

Distribution: limited

IOC/INF-194
PARIS, 24 April 1973
Original: English

UNITED NATIONS EDUCATIONAL,
SCIENTIFIC AND CULTURAL ORGANIZATION

INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION

Second Session of the IOC Executive Council

Unesco Headquarters, Paris, 7-12 May 1973

Secretariat Note on the

AQUATIC SCIENCES AND FISHERIES INFORMATION SYSTEM (ASFIS) -
A COMPUTER-ORIENTED SYSTEM OFFERING INTEGRATED INFORMATION SERVICES

By Resolution VII-11, the Secretary was instructed to prepare, in close co-operation with the Food and Agriculture Organization of the United Nations, a second and comprehensive draft plan for the establishment of an Integrated Information System on Aquatic Sciences.

The attached paper, which has been prepared by the Fishery Resources Division, Department of Fisheries, FAO, may be considered to be the first draft of such a plan. It is circulated to members of the Executive Council at this stage for information only and in order to provide them with an extended opportunity to study the proposals therein before the matter comes up for discussion during the VIIIth session of the Assembly (item 8.4 of the Provisional Agenda for IOC/VIII).

The paper will be refined and developed further by the IOC and FAO secretariats during 1973 and presented as a working paper for the above Assembly session.

Distribution limited

IOC/INF-194
Rome, 10 April 1974
Original English

FOOD AND AGRICULTURE ORGANIZATION
OF THE UNITED NATIONS

AQUATIC SCIENCES AND FISHERIES INFORMATION SYSTEM (ASFIS)

A COMPUTER-ORIENTED SYSTEM OFFERING INTEGRATED INFORMATION SERVICES

SUMMARY

In accordance with resolution IOC VII-11, this paper outlines the proposed development of an integrated information system to service the requirements for various types of information in the entire field of aquatic sciences and fisheries to be based on the existing FAO information services. It illustrates that much more than the volume of scientific information is at the root of modern information problems, and establishes that many of the specialized information requirements inherent in modern scientific activity can only be met by highly specialized mission-oriented services. Because of the widely dispersed nature and international character of marine science, these services will demand vastly improved access to world-wide sources of relevant information. In turn, this requirement demands that a broader international collaborative programme be developed, through voluntary participation of interested national and other institutions to bring those information resources under good consistent bibliographic control, and to pool facilities and resources in order to provide a more economical and comprehensive service.

INTRODUCTION

A working paper entitled "Scientific Information System on Aquatic Sciences and Fisheries" was prepared by the Fishery Resources Division of FAO in consultation with the IOC Secretary, and presented to the Seventh Session of the Commission (26 October to 5 November 1971). It reviewed the scientific information activities of FAO Fishery Resources Division, centred around files originally set up to meet in-house needs but made more generally available in response to extra-mural demands. As a result a resolution was adopted (Resolution VII-12, see Annex II) instructing the Secretary and FAO to prepare a comprehensive draft plan for the establishment of an integrated information system on aquatic sciences and fisheries to be presented to the IOC Executive Council. This paper has been prepared in response to that request.

Obviously, a working paper of this sort cannot hope to give detailed treatment to the specialized services needed (or projected) for a field as broad as marine science. Indeed, identifying the need for, and defining the scope of such services is the responsibility of the potential user. The short history of information science in its modern context is replete with failures because a system designer, usually frustrated by lack of a clear definition of what was needed, gave his clientèle what he thought they needed. On the other hand, it can be unequivocally stated that a prerequisite to the use of the new information processing technology for information retrieval is vastly improved information access. It is to this theme that this paper is largely addressed. Techniques and technology far in excess of our present capacity to capitalize on them already exist. The immediate need is to build up and support the level of international cooperation necessary to take advantage of the new technology as applications arise.

THE MARINE SCIENCE SCIENTIFIC INFORMATION PROBLEM

The "crisis" caused by the "information explosion" is due in part to the often overlooked implications of exponential growth. With a "doubling time" of 8 to 10 years, the production rate and accumulated volume of scientific literature have increased a thousand-fold since conventional, discipline-oriented (i.e. Society and journal-oriented) abstracting and indexing services were born - about the turn of the century; the number of scientists seeking access has similarly grown. Because the growth has been exponential, most of the files are recent and therefore very active; the vast majority of all the scientists that ever lived, are alive and practising. Yet, surprisingly perhaps, conventional services still adequately serve vital sections of the scientific community. Most scientists working on the frontiers of pure research are blissfully ignorant of the information crisis.

