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Progress of the Co-ordinated
Mediterranean Pollution Monitoring
and Research Programme (MED POL)
and Related Projects of the
Mediterranean Action Plan

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ESTIMATED REQUIREMENTS AND SOME ALTERNATIVES
FOR A
DATA-HANDLING AND PROCESSING FACILITY NEEDED AS
SUPPORT FOR THE MEDITERRANEAN ACTION PLAN

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1. INTRODUCTION

- 1.1 This document should be read as supporting information to Chapter 19 on Information Storage, Handling and Dissemination of the Draft Progress Report on the Implementation of the Co-ordinated Mediterranean Pollution Monitoring and Research Programme (MED POL) and Related Projects of the Mediterranean Action Plan (UNEP/WG.11/3 (Prov.)). Its purpose is to facilitate discussion on the most desirable and feasible system of central data handling and processing which might satisfy the needs of the various environment assessment projects of the Mediterranean Action Plan - in particular those of the seven MED POL pilot projects and the MED X project - and in due course could provide the complex information processing capability needed as support for all the activities undertaken under the various components of the whole Mediterranean Action Plan.
- 1.2 As the requirements for processing data other than those generated by the seven MED POL pilot projects and the MED X project are largely unknown, this document is mostly based on the requirements of these projects assuming that, in principle, the needs of the other activities will be similar in nature and could be easily accommodated.
- 1.3 The document is a compilation of some alternatives proposed by the Instituto de Investigaciones Pesqueras in Barcelona, the Fisheries Department of FAD, IOC and IRS of UNEP which are reproduced here without any substantial changes. The Introduction, the section on Requirements and the Summary were prepared by the Secretariat.

2. REQUIREMENTS

- 2.1 Although the precise nature of work to be performed using MED POL and MED X data, often initial processing within a particular sub-project, is unknown, it will be assumed that such work would include:
 - (a) central archiving
 - (b) statistical analysis
 - (c) analysis of relations between various pollutants and between pollutants and various other parameters
 - (d) modelling
 - (e) supply of data or data excerpts to authorized users.
- 2.2 It is not assumed that all of these functions would necessarily be performed within the data centre, or by its own staff. However the data centre would be required to ensure that confidentiality requirements with respect to the original data were respected by all prospective users. This proviso requires a considerable degree of supervision, especially if work is done outside the centre.
- 2.3 The central archiving function would include the conversion of incoming data to a common form and format. Data could be supplied on input sheets, punched cards or various magnetic tape configurations. All such data would need to be converted to "standard" format and made available, to authorized users at least, in that format.

- 2.4 Statistical analysis and inter-parameter analysis are basic operations which would be required in the environmental (i.e. inter-disciplinary) treatment of the data. Whether original research into such inter-relationships is done at the centre or not, a certain amount of regular analysis of this type on a "production" basis would seem likely to be required of the centre.
- 2.5 Modelling is largely research and could be carried out in research units outside the centre, provided that the confidentiality arrangements were satisfactory. However, it is once again likely that the centre would need to be able to do some modelling itself. For these purposes access to a major computer would be necessary.
- 2.6 Output from the centre is likely to be required both on a regular schedule and in response to *ad hoc* requests. Such data should be in a form which is convenient to the user.
- 2.7 Non-confidential data should be forwarded to World Data Centres in suitable formats. This may require designation by IODE/WDC as a Regional Data Centre of the World Data Centre system.

The following alternatives are by no means exhaustive. They simply encompass those possibilities proposed to UNEP by 30 June 1977.

3. ALTERNATIVES

- 3.1 Use of existing facilities at a national institution which might play a regional role (alternative submitted by the Instituto de Investigaciones Pesqueras, Barcelona, Spain)

The Instituto de Investigaciones Pesqueras, Barcelona, although not being an officially designated national oceanographic data centre (NODC) but a participant in the seven pilot projects of MED POL, has real capabilities both in computer facilities and personnel experienced in oceanographic data processing, to act as central data processing unit for MED POL, provided some financial support could be obtained from UNEP and the United Nations specialized agencies.

The present proposal refers to the implementation of a central data processing unit for the pilot projects constituting the UNEP Co-ordinated Mediterranean Pollution Monitoring and Research Programme (MED POL) during the remainder of the pilot project phase, that is 18 months beginning immediately after the clearance of an agreement between UNEP and the Instituto de Investigaciones Pesqueras.

Cross-referenced files would be established for the storage and retrieval of the following types of data:

- data already produced by the pilot projects
- data produced in the future by participating research centres (RCs)
- data obtained from other sources considered relevant to the programme.

Development of criteria for standard reporting formats for each individual item of information, including inventory and data formats, as well as for the reporting of the available information. This would be carried out in close collaboration with the specialized agencies.

