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International Council for the
Exploration of the Sea

C.M.1979/D:3
Statistics Committee

REPORT OF THE WORKING GROUP ON THE EVENTUAL ESTABLISHMENT OF AN ICES ADP SYSTEM FOR FISHERY STATISTICS

Charlottenlund, 5-9 March 1979

This Report has not yet been approved by the International Council for the Exploration of the Sea; it has therefore at present the status of an internal document and does not represent advice given on behalf of the Council. The proviso that it shall not be cited without the consent of the Council should be strictly observed.

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International Council for the
Exploration of the Sea

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ERRATA SHEET

Page 6, Section 3.5: the first line of the second paragraph should read:

"If an early decision is not made by the Council to acquire its own ....."

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Charlottenlund, 5-9 March 1979

1. Participants

H B Becker	Netherlands
O A Davidsen	Norway
C A Goody	United Kingdom
D de G Griffith	Ireland
E G Heyerdahl	U S A
B W Jones	United Kingdom
H Lassen	Denmark
K Laumann	Denmark
J A Pope (Chairman)	United Kingdom
J F de Veen	Netherlands

ICES Secretariat was represented by the General Secretary, Mr H Tambs-Lyche, and by Messrs J Smed, V Nikolaev, W Panhorst and A Piotrowski.

2. Terms of Reference

The Working Group's terms of reference, as set out in Council Resolution, C. Res. 1978/2:23, were to:

"(a) advise the Secretariat on detailed specifications and costs for the hardware and software which the Council will require in order to implement its fishery statistics and stock assessment computing need;

(b) review and evaluate progress in the development of software which has taken place since its last meeting;

(c) define standards for the documentation of analysis programs to be used by Assessment Working Groups;

(d) prepare instructions for the submission of biological records to the ICES Data Bank and to define appropriate checking and vetting procedures for the input of these data;

(e) carry out, if possible, a full trial run on the 1975-77 North Sea plaice data called for by the Working Group at its last meeting."

3. Advice on Hardware and Software for the Council's Computing Needs

The Chairman and the General Secretary clarified the status and priorities of the meeting in the light of the general situation regarding new headquarters for ICES. It was considered that the most feasible approach would be when giving its advice on computer systems for the Working Party to provide a range of alternatives with detailed explanations of the differences involved, taking into account the needs of Fish Stock Assessment Working Groups, the Service Hydrographique and the ICES Administration.

As a first step the ADP Working Group decided to categorise the existing uses of computer facilities, recording present activities as well as identifying potential future applications. These requirements were grouped under the heading STATLANT fishery statistics, Working Groups for stock assessments, hydrographic data studies and ICES administrative needs. Of these, the requirements of the Assessment Working Groups demand the most immediate consideration for several reasons, including the following:

(1) since 1972, Working Groups have been using a mini computer belonging to the Danish Institute for Fisheries and Marine Research (located at the same building as the Secretariat) to carry out their analyses.

(2) If the Secretariat moves in the near future to a new location, the continued use by Working Groups of the Danish mini computer would be extremely inconvenient and time-consuming and may quite likely not be possible at all.

(3) During 1978 the Assessment Working Groups attempted to use the RECKU computer facilities. Due to shortcomings of that computer centre, specified in the 1978 ADP Working Group Report, the Group became firmly of the opinion that the correct way to perform assessment and statistical analyses of basic stock statistics was "to have in-house computing facilities rather than rely entirely on a computer centre". (Doc. CM 1978/D:3). Even bearing in mind that some improvements have occurred at the RECKU centre, the Group still were of the opinion that it could not be depended upon for assessment purposes.

(4) Not only is this computing capability essential to the completion of Working Group assignments, it is also a requirement of the ACFM when meeting at the Secretariat to prepare advice, where certain calculations may need to be re-done or expanded, using the identical calculation procedures employed by the Working Groups.

(5) As the tasks assigned to the Assessment Working Groups continue to increase and the routine use of computers by Working Group participants expands, even greater importance will need to be placed on the availability of an easy to use "in-house" computing facility.

