictions and allows for migration between user-selected subdivisions. Options for simple reallocation of effort options following box closures are also implemented.

A price modification model is available to allow prediction of future prices.

Input to the program is from the STCF North Sea database (catch and effort data by fleet and ICES rectangle and stock numbers at age). For spatially disaggregated predictions, the spatial distribution of stock size needs to be derived from survey data (eg. 1991 International Bottom Trawl Survey IBTS).

The LTMWG also has available the MSFOR multi-species projection model which can be used for steady-state analyses (see Section 3.1).

4.2 Available Data

Although fleet-disaggregated data will need to be provided annually by national institutes for use by the area-based working groups, the level of disaggregation required by the LTMWG is much greater. This imposes an additional burden which can be hard to justify and would only be recommended to be carried out on an annual basis if necessary. Data for 1989 have been provided to the STCF database and data for 1991 are due to be input by May 1993. The LTMWG recommended

[1](Assessment of Bio-economic Consequences of technical measures, Lewy *et al.*, 1992).

at least one more update of the database before 1955. This would allow a comparison between years, and with data from the IBTS program, and should help in making a decision as to whether it is necessary to update the database annually or at less frequent intervals.

The STCF data should be as detailed as can reasonably be achieved given the various national databases. The current level of disaggregation is by gear type (sometimes subdivided by vessel length category) and by species, age, quarter and ICES rectangle. It is desirable that the database be maintained at the rectangle level but rational advice on the effects of mesh changes can only be given if those changes are assessed for relevant fishing units. There is a need, therefore, to split the current fleets into more homogeneous units (ideally métier). However, many of the entries in the current database are estimates rather than real data and further disaggregation may not be feasible.

5 SUGGESTED DISTRIBUTION OF WORKING GROUP RESPONSIBILITIES

The earlier sections of the report review the needs of the various working groups. It would seem appropriate that the Multispecies Working Group would continue to be the main user and developer of MSVPA. This would allow the further development of the model to improve, for example, the feeding model or the effects of other predators. Any changes to MSVPA would lead to new M2 estimates which would then be exported to single-species VPA. It is desirable that, to this end, the Multispecies Assessment Working Group undertakes a "key run" at each of its main meetings so that up-to-date inputs are available for other analytical methods. It should also be remembered that MSVPA is very data-demanding so for the present it can only be used for the North Sea and the Baltic where stomach content data are available. There may be a case for the Multispecies Assessment Working Group investigating alternative multi-species methods for those situations where large quantities of feeding data are not likely to be available.

In recent years, the main multi-species tool used in assessment work has been MSFOR or methods of a similar generic type. It seems likely that this will continue to be the case and it is these tools which should take the highest priority in the development of user-friendly versions for other working groups. These tools are generally designed to examine equilibrium states and are most relevant to long-term management considerations. It seems most appropriate that the tools would be used principally by the Working Group on Long-Term Management Measures. It is this Working Group which should be responsible for examining, for example, questions of mesh size, box closures and the long-term consequences of revised exploitation rates in certain fisheries.

The establishment of the Long-Term Management Measures Working Group should free the area-based working groups to concentrate more on the present status of stocks and their short-term evolution. This does not mean they will not want, from time to time, to use long-term tools. However, they should be more concerned with short- to medium-term considerations within the context of long-term management. In general, these will be dominated, if anything, by technical interactions and appropriate tools need to be developed for this. The type of problem relevant to this might be achieving consistency of TACs within mixed fisheries. Another particular example would be the investigation of the effect of the flatfish fishery on the North Sea cod stock, a component of the mixed roundfish fishery.

Although the suggestion that the Multispecies Assessment Working Group should regularly perform a "key run", at least for the North Sea, is specific, the delimitation of tasks between the working groups is not seen as a rigid demarcation. In fact it would be highly desirable that the area-based working groups and the Long-Term Management Measures Working Group have close communication. The area-based working groups should recommend appropriate areas of investigation to the LTMWG in order to provide a context for short-term assessment. A schematic representation of how the working groups might interact is shown in Figure 5.1.

6 FRAMEWORK FOR DATA AND ANALYSIS

6.1 General Considerations

The Planning Group has arrived at the following needs for a multi-fleet, multi-species assessment package:

1) The ability to handle data from a variety of sources, e.g., fleet disaggregated catch data for routine ass essments, stomach content data, and occasionally, highly disaggregated data for specific purposes.

2) The inevitably large size of these datasets means that it will be necessary to use an efficient data management system.