In many fields of scientific endeavour, the secondary effects of primary growth have the more serious consequences - the exponential arrival of new information means exponential obsolescence of old information. Quantitative techniques applied to biological systems obfuscate sacred concepts and devalue the credibility of textbooks and reference works almost overnight. Any selected bibliography not only demands more resource to generate and maintain - it also disseminates more obsolete information. The more controversial papers are frequently obsolescent by the time they are published via the conventional route, let alone by the time a bibliographer spots them. Linguists tell us that the increasing complexity of society and its needs introduce tens of thousands of new words and meanings to the English tongue each year. If only a fractional percentage of these are of potential value in indexes, it is little wonder that this year's results cannot be entered in last year's index structure.

But just as subtle as the consequences of exponential growth have been the consequences of changes in the over-all "organization" of research. The post Second World War period has seen the arrival of "big" science predicated on the wartime demonstration of the enormous potential of carefully coordinated research programmes. As a result, research has become predominantly mission-oriented and interdisciplinary, the bulk of it carried out in government laboratories or under government sponsorship. Thus "topical" reports (mostly government publications) have grown in volume and importance relative to journal literature; they are increasingly the best source for up-to-date information and (because of the restrictions imposed on journal papers) frequently the only source of complete information. But because of difficulties in acquisition and differences in style, these non-conventional sources are not covered adequately in conventional services. From the point-of-view of technological and economic application, rather than as a basis for further research, the information content of even journal articles has become vastly more complex.

This has particularly sad consequences for programme coordinators - a new kind of information seeker bred by integrated "big science". If anything, they are more interested in non-conventional sources - up-to-date interim, or even negative, but intent-oriented results - than in the two-or-more years old confirmed results he finds in current journals accessed via conventional indexes based on content. By their very nature, conventional services alone give him a distorted perspective; yet his only alternative is to pore through copious quantities of substantive copy - if he has been lucky enough to acquire any. In any event, increasingly acute problems can be expected for the marine sciences, where we have interdisciplinary growth not just for one but for several uses of ocean-space, with growing interaction between those uses.

Another problem in most fields of science is the unprecedented dispersal of information sources. Gone is the colonial era when virtually everything was reported to meetings and society publications in a few western capitals. The newly independent nations have set up their own academies, programmes and publications. As their research capacity expands and improves, so their

contributions to the world literature increase in volume and importance. Their need for information increases simultaneously. Advances in transportation and communications technology are helping to iron out some of the wrinkles engendered by this dispersal, but few librarians or scientists would claim that the situation will ever be as "convenient" as in the old days - and none can ignore the much higher inherent costs. Here too, the international and highly dispersed nature of marine science research can be expected to give rise to increasingly acute problems.

Frequently, the "exponential arrival" of scientific advances creates special information problems. The principal demand of a computer-oriented information management system is for a logical and systematic approach to the users' jurisdiction. This requirement has revolutionized the traditional collection and "style" of many kinds of information - and in the process has revolutionized management itself. Marine science has no immunity to these requirements. The growing field of aquaculture already calls for information services dedicated to fish introductions; "clean" access to information on the growing impact of man on his environment in areas such as the depletion of aquatic resources, marine pollution, is another pressing need.

This motley of confusing "primary" events has had profound impact on the tools used by the information sleuth - traditionally the reference librarian. Much of his basic reference material - world lists, directories, catalogues - is obsolete before it is received. Cumulative indexes are received months and sometimes years after the effective date of cumulation. They have become extremely expensive; many have ceased publication. Bibliographic and information services have proliferated not only in number, but regrettably also in style; bibliographic descriptions are frequently so vague and inconsistent that separate references to the same report appear to be distinct; translations and non-conventional documents, particularly, suffer in this regard. Likewise, the rush to make non-romance language material generally accessible has produced a plethora of schemes for transliteration and abbreviation. Thus at a time when budgetary restrictions have forced libraries to rely increasingly on external resources (inter-library loan) the tools through which identification and acquisition of substantive material must proceed have become increasingly stubborn.

In a very real sense, then, the information crisis is an environmental problem. We are suffering because the "production emphasis" has virtually blinded us to the need for sustained investment in monitoring, regulation and control. And the crisis is now so deeply felt because in the "global village" scientific and technical information have acquired the status of a vital resource, eagerly sought by an ever-growing and diversifying body of individuals and institutions, as well as practising research scientists for whom the prevalent style and reporting procedures were devised.