The acquisition of a mini computer by ICES for the support of the Assessment Groups makes it available for other requirements. Consequently the ADP Working Group went on to explore the full range of ICES computer requirements and the necessary expansion of a basic configuration required to carry out the tasks itemised.

3.1 STATLANT Fishery Statistics

The compilation of STATLANT data for publication is currently handled at a computer centre (RECKU). The need to make further use of these data for both assessment and Secretariat purposes and also to process biological sampling data would require, if carried out in-house, a considerable expansion of a basic mini computer configuration. In addition, it is

expected that there will be a large increase in the submission of catch and effort data from national statistical reporting offices.

The implications of these requirements are that a computer configuration far exceeding the operational capabilities of the existing ICES staff would be necessary. The ADP Working Group therefore considered it could be beneficial if the ICES mini computer were linked to some large mainframe computer. The Group considered three possible methods of communication between ICRS and a mainframe, namely:

(1) use of a mini computer as a concentrator for several teletype compatible terminals. Transmitting from a terminal to a mainframe in this way could be a heavy overhead on the mini computer.

(2) a direct interactive communication between a terminal and a mainframe.

(3) terminals connected directly to a mainframe with printer output routed to the mini computer using, ideally, the following protocols:

for connection to	UNIVAC	NTR (at RECKU)
" "	IBM	IBM 2780
" "	IBM	IBM 3780
" "	CDC	UT 200/UT
" "	ICL	7020

The Working Group considered that, of most immediate use, would be the ability of the mini computer to serve as a remote job entry (RJE) station (ie (3) above) with adequate input capability. It was agreed that the small extra cost to provide this facility was justified.

As the NTR protocol necessary for a mini computer to communicate with RECKU, would place a severe limitation on the choice of potential mini computers suitable for ICES, the ADP Working Group recommends that a link to RECKU should not be considered mandatory.

3.2 Service Hydrographique

The Service Hydrographique currently uses IBM computer facilities at NEUCC and will continue to do so in the foreseeable future. The same

general conclusions reached for the STATLANT requirements apply, namely the need to use the mini computer as a link to a mainframe and the advantages of a key-to-disc data entry system. A magnetic tape drive was noted as being desirable but not essential.

3.3 Secretariat Requirements

Three possible requirements of the Secretariat, namely text processing, business accounting and key-to-disc systems were considered. The Group felt that these are specialised areas and would be best considered as separate requirements. Stand-alone systems are commercially available and these offer a more cost-effective approach unless suitable software happens to be available for the mini computer finally chosen. The Group also noted the possibility of using RECKU for text editing.

3.4 Software Requirements

The operating systems were considered to be the most important feature on which attention should be concentrated. It was recognised that because of the workload it would not be possible for the ICES staff to do systems programming. Thus the ICES staff will have to rely to a great extent on the operating system which a manufacturer can supply and, therefore, the system should be of a very high standard.

It was noted that, since there is at present a general use in the ICES member countries of BASIC and FORTRAN, the concurrent use of both languages should be a necessary requirement. The inclusion of other languages would be an advantage.

The use of a floating point processor, which greatly increases the speed of a mini computer in scientific calculations deserves the closest consideration.

The Working Group confirmed its opinion that an interactive on-line system providing a link between biological and catch data should be implemented on a large mainframe for the time being. The requirements of such a system were described in previous reports.

For the Assessment Working Groups, besides a standard statistical analysis package, special packages (linear, graphic, optimisation programs) could be provided at mainframes but seldom at a mini computer. Besides, most statistical packages are machine-dependent, particularly in respect of some sub-routines, though there are some packages developed at national laboratories which may be fairly readily transferable.

The ADP Working Group discussed graphics requirements and concluded that x-y plots on a simple hard copy device would meet the needs of the Assessment Working Groups as well as some of the needs of the Service Hydrographique and could be provided by a mini computer. More sophisticated tasks would require greater capability involving an increase in the size of the necessary package. It was agreed, therefore, that such a system should be chosen which could support an x-y plotter preferably with the possibility of a later extension to cover contouring as well, for processing, for example, international surveys' data.