3) Flexible and easy access to, and extraction of, these data for use with analytical and presentational tools.

These tools will be of two types:

(i) fisheries-specific tools which would be external to any database system; (ii) statistical and summarising tools that could be either internal or external to the database.

A modular approach will be the key to a successful design and the computational routines need to be implemented as separate, external programs which can easily be replaced with alternatives or updates. Accordingly, suitable formats for interface between the data and external programs need to be designed.

4) The main tasks of the package will be for fleet-orientated assessments and this must be reflected in the design of the database. Therefore, data must be stored by fleet rather than by stock as at present. This should avoid the problem of inconsistent fleet definitions between stocks. However, the Planning Group were not in a position to explore all the practical ramifications of this structure, for example when an additional stock needs to be included.

   By not trying to include all possible requirements in a package at the design stage, but concentrating instead on the data and ease of access to it, it should be possible to build a system that will be able to cope with the varying needs of working groups now and in the future.

6.2 The DIFMAR Proposal for a Multi-species, Multi-fleet, Multi-area Assessment Package

DIFMAR will develop a new software package which combines and extends the facilities from the MSVPA, MSFOR and ABC models (Anon., 1993c). The package will also include a database.

In the design of this complex system of models and data, the establishment of a user-friendly system has been a dominant objective. The design of the system, therefore, reflects more the possibility for making a user-friendly and intuitive dialogue than execution efficiency.

The system is designed so that both experienced and novice users will have the facility to use the system on their own conditions. This means that both a batch command language and a graphical user interface will be available for communication to the system.

Possibilities for user-defined analyses and presentation of data require a flexible user-friendly system. The SAS package has been chosen for such a purpose.

The system consists of a core database and operations for data manipulation and presentation of data in a user-friendly way. The database is organized in a way that naturally fits the requirements of assessment and management.

Data are always stored at the lowest level of aggregation necessary to allow "low level" analysis. Catch numbers are, for example, stored by species, age, year, quarter, sub-area, management box, fleet and catch category. This aggregation level seems irrelevant in VPA, but may be relevant in highly detailed forecasts including fleets, closed areas, mesh changes, *etc.* If data cannot be provided at such a detailed level, the irrelevant indices can be set to a constant (or missed out).

A modular approach is the key to the design and, therefore, the component routines will be implemented as separate, external programs which can easily be replaced with alternative routines. The only restriction is that routines must conform to an internal data communication format between modules. The VPA and forecast will be implemented as modules using a high level language (C) relying on SAS for data input and output. Further details are given in a working paper (WD1).

Figure 6.1 from WD1 illustrates the structure of the system. The databases used as inputs to VPA are "FOOD" (including stomach contents, *etc.*), "VPA-BIO" (mean weight, natural mortality *etc.*), "VPA-CATCH" (catch numbers, mean weights, terminal F) and optional "TUNING" (catch and effort). The operation "VPA" takes input from these databases and writes the results back to the "VPA-BIO" and "VPA-CATCH" databases. The "VPA" operation could optionally communicate with an external "TUNING" program.

The "VPA-BIO" and "VPA-CATCH" databases can then be used by the operation "PREPARE PREDICTION" to generate the "FOR-BIO" and "FOR-CATCH" databases used as inputs in a forecast run.

6.3 Data Exchange Format

The definition of suitable data exchange formats, both for the provision of data for the database and for extraction by working groups and countries, is essential. If the exchange format reflects the logical structure of the data it will be in the form of relational database tables. Many countries have databases that are capable of generating ASCII files in the appropriate exchange format and, as the experience of the STCF database has shown, there will be little need for the provision of standard data entry software to generate the necessary files. The variety of software used by working groups and national institutes, however, will mean that data formats for data extraction need to be as flexible as possible.

There are two basic types of ASCII exchange formats.

1) Stand-alone records within individual lines prefixed by an identifier identifying its type. Each record includes index variables for the actual data variable. Individual records can be for total catch, catch at age, etc. The overall structure of the data is in the form of relational database tables.

2) The structure of the data is described by a header and subsequent lines in the file can be of various forms. Each line has to be interpreted in the context of the file. Such files are often comma-separated since they are generated and used in spreadsheets.

The STCF database and the ICES exchange format for bottom trawl surveys are of type 1.

e.g., STCF, "Total catch" format.