A BLUE-PRINT FOR IMPROVEMENT

It is axiomatic that any modern vehicle for the communication of scientific information be not only aimed in the right direction, but also carry only information relevant to the mission it is intended to serve - the system must not push mountains of information in all directions leaving the unfortunate recipient to sort the wheat from the chaff. Rather it must enable the user to pull the information he needs. Mission-oriented science demands the support of mission-oriented information services.

This has long been recognized in other "modern" research areas. During the last 15-20 years, nuclear and space programmes have spawned an incredible number and variety of specialized information centres that have collection, organized, and brought to life vast amounts of information relevant to their respective missions.

The establishment of a network of interconnected specialized information services must be considered as an eventual and essential objective in a systematic solution of marine science information problems. Because of their contribution to the international community, through their participation in the system, some national institutions acting as specialized centres - particularly in developing countries and regions - may require international support or assistance as their products and services should be readily available to the world community of marine experts, and marine science agencies and institutions. Since the level of information analysis required to support such specialized services demands an in-depth knowledge of the relevant subject matter and its broad conceptual relationship to the other areas of aquatic science, it is desirable that specialized information centres be associated with research institutions pursuing relevant research. In this way, scientists who are among the major users and have a vital role to play in the functioning and development of the centre, will be close at hand. Apart from the services one traditionally expects, such centres may, in certain cases, undertake, as part of their overall responsibility, the preparation of specialized bibliographies, compilations, summaries and reviews on either a regular or ad hoc/contractual basis to meet the requirements of programme coordinators, regulatory bodies, and governmental and intergovernmental agencies.

But if specialized information centres are to function effectively they must themselves be alerted to and nurtured by basic information from world-wide sources. A more immediate objective to the solution of our problem, then, is to bring the world's marine science literature under good, consistent bibliographic control, and thereby improve its accessibility. To achieve this objective, it is obvious that close international cooperation will be needed. This was recognized by the UN Conference on the Human Environment (Stockholm 1972), and the Unesco sponsored Intergovernmental Conference for the Establishment of a World Science Information System, UNISIST (Paris 1971) spelled it out in detail.

Ideally, of course, an international information system should be completely open. Any institution wishing to contribute to it (and benefit from it) should be able to do so. Only in this way can the world's information resources be adequately tapped. This is particularly important in relatively new interdisciplinary areas of concern such as pollution, from which anything acceptable for publication in scientific journals does not usually materialize for several years. These delays do not necessarily affect those engaged in the tactical conduct of research, but for those engaged in its strategic management, for those in resource development, in regulation and control, in almost any other activity that involves scientists, significant amounts of valuable information lie relatively dormant in non-conventional reports. Beyond this there is a growing need for organized access to other sources of information - drawing, maps, films, sound recordings, training manuals - reference to which, if found at all, is usually found by chance.

Accordingly, bringing all potentially valuable information resources under good, consistent bibliographic control will demand two types of input:

- conventional material, usually available through normal commercial channels
- non-conventional material, access to which is more difficult because, traditionally at least, it has not been a commercially viable product.

Bibliographic descriptions for the former are best submitted via input centres with designated responsibilities organized on a regional basis, more-or-less along linguistic boundaries. But since the bulk of the non-conventional material is a direct result of government-sponsored programmes, access to it must be maintained through direct links with national (governmental) institutions. Since only they are currently aware of its existence, only they have direct access to it, and only they can decide which items merit inclusion on qualitative grounds without raising political or proprietary problems, they are the only sources for input of non-conventional material.

The records created would be filed and processed in a central computer facility. It will be mandatory that all bibliographic descriptions be prepared for machine manipulation in full accordance with the emerging UNISIST proposals and other internationally accepted or emerging standards and cataloguing practices. In particular, the magnetic tape products of ASFIS should be written in the communication format (MARC-II) already adopted as a standard in the USA and the UK, as an ISO Recommendation and as a UNISIST Proposal. To achieve the desired flexibility, each record would be classified in a multi-dimensional scheme. Subject categorization would be guided by a subject authority list with scope descriptions. World-wide consistency in indexing terminology and depth, and thereby consistency in retrieval, would be achieved through development of a comprehensive, structured thesaurus displaying term relationships. The thesaurus would be under constant review to maintain its viability as scientific terminology passes through its semantic gyrations. Check codes would identify documentary units by type (monograph, journal paper, maps, etc.) by "literary style" (data compilation, training manual, etc.), by principal area of application in order to facilitate the creation of sub-files for applied "information packaging". Useful ephemeral devices could be introduced - material relevant to pre-defined priority areas could be checked at input and weekly or monthly lists of items pertaining to those areas produced. Since the inclusion of non-conventional sources would introduce material of interim nature, it would be essential to include an up-date mechanism by means of which records for such material would be deleted as the final report becomes available, and thus keep the files "clean".