The software requirements of the Service Hydrographique are satisfied by access to standard packages available at a mainframe computer.

For fishery statistics, requests for data could also be handled by standard manipulation packages.

3.5 Current Implications

Currently Assessment Working Groups are dependent on facilities provided by the mini computer of the Danish Institute for Fisheries and Marine Research. This facility will continue to be available to Assessment Working Groups in 1979, but at present there is no guarantee that this machine will be available in 1980 as it is being phased out of service.

If an early decision is made by the Council to acquire its own mini computer it is probable that such a machine could not be ordered, delivered, and installed and brought to an adequate degree of working efficiency in time to service the 1980 meetings of Assessment Working Groups.

The ADP Working Group draws the attention of the Council to the consequent need to make interim arrangements to provide computing facilities for the Assessment Working Groups in 1980, and recommends that this would best be achieved by continuing the service contract on the Danish RC 7000 from July 1979 to June 1980. This course of action will probably be the only one open to the Council if its accommodation remains unchanged during 1979.

3.6 Configuration for ICES Mini Computer

Having identified those areas where ADP facilities are required the Working Group next considered the minimum hardware and software needed to carry out the various tasks, dividing them into those which are immediately necessary or desirable and those which would be required to meet expected future needs. Criteria used included such things as (a) size of computer files, (b) amount of accessing of files, (c) types of computation involved, (d) input and output media, (e) quantity of output, (f) response time, (g) programming languages. The following requirements were drawn up.

A. Hardware

1. C.P.U.
   - 64 K word (16 bit) usable memory after operating system and RJE (expandable to 128 K words)
   - floating point hardware
   - real-time clock
   - power-fail memory protection (preferably at least 60 min)
   - 30 cps hard copy system console.

2. Disc
   - one fixed/exchangeable disc drive (FED) (expandable up to 4 drives)
   - disc capacity about 20 M bytes.

3. Printer
   - one printer, 132 print positions, 200 lines per minute, not requiring special stationery but preferably capable of using multi-part stationery
   - ability to add a second line printer.

4. Terminals - one 30 cps 132 print position teletype compatible hard copy terminal with 8-channel paper tape reader and punch

- 3 teletype compatible VDU's switchable between 300 and 4800 baud (these terminals and the hard copy terminal must be capable of connection to a remote mainframe via a modem)
- capability of connecting 16 terminals (including buffered VDU's) simultaneously and paging output to teletype compatible VDU's.

5. Magnetic Tape- capability of connecting one 800/1600 bpi tape drive (expandable to 3 drives).

6. Graph Plotter- capability of connecting a plotter and a simple graphics video terminal.

B. Software

1. The operating system must be capable of multi-programming giving on-line operation to terminals and two batch streams with automatic queuing.

2. The computer must be capable of performing RJE functions, in particular emulating IBM 2780 and preferably also NTR. It should be capable of communicating with two mainframes simultaneously at a minimum of 2400 baud.

3. Programs should be able to run on at least two priority levels which may be selected by the manager at run-time.

4. Spooling, allowing automatic queuing and output to printer, plotter, paper tape and terminals.

5. An efficient editor is necessary.

6. Sort programs, able to sort on disc 10K records using any (up to at least 6) fields as key.

7. Memory protection for multi-programming including a password system for file protection.

8. Comprehensive accounting system particularly on file accessing.

9. Comprehensive diagnostics of hardware, particularly on communications facilities.

10. (a) FORTRAN IV with good error diagnostics and editing,

(b) BASIC with good error diagnostics and editing,

(c) COBOL desirable but not essential,

(d) graph plotting software to be available when plotter is acquired,

(e) comprehensive scientific software packages,

(f) data entry system (key-to-disc) is desirable but not essential.

(a), (b), (c) and (f) must be capable of running simultaneously.

11. A data base management system is desirable but not essential.

C. General

1. The system should be able to function in normal office conditions.

2. It should operate from a power supply of 220v, 50Hz.

3. It should be able to run unattended.

4. A maintenance contract is required which will guarantee the on-site attendance of an engineer within 24 hours of reporting a fault (weekends excepted) and the machine should be serviceable for at least 90% of the hours 09.00 - 17.00 on normal working days. At certain times of the year the on-site response will be required to be significantly shorter (2-4 hours) and include evenings and weekends.