TOCDEN891AHBLL	1022	45014
TOCDEN891AHCOD	4976156	52234468
TOCDEN891AHDAB	5088	31435
TOCDEN891AHDGS	76089	803170
TOCDEN891AHHAD	80450	937483

Data for the Lowestoft VPA, and often for area-based working group assessment packages (e.g. Study Group on Fisheries Units in Sub-areas VII and VIII), are of type 2.

e.g., Lowestoft VPA input file.

```
Landings (tonnes)
1 1
1963 1991
0 0
5
      107936
      115795
      172620
       .
       .
       .
      85580
```

Data-format 1 is the most suitable for exchange between databases because it reflects their internal structure and because of the extra security inherent in the stand-alone record structure. Data in form 2 are commonly required for specific applications.

The Planning Group feels unable to make a final recommendation on the exact form of files for data exchange or on the data that they should contain. However, the data exchange format as used by the STCF Sub-group was successful in allowing highly disaggregated fleet data to be transferred between national institutes and a central database (see Appendix 1 for a full specification of the exchange format). Area-based working groups should consider this type of exchange format rather than the type used, for example, as input to the Lowestoft VPA package.

6.4 Implications for IFAP

The concepts outlined in Section 6.1 are essentially the same as those underlying IFAP : a core database and external analytical tools. IFAP, however, is stock-based rather than fleet-based and, already, some of the fisheries assessment tools are internal to the structure. If the structure detailed in Sections 6.1 and 6.2 is developed, IFAP will effectively become redundant in its present form. This clearly has implications and needs to be considered further.

7 CONCLUSIONS

There are no immediate needs for transfer of analytical software from the Multispecies Assessment Working Group to the area-based working groups.

There is a need for new analytical and data management software for the area-based working groups, the multi-species working groups and the Long-Term Management Working Group.

Working groups should consider re-defining data structures so that the fleet becomes the primary unit rather than the stock (as is the case for IFAP). Only by considering the fleet as the central unit will it be possible to address the central problems of technical interaction.

New software developments should be centred around the data structures and the data-processing modules should be interchangeable, as exemplified by the design suggested by DIFMAR. Unlike the existing MSVPA and MSFOR packages, the new analytical software should be composed of independent modules, with highly flexible interface facilities. New modules will be added by the various institutes as needs arise.

Area-based working groups should consider the STCF exchange format as a basis for formulating a common format for the exchange of their own data.

8 RECOMMENDATION

In view of the discussions at the Planning Group it is recommended that no further meeting on the definition of data structures be convened until the equivalent structure in the Danish package (Section 6.2) is completed. When this has been done it may well serve as a prototype for the development of a system by ICES to replace or enhance IFAP. Once this stage has been reached it will be worth ICES returning to the problem. Similarly there is little point in the area-based working groups defining the final exchange format until the data structure into

which it will fit has been determined. In the meantime these groups should give consideration to an abbreviated version of the STCF format (Appendix 1) as a likely exchange format.

9 REFERENCES AND WORKING PAPERS

References

Anon. 1989. Report of the meeting of the STCF Working Group on Improvements of the Exploitation Pattern of the North Sea Fish Stocks, Nantes, September 1989.

Anon. 1991. Report of the meeting of the STCF Working Group on Improvements of the Exploitation Pattern of the North Sea Fish Stocks, Charlottenlund, September 1991.

Anon. 1992a. Report of the Multispecies Assessment Working Group. ICES, Doc. C.M.1992/Assess:16.

Anon., 1992b. Report of the Study Group on the Analysis of Feeding Data, St. John's, Newfoundland, 17-19 March 1992. ICES, Doc. C.M.1992/G:4.

Anon., 1993a. Report of the Working Group on the Assessment of Northern Shelf Demersal Stocks. ICES, Doc. C.M.1993/Assess:2.

Anon., 1993b. Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak. ICES, Doc. C.M.1993/Assess:5.

Anon., 1993c. Report of the Working Group on Long-Term Management Measures. ICES, Doc. C.M.1993/Assess:7.

Lewy, P., Vinther, M and Thomsen, L. 1992. Description of the STCF database system and the prediction model ABC, Assessments of Bioeconomic Consequences of technical measures. ICES, Doc. C.M. 1992/D:17.

Working Documents

WD:1 Vinther, M., Lewy, P. and Thomsen, L. Specification and documentation of the Danish Institute for Fisheries and Marine Research, multi-species, multi-fleet, multi-area model. Charlottenlund, January 1993.