Production of inventory and summary reports of presently available data on request by the specialized agencies.

Other products, especially graphics, would be produced on request by the agencies. Samples of such products would be obtained in a short time for comments before considering them as standard.

Further processing, especially statistics for the assessment of the general status of pollution in the Mediterranean would be carried out in close collaboration with experts of the specialized agencies or scientists from the research centres participating in MED POL or Regional Activity Centres as designated by UNEP.

The security of any classified or sensitive data would be ensured by the terms of the agreement and released only to UNEP, to the agency or the research centre originating the information. All other data would be channelled into the international data exchange system, as specified by the recommendations of the Intergovernmental Oceanographic Data Exchange (IODE) Working Committee.

The present computer facilities at the Instituto Investigaciones Pesqueras consist of:

- Central Processor	IBM 1130	16 K byte memory
- Magnetic Disc	IBM 2310	3 X 1 Mega byte
- Card Read/Punch	IBM 1442	80 column cards
- Line Printer	IBM 1132	120 char. 200 lpm
- Paper Tape Reader	IBM 1134	8 chan. ASCII
- X-Y Plotter	CALCOMP	30" width
- Alfanumeric Terminal and Graphic Display	TEKTRONIX 4010	
- Hard Copy for above	TEKTRONIX 4610	
- Teleprocessing Terminal	IBM 2740	IBM 360 (CSIC)

The amount of data stored in the system at present amounts to 5 to 6 million for standard oceanographic observations and 2 to 3 million for fisheries and other related activities. Software for storage and retrieval of these types of data is at present available (CREPUSCULO, DATHI, PEZ Data Banks). Graphic display and statistical routines as well as general input/output software are also available, including formatted output for printed reports.

3.2 Data and information facilities maintained by the FAO Fisheries Department (alternative submitted by FAO)

FAO Fishery Data Centre, a specialized Data Centre for fisheries, was established to facilitate the assistance given by FAO to its member countries and co-operating fishery institutions by providing: standards for data collection, organized storage, rapid retrieval, and efficient processing of biological and statistical data used in the assessment of fishery resources. Within this context the Data Centre also acts as a referral service for contaminant data for which it provides inventory information.

In 1975, with the assistance of UNDP, FAO developed a data storage and inventory system for information on the levels of contaminants in aquatic organisms, especially those of commercial importance, and the products derived

from those organisms. At present the Data Centre holds information on about 200 projects investigating the effects of contaminants on various living organisms and provides periodic inventories through print-outs indexed by:

- (a) contaminant by host species
- (b) host species by contaminant
- (c) geographic area of contamination
- (d) country undertaking project
- (e) details of project

The Data Centre is capable of storing other data on pollutants and contaminants and providing inventory information on their location in order to assist scientists to approach data holders directly for further information.

The Data Centre is equipped to store, analyse and disseminate biological data on the study of fish stocks and through existing programmes analyse this data to provide information on the distribution, occurrence and abundance of species. The fishery data include length, length/weight relations, age, maturity, and other parameters required for routine fishery studies. It could provide information on stratified or random sampling based on routine statistical tests. Detailed statistical tests can be performed by utilizing existing statistical programme packages.

Those United Nations agencies or programmes which wish to use the existing Fishery Data Centre system can do so at nominal cost of data handling and processing provided that the existing data system developed by the Centre meets the requirements of those agencies. The Data Centre could also, at cost, key-punch and store, analyse, and disseminate information in a required print-out format to interested institutions and agencies.

Within the Aquatic Sciences and Fisheries Information System (ASFIS), and with UNEP support, registers of institutions and scientists working in the institutions are now being completely mechanized. The data base maintained in the Data Centre will be capable of providing detailed personal information on workers in pollution in any given geographic area as well as details of the institutions and activities undertaken by such institutions. The Data Centre services of the institution and expert modules of ASFIS are for the use of the world scientific community and provide the required basic information on institutions and scientists to the United Nations agencies.

The Aquatic Sciences and Fisheries Abstracts (ASFA) module of the ASFIS system is a mechanized abstracting service that provides information to the world scientific community on living and non-living resources of the oceans and fresh-water bodies. Through a specialized input centre, the Marine Biological Association of the U.K., Plymouth, England, pollution literature is adequately covered. The system stores 15,000 references per annum and is capable of disseminating the data base on magnetic tapes for mechanized search at input centres.