The following points clarify some of the above requirements.

A2 The disc capacity of 20M bytes was considered necessary for Assessment Working Groups and should be part fixed and part exchangeable to allow back-up and copying for system and file security.

A3 The printer should not require chemically treated stationery. It should provide a good quality print-out suitable for direct reproduction for Working Group reports. It was recommended that the supplier should be asked to provide an interface for the line printer currently used by ICES.

A4 Four terminals is regarded as a minimum initial requirement. Preference should be given to a high quality print hard copy terminal.

B2 IBM 2780 emulation is a necessary requirement for connection with NEUCC. NTR emulation is a requirement for connection with RECKU. The latter requirement may impose a severe limitation on the choice of a mini computer and should not be treated as essential. The present modem in ICES allows connection to RECKU and, in the near future, there may be a network linking inter alia the computers at NEUCC and RECKU. Therefore NTR emulation is treated as desirable only.

3.7 Choice of a Computer System

An initial list, prepared prior to the meeting by the Systems Analyst with the assistance of Messrs Hans Lassen and Keld Laumann, of 20 computer suppliers was considered by the ADP Working Group. After thorough discussion some of these were excluded from further consideration on the basis of being clearly too expensive and others because of their obvious limitations in hardware or software (eg no floating point hardware, inability to supply one of the essential computer languages or to run different languages concurrently, etc.). This process of elimination left a short list of four computers which the Working Group felt, on the basis of the Systems Analyst's report, might be capable of meeting the requirements of ICES. These four computers are:

Computer	Supplier
HP 1000	Hewlett-Packard
PDP 11/34	Digital Equipment Corp.
	Datalog
Nord-IOS	Norsk Data
Nova 4/X	Data General

The configuration given in the previous section is the minimum configuration which the Group thought could do the necessary work efficiently. Some items on the list are designated as desirable in order to provide additional services in the future when ICES funds permit.

The preliminary information available to the Group allowed initial estimates of the basic costs (ie purchase prices only) to be made. These lay within the range D Kr 486,000-604,000. However, these figures should not be considered as final since they may undergo changes in formal responses by the suppliers to the more detailed specification given in the previous section of this report.

The ADP Working Group concluded that a further critical evaluation of the four short-listed mini computer systems was still essential before a final recommendation on the choice can be made, particularly regarding their software limitations. Criteria which should be applied in this final evaluation include the following:

- the present availability of the necessary software,
- the cost of additional (desirable) software and hardware recommended for the future enhancement of the system,
- the ability of a supplier to sign a single contract for the entire configuration,
- the on-site attendance provisions of a maintenance contract,
- additional access to software (eg if a particular make of computer were already employed by a national fisheries laboratory in an ICES member country).

In addition the ADP Working Group recommended that, as part of the final evaluation procedure, appropriately designed bench-mark trials should be used for comparing the processing powers and operating systems of the short-listed computers.

The ADP Working Group stressed the point that the final decision should certainly not be made solely with regard to the cost of buying the equipment.

The Working Group also stressed the fact that the decision about the relative competence of each supplier to meet the requirements of ICES could only be decided after detailed discussions with the representatives of

each company. Although the Group has recommended above the areas of questioning which should be pursued, it wishes to stress that it feels it cannot be held responsible for the final selection unless at least some members were present. Some doubt was expressed about the possibility of this and the final technical discussions and recommendation may have to be the sole responsibility of the Secretariat.

In connection with the final evaluation, the Working Group noted that it would be very useful and informative for the ICES Systems Analyst if he could visit laboratories in ICES member countries where different computer systems are employed.