APPENDIX 1

STCF, Data Exchange Format

A. FLEET DATA:

POSITION	FIELD	TYPE	RANGE	COMMENT
1- 3	Record type	3A	FLE	Record type is FLE (FLEet)
4- 6	Country	3A	See Appen. B	ICES alpha code for countries
7- 8	Year	2N	00-99	The two last digits
9- 9	Fleet code	1AN		Code for fleet, to be used in other record types
10-34	Fleet description	25AN		Free text
35-54	Gear	20AN		Free text
55-69	Effort Unit 1	15AN		Effort unit for effort 1 in "EFFORT DATA"
70-84	Effort Unit 2	15AN		Effort unit for effort 2 in "EFFORT DATA"
85-99	Effort Unit 3	15AN		Effort unit for effort 3 in "EFFORT DATA"
100-102	Mesh Size	3N	0-999	Mesh size in mm
103-106	Extension length	4.1N	0-99.9	Length (m) of the extension piece
107-110	Number of meshes	4N	0-9999	Number of meshes around the cod-end

B. GEAR SELECTIONS DATA:

POSITION	FIELD	TYPE	RANGE	COMMENT
1- 3	Record type	3A	GES	Record type is GES (Gear Selection)
4- 6	Country	3A	See Appen. B	ICES alpha code for countries
7- 8	Year	2N	0-99	The two last digits
9- 9	Fleet code	1AN		Code for fleet given in "FLEET DATA"
10-12	Species	3A	See Appen. C.	ICES 3-alpha code for species items
13-20	L25 α_0	8.3N	-999.999 to 9999.999	α_0 constant in gear selection model for L25
21-27	L25 α_1	7.3N	-99.999 to 999.999	α_1 constant in gear selection model for L25
28-34	L25 α_2	7.3N	-99.999 to 999.999	α_2 constant in gear selection model for L25
35-41	L25 α_3	7.3N	-99.999 to 999.999	α_3 constant in gear selection model for L25
42-49	L50 β_0	8.3N	-999.999 to 9999.999	β_0 constant in gear selection model for L50
50-56	L50 β_1	7.3N	-99.999 to 999.999	β_1 constant in gear selection model for L50
57-63	L50 β_2	7.3N	-99.999 to 999.999	β_2 constant in gear selection model for L50
64-70	L50 β_3	7.3N	-99.999 to 999.999	β_3 constant in gear selection model for L50

The parameters α_{1-4} and β_{1-4} should be adjusted to give the L25 and L50 in mm.

C. EFFORT DATA:

POSITION	FIELD	TYPE	RANGE	COMMENT
1- 3	Record type	3A	EFF	Record type is EFF (EFFort)
4- 6	Country	3A	See Appen. B	ICES alpha code for countries
7- 8	Year	2N	0-99	The two last digits
9- 9	Quarter	1N	1-4	
10-10	Fleet code	1AN		Code for fleet given in "FLEET DATA"
11-14	Square	4AN		ICES statistical rectangles
15-24	Effort 1	10N	0-9999999999	Effort in unit given in effort unit 1
25-34	Effort 2	10N	0-9999999999	Effort in unit given in effort unit 2 (optional)
35-44	Effort 3	10N	0-9999999999	Effort in unit given in effort unit 3 (optional)

D. TOTAL CATCH DATA:

POSITION	FIELD	TYPE	RANGE	COMMENT
1- 3	Record type	3A	TOC	Record type is TOC (Total Catch)
4- 6	Country	3A	See Appen. B	ICES alpha code for countries
7- 8	Year	2N	0-99	The two last digits
9- 9	Quarter	1N	1-4	
10-10	Fleet code	1AN		Code for fleet given in "FLEET DATA"
11-11	Category	1A	H, I or D	H=Human consumption, I=Industry or D=Discards
12-14	Species	3A	See Appen. C	ICES 3-alpha code for species items
15-24	Weight	10N	0-9999999999	Total weight in kg (whole fish weight)
25-34	Value	10N	0-9999999999	Total value in national currency Total value is blanked if category is discards

E. CATCH DATA:

POSITION	FIELD	TYPE	RANGE	COMMENT
1- 3	Record type	3A	CAT	Record type is CAT (CATch data)
4- 6	Country	3A	See Appen. B	ICES alpha code for countries
7- 8	Year	2N	0-99	The two last digits
9- 9	Quarter	1N	1-4	
10-10	Fleet code	1AN		Code for fleet given in "FLEET DATA"
11-11	Category	1A	H, I or D	H=Human consumption, I=Industry or D=Discards
12-15	Square	4AN		ICES statistical rectangles
16-18	Species	3A	See Appen. C	ICES 3-alpha code for species items
19-28	Weight	10N	0-9999999999	Total weight in kg (whole fish weight)