The ASFIS system could generate selected bibliographies on studies and research relevant to any subject including pollution. Through the system, regular up-dates of the present bibliography (Calamari (1977) FAD Fish.Tech. Pap., 165) can also be prepared covering the references for the years 1976

onwards as the data starting from 1976 will be computer-searchable. Through other specialized ASFIS registers, lists of experts and of institutions can also be prepared upon request. Should UNEP, within the Mediterranean Action Plan, wish to utilize the existing ASFIS system and Data Centre facilities, they are invited to specify their requirements in order that a precise cost estimate and time scheduling can be prepared for their consideration.

3.3 Data management through the International Oceanographic Data Exchange (IOOE) System (alternative submitted by IOC)

Questions of data management, especially those concerning the storage, processing, and exchange of data, have occupied the attention of oceanographers for decades. It has been in response to these concerns that IOC has devoted a major effort throughout the past years to developing a system known as the International Oceanographic Data Exchange (IOOE). This system is now being accepted as the principal basis for international storage and exchange of oceanographic data. The Working Committee on International Oceanographic Data Exchange (WC/IOOE) and a number of subsidiary and related groups* are continuing to work to improve the system and facilitate its acceptance and implementation.

The IOOE system is offered to the agencies, countries, and research centres participating in the research and monitoring projects on pollution in the Mediterranean Sea as an appropriate way to handle the data produced by their projects. It has the advantages of a system to which a great deal of thought and planning has been given, not only by the administrators of international agencies, but also by several groups of experts both in Marine Science and in data management. In offering this system, IOC is motivated not only by its desire to see its own system accepted, but also by the hope that scientists and data managers can avoid repeating most of the man-years of effort that have gone into developing IOOE, and also avoid unnecessary fragmentation of data means by which data are made available to those who can use them for constructive purposes.

IOC therefore urges those who are involved in the joint co-ordinated project on Pollution in the Mediterranean to consider seriously: a) adopting the IOOE system entirely, or b) adopting as much of it as appears appropriate for the Mediterranean programme. Regardless of how much or how little of the IOOE system is adopted, however, it is most desirable that the system selected for the Mediterranean programme be fully compatible with that of IOOE, so that data can be exchanged freely, and so that data from both sources can be readily combined and processed by centres working within either system.

More complete information about IOOE is given in IOC's Manuals and Guides No. 9 "Manual on International Oceanographic Data Exchange", Fourth edition, 1976. In the following note, references to specific items in this Manual are given in parentheses, e.g. (2.3.2).

*Group of Experts on the Development of a Pilot Programme for Responsible National Oceanographic Data Centres (RNODCs)
Ad hoc Group on Format Development
Ad hoc Group on IGOSS Data Archiving and Exchange
Ad hoc Group on Marine Pollution Data
Group of Experts on Marine Environmental Data Information Referral System
Joint FAO/IOC Panel of Experts on ASFIS (i.e. on Aquatic Sciences and Fisheries Information System)

The following is a brief outline of the system and how it works:

Individual countries or groups of countries are encouraged to have their own National Oceanographic Data Centres (NODCs) or Regional Data Centres (RDCs) which will store all data submitted to them concerning their particular country or region (2.3.2). These data may be made freely available or subject to restriction as decided by the country or the principal investigator concerned. A country may have its own NODC and also contribute data to the RDC for the region. Some countries which do not have an NODC, have appointed a Designated National Agency (DNA) to act as co-ordinator and point of contact for matters of international data exchange.

Some NODCs may assume special responsibilities for certain programmes or areas of interest. These will normally be data centres that have advanced facilities and skills which can be used to process data in special ways, to produce special data-products, or to assist other centres with problems of data-handling. These centres are called Responsible National Oceanographic Data Centres (RNODCs) (2.3.3). There could well be one or more RNODCs designated for the Mediterranean projects, for example.

There are two World Data Centres: WDC-A in Washington, USA, and WDC-B in Moscow, USSR (1;App.1). These two centres undertake to store all data submitted to them, regardless of origin. In turn, they undertake to provide any data which are not limited by some security classification, to any NODC that requests them.

Normally, a research centre or investigator would go through his own NODC or RDC in dealing with the WDCs; where there is no NODC or RDC, the research centre deals directly with the WDCs.

At the moment the WDC 'B' Oceanography, Moscow acts as the RDC for the Mediterranean and is responsible for handling all data collected during the IOC's Co-operative Investigations in the Mediterranean (CIM).