4. Standards for Program Documentation

The ADP Working Group discussed the standards which should be adopted for the documentation of analysis programs to be used by the Assessment Working Groups. The ADP Working Group agreed that such programs could be divided into three broad categories:

1) Standard programs used by almost all Assessment Working Groups, such as VPA, catch prediction, yield per recruit;
2) Specific programs used on a continuous basis but by only one Assessment Working Group;
3) Ad hoc programs prepared, for a specific use by an Assessment Working Group, often during a meeting and frequently for one time use only.

The ADP Working Group recommended that an ICES program library should be established and that programs or copies of programs of permanent standing should be kept by the ICES Secretariat. All such programs should be catalogued and it would be necessary to maintain a log of what programs were used by what Working Group and in what year, firstly to enable the ACFM to easily check or modify assessments and secondly to notify the users about any errors detected in a program.

Documentation is required to inform a user about what the program does, how it does it, what mathematical formulae are used; to explain the logistics behind the program for a user to know in which cases it can be used and what its limitations are; to provide the possibility for making necessary modifications to the program.

A user's guide or manual is necessary for categories 1) and 2) listed above so that any Assessment Working Group member can choose from the library a program suitable for his purposes and run it without additional instructions.

The methods used should also be documented for the first two categories. For the third category this information should be provided in the report of the Assessment Working Group.

Program listings (code) should be available in the program library for all three categories of program but code documentation is necessary only for the first category.

Every program, from whatever source, deposited in the program library must be accompanied by a full set of test data and verified output.

The ADP Working Group recommends that the ACFM specify the programs to be included in the first category (standard programs) and should be responsible for deciding when these have to be changed. The ICES Secretariat should give priority attention to the smooth operation of standard programs. These should have a well-formatted output to enable their direct reproduction in a Working Group report, thus saving typing requirements and helping to avoid technical mistakes.

Maintenance of programs in the first category, their documentation and the execution of changes requested by the ACFM should be the responsibility of the ICES Secretariat. All original programs should be kept unchanged but copies may be modified when warranted.

Maintenance of programs in the second category and their documentation should be the responsibility of the Assessment Working Groups themselves. It should be the responsibility of the Chairman of an Assessment Working Group to decide whether a program should be changed and to execute the change. Naturally the use of a modified program should be referred to in that Working Group's report. The ICES Secretariat should note the listings so that a modified version may be re-run at the request of the ACFM. The ICES Secretariat should also be responsible for the documentation in the event of the necessary transfer of a program to a different computer, or when a new computer is used and for updating files.

A tabulated summary of these recommendations is given in Table 1.

5. North Sea Plaice Trial Run

In view of the requirement for the ADP Working Group to give top priority to the specification of a mini-computer system for ICES, the Group was unable in the time available to deal fully with the important task of completing a trial run of the biological component of the FISHDAT system. This component, it will be recalled, provides the facility for organising the input data in the way required to permit application of the techniques which give assessments and management procedures.

North Sea plaice data for the years 1975 and 1977, collected in the Netherlands, were put on magnetic tape prior to the meeting but the remaining data had to be loaded via a terminal and this was not completed during the meeting. In view of this and because data from England were likely to be available soon the ADP Working Group requested Messrs H Lassen and W Panhorst to carry out a full trial run

on the 1975 - 77 North Sea plaice data. A report on this trial run should be submitted to the members of the ADP Working Group and to the Flatfish Working Group scheduled to meet at Charlottenlund on 14 - 18 May 1979.

6. Remaining Items

The ADP Working Group regrets that there was no time available to it for any discussion at all of items (b) and (d) of its terms of reference. The Group is, nevertheless, fully aware of the importance of these items, particularly the matters listed under (d). Because of the importance and urgency of ensuring the correct submission of biological material to ICES it is recommended that this topic be given high priority at the Group's next meeting.

Table 1. Documentation of Analysis Programs

Program Category*	Responsibility for changes	Changes to be executed by	a	b	c	d	e	File updating by
1)	ACFM	ICES Secretariat	+	+	+	+	+	ICES
2)	WG Chairman	WG member	+	+		+	+	ICES
3)	WG Chairman	WG member		+**		+	+	-

* See section 4 of this report

** To be given in Assessment Working Group report

a Users Guide

b Method used

c Code documentation

d Test data

e Code listings