F. CATCH AT AGE DATA:

POSITION	FIELD	TYPE	RANGE	COMMENT
1- 3	Record type	3A	CAA	Record type is CAA (Catch at Age data)
4- 6	Country	3A	See Appen. B	ICES alpha code for countries
7- 8	Year	2N	0-99	The two last digits
9- 9	Quarter	1N	1-4	
10-10	Fleet code	1AN		Code for fleet given in "FLEET DATA"
11-11	Category	1A	H,I or D	H=Human consumption, I=Industry or D=Discards
12-15	Square	4AN		ICES statistical rectangles
16-18	Species**	3A	See Appen. C	ICES 3-alpha code for species items
19-20	Age	2N	0-10+	Fish age. Herring, winter rings
21-31	Number	11N	0-9999999999	Numbers
32-36	Weight	5N	0-99999	Mean weight in gram (whole fish weight)
37-40	Length	4N	0-9999	Mean length in mm

** Cod, haddock, herring, mackerel, norway pout, plaice, saithe, sandeel, sole, sprat and whiting

G. PRICE AT AGE DATA:

POSITION	FIELD	TYPE	RANGE	COMMENT
1- 3	Record type	3A	PRI	Record type is PRI (PRIce at age data)
4- 6	Country	3A	See Appen. B	ICES alpha code for countries
7- 8	Year	2N	0-99	The two last digits
9- 9	Quarter	1N	1-4	
10-10	Fleet code	1AN		Code for fleet given in "FLEET DATA"
11-11	Category	1A	H or I	H=Human consumption or I=Industry
12-14	Species**	3A	See Appen. C	ICES 3-alpha code for species items
15-16	Age	2N	0-10+	Fish age. Herring, winter rings
17-22	Price	6.2N	0-999.99	Price per kg (gutted fish weight) in national currency

** Cod, haddock, herring, mackerel, norway pout, plaice, saithe, sandeel, sole, sprat and whiting

H. PRICE FLEXIBILITY:

POSITION	FIELD	TYPE	RANGE	COMMENT
1- 3	Record type	3A	PFX	Record type is PFX (Price FleXibility)
4- 6	Country	3A	See Appen. B	ICES alpha code for countries
7- 8	Year	2N	0-99	The two last digits (NOT IN USE YET)
9-11	Species**	3A	See Appen. C	ICES 3-alpha code. Species with regard to price
12-14	Species**	3A	See Appen. C	ICES 3-alpha code. Species with regard to quantity
15-20	Flexcros	6.3	-9.999 to 99.999	Flexibility with regard do domestic fleets landings
21-26	Flexrest	6.3	-9.999 to 99.999	Flexibility with regard to landings in other EC+ countries

** Cod, haddock, herring, mackerel, norway pout, plaice, saithe, sandeel, sole, sprat and whiting

I. LANDINGS DISTRIBUTION:

POSITION	FIELD	TYPE	RANGE	COMMENT
1- 3	Record type	3A	LDI	Record type is LDI (Landings DIstribution)
4- 6	Country	3A	See Appen. B	ICES alpha code for countries
7- 8	Year	2N	0-99	The two last digits
9- 9	Quarter	1N	1-4	
10-10	Fleet code	1AN		Code for fleet given in "FLEET DATA"
11-11	Category	1A	H or I	H=Human consumption or I=Industry
12-14	Species	3A	See Appen. C	ICES 3-alpha code for species items
15-17	Destination count.	3A	See Appen. B.	Foreign landing country
18-20	Part landed	3N	0-100	Part (%) of total fleet catch landed in foreign country

J. WHOLE FISH / GUTTED FISH WEIGHT RATIO:

POSITION	FIELD	TYPE	RANGE	COMMENT
1- 3	Record type	3A	WFG	Record type is WFG (Whole Fish / Gutted fish)
4- 6	Country	3A	See Appen. B	ICES alpha code for countries
7- 9	Species**	3A	See Appen. C	ICES 3-alpha code for species items
10-14	Ratio	5.3N	0-9.999	Whole fish / gutted fish weight ratio

** Cod, haddock, herring, mackerel, norway pout, plaice, saithe, sandeel, sole, sprat and whiting

All numeric fields (N) should be right justified and space filled and all alpha (A) and all mixed alpha/numeric fields (AN) should be left justified and space filled. Missing fields should be blanked. All alpha in upper case.