To facilitate all of these processes, certain standard formats are used in reporting data:

- (a) Log forms are used for recording pollution (petroleum) data. These are already being used by project MED I and by the IGOSS Pilot Project on Pollution (Petroleum) Monitoring (see IOC Manuals and Guides No. 7: *Guidelines to Operational Procedures for the IGOSS Pilot Project on Marine Pollution (Petroleum) Monitoring*).
- (b) A new format, based upon the one developed for the GARP (Global Atmospheric Research Programme) of ICSU, is now being finalized by the NODCs of Japan and USA for use in the IGOSS Pilot Project on Marine Pollution (Petroleum) Monitoring (MAPMOPP). The *ad hoc* Group on Marine Pollution Data has recommended that this format be used for a trial period before March 1978, and if it proves to be fully satisfactory in this trial that it be referred to the Ninth Session of IOOE for final approval. It would then replace the present log forms so that the data can be prepared more readily for the computer.
- (c) Another new format, GF-2 (General Format-2) also based upon the GARP format, has been recommended by WC/IOOE and approved by the Eighth Session of IOOE for the reporting of general oceanographic data. The *ad hoc* Group on Marine Pollution Data has recommended that GF-2 also be

tried for pollution data during the preliminary phase of the Programme for Monitoring of Background Levels of Selected Pollutants in Open Ocean Waters which is being jointly sponsored by IOC, WMO and UNEP. If it proves fully satisfactory for this programme, the *ad hoc* Group recommends that it also be used in the UNEP Regional Seas Programme. It is intended that this format eventually be used for all data, including those on petroleum pollution. Data presented meanwhile in the format which is recommended for the MAPMOPP project (item b, above) will be fully compatible with those presented in GF-2.

An important part of the international system of data exchange is the announcement by participating countries of the programmes that they intend to undertake and for which data will (or will not) be made available for exchange (3.1). Designated National Programmes (DNPs) are those for which the country agrees in advance to make the data freely available. National Oceanographic Programmes (NOPs) are those which the country announces its intention to carry out but for which the data will not be placed on open file. The announcement of both DNPs and NOPs has proven useful for the co-ordination of programmes and training in the past. In some cases, nations may be willing to enter into bilateral arrangements to exchange information (3.4) but be unwilling to make certain data generally open to all. In such cases the announcement of an NOP can serve to indicate an area of interest and lead, under appropriate circumstances, to bilateral exchanges.

Upon completion of a cruise, research centres and investigators should also submit what is known as a ROSCOP form (Report of Observations/Samples Collected by Oceanographic Programmes). This announces to the data centres that they have data on a particular area and subject. Usually, but not necessarily, these data will be placed in storage with the appropriate NOOC, RNOOC and WOC and made available to data users.

Other forms serve a similar purpose for data pertaining to geology/geophysics, biology, and environmental information (4.3).

A list of countries participating in the IOOE system, with their National Co-ordinators and Oceanographic Data Centres, is given in Appendix 2 of Manual No. 9.

The principal paths of data flow in a system such as has been outlined here for the projects under MED POL are indicated schematically in the attached figure.

3.4 The Joint United Nations "International Computing Centre"

The International Computing Centre was established in 1971 in Geneva, taking over the computer system previously operated by WHO. It is managed by a Committee composed of representatives of nine organizations of the United Nations system. The ICC is essentially a computer service bureau providing hardware facilities for the United Nations system and is funded on a self-supporting basis by contributions from participating organizations. These contributions are directly related to the particular organizations' use of the facilities provided.

The computer hardware has been upgraded consistently since 1972 and the details shown in the attached table represent the configuration as it will be by the end of 1977.

Data confidentiality and security have always been an important consideration in the ICC. It is not possible for a user to read or overwrite files belonging to another user. Visitors are not permitted in the computer area. The ICC has consistently followed a policy of complete and deliberate disinterest in the nature of the work being done on its machine.

A major advantage of the ICC is its experience in handling data originating from all over the world on all types of computers and its ability to provide data in forms suitable for most users.

The ICC is, however, purely a hardware facility. Except for systems software support it does not normally do programming. It will not perform the work necessary to submit input or analyse results. This must be provided by the user.

Software support at ICC is of the highest quality. All systems software used by participants is effectively 'pooled' for use by all other participants. Hardware facilities include on-line processing under ISO, WYLBUR, ISIS, STAIRS etc., the reading and writing of magnetic tapes of all standard types etc., etc. The Centre has continuous access to microfiche, computer offset and optical character recognition equipment. It is unlikely that any processing required by the Mediterranean Action Plan would require more computer power than could be provided at ICC.

4. SUMMARY

A brief summary of the capabilities of computer facilities which have so far been suggested as possible data centres for the Mediterranean Action Plan is given in the attached table. The table is incomplete and it is hoped that those who submitted the various proposals will be able to provide the Meeting with the missing information.

No decision is expected from the Meeting as to the institutional arrangements for data processing. However, a recommendation on the extent and type of services required and on the location preferred, would assist UNEP in the formulation of a proposal to the Intergovernmental Meeting on the Mediterranean Action Plan (Monaco, November/December 1977) and to the Meeting of Contracting Parties to the Barcelona Convention, planned for 1978.