APPENDIX B: ICES alpha codes for countries.

BEL = Belgium
DEN = Denmark
ENG = United Kingdom (England and Wales)
FRA = France
GFR = Germany, Federal Republic of
NED = Netherlands
NOR = Norway
SCO = United Kingdom (Scotland)
OTH = Other countries

APPENDIX C: ICES 3-alpha code for species names.

Main species

COD =	Cod	Gadus morhua
HAD =	Haddock	Melanogrammus aeglefinus
HER =	Herring	Clupea harengus
MAC =	Mackerel	Scromber scrombrus
NOP =	Norway pout	Trisopterus estimarkii
PLE =	Plaice	Pleuronectes platessa
SAN =	Sandeel	Ammodytes spp.
POK =	Saithe	Pollachius virens
SOL =	Sole	Solea vulgaris
SPR =	Sprat	Sprattus sprattus
WHG =	Whiting	Merlangius merlangus

Other species

BLL =	Brill	Scophthalmus rhombus
DAB =	Common dab	Limanda limanda
DGS =	Spiny dogfish	Squalus acanthias
GUX =	Gurnards	Triglidae
HOM =	Horse mackerel	Trachurus trachurus
HKE =	European hake	Merluccius merluccius
LEM =	Lemon sole	Microstomus kitt
MEG =	Megrim	Lepidorhombus whiffiagonis
MON =	Monk	Lophius piscatorius
NEP =	Norway lobster	Nephrops norvegicus
PAN =	Pandalid shrimps	Pandalus spp.
PIL =	Pilchard (sardine)	Sardina pilchardus
SKA =	Skates and rays	Raja sp.
TUR =	Turbot	Psetta maxima
WHB =	Blue whiting	Micromesistitus poutassou
OTH =	Other species	Additional other "other species"

Figure 5.1 A schematic representation of how some of the ICES working groups and ACFM might interact. The arrows show how the main information flows might take place.

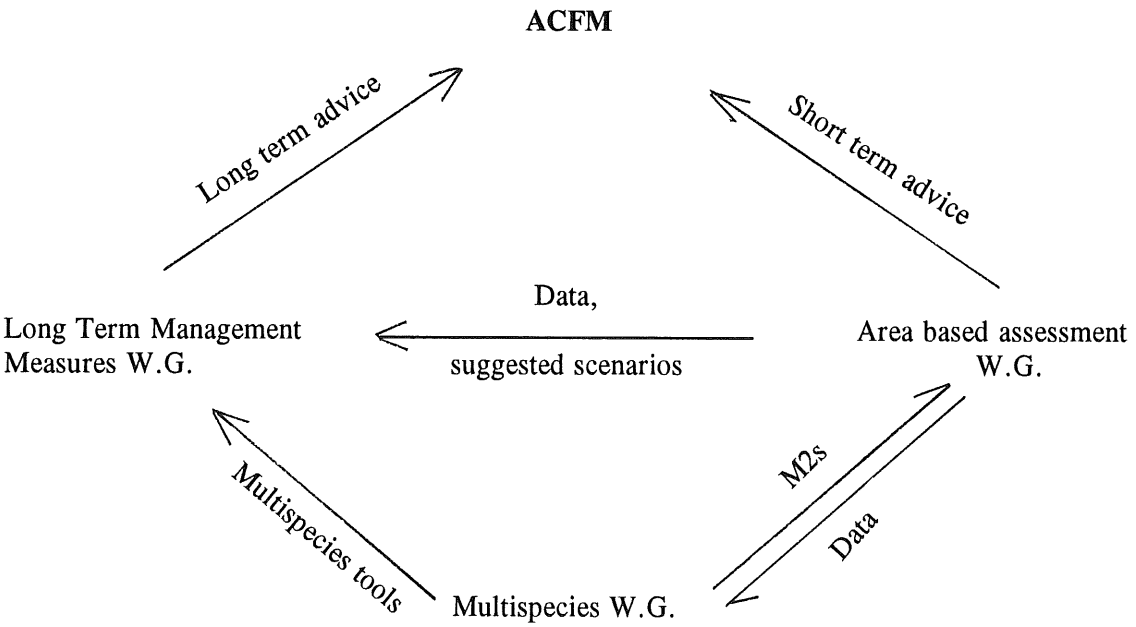

Figure 6.1 DIFMAR proposed package for multi-species, multi-fleet, multi-area assessment.