As might be expected, input preparation of this nature is time-consuming and calls for competent staff of scientifically mature judgement. Accordingly, input costs would be high. But because of the enormous capability of modern computer systems, this seemingly high input cost is substantially offset by low processing and output costs provided there is sufficient demand to exploit that capability. Herein lie both the challenge and the solution. Unless agencies with common interests pool resources to promote the further development of integrated systems, each will overlap high input costs without necessarily having output requirements to offset them. Furthermore, because of the need for a multi-disciplinary approach for the solution of modern problems, it is becoming increasingly important that systems serving different interests be at least compatible. Only then can information be "switched" from one system to another in a cost-efficient and time-efficient manner. But the high decentralized input preparation inherent in this proposal will disperse these costs, and apportion them on the basis of volume of literature created by the region or nation. Since the wealthiest nations are also the greatest producers and consumers of information, this is roughly in accordance with "ability to pay" and "benefits received".

Output from this computerized processing would take a variety of forms. A routine product would be a monthly annotated bibliography of all material input, with items listed by broad subject category - a traditional-type service to meet the general needs of the whole marine science community. The bibliography would be printed for distribution and, at the discretion of particular groups of users, distributed on magnetic tapes for subsequent processing and listing at destination. More selective services would be provided to the specialized information centres, national and international institutions, and perhaps even individuals, by comparing an interest profile of the user against the monthly transactions, and transmitting only those records that match, again either printed or on magnetic tape. In addition to these routine alerting services, sub-files would be machine processed to provide retrospective searches to meet specific demands. Note that for these selective services, the type of documentary unit, the regional or national centre supplying the input, language, and so on can all be used as criteria for selection or rejection of a record, in addition to subject indexing. These seemingly simple devices greatly facilitate the tailoring of information access for special purposes.

Another form of output would be a periodically up-dated authority list for corporate entries, i.e. a list of institutions from which the non-commercially available substantive information referenced can be obtained. This is particularly important for non-conventional sources, and might even be augmented by establishment of depository collections of difficultly available material at regional centres, around which copying services could be built. This authority list would also provide the means for periodically up-dating the FAO Directory of Marine Science Institutions detailing the programme and facilities of each institution. Similarly, authors publishing in various areas of the marine sciences would be listed with their affiliations to facilitate updating of the FAO International Directory of Marine Scientists, or for taking inventory of aquatic science research projects.

Since the system will be capable of accepting interim information, it will be possible to prepare and up-date periodic lists of translations in process or reviews being written. These can then be fed through the network. Similarly, maintenance of the FAO World List of Aquatic Science Periodicals - both scientific journals and report series published periodically - would be more-or-less routine. A World List of Aquatic Science Meetings and Conferences showing name, sponsor, place and date, a register of which FAO already maintains and publishes as part of Marine Science Contents Tables, could also be handled in this manner. The efficiency of traditional library services would be substantially reincarnated if basic reference material of this type were restored to its erstwhile utility. Since output of any variety is obtained by logical operations on the data elements uniquely identified at input, system capability is determined principally by the effort and resource brought to bear on input preparation.

But just as the specialized information services are augmented by secondary reviews and custom bibliographies, so the creation of a broadly based bibliographic service will not obviate the need for informative news services. Using newsletters and similar vehicles modelled on Unesco's "International Marine Science", the network of specialized, regional and national centres must be kept informed of basic information dealing with, say, new programmes, resolutions adopted, key results, contained in the documents being accessioned into their systems. All these different forms of output are interrelated. Since most of them can be interconnected in whole or in part through the bibliographic network, the potential pay-off in so doing is handsome. But this implies that participating institutions generating information of interest to the network accept some responsibility for its communication.

Implementation of ASFIS

It is important to recognize that a scientific information system is like a living organism that must constantly adapt to a whole range of influences and changes in its environment, or become useless. Furthermore, because of the subtleties of language, "perfect" retrieval is attainable by neither cerebral nor electronic processes. For the most part, then, implementation of the ASFIS concept will not involve drastic changes, but rather directing the evolution of existing FAO and other broadly-based services, by optimizing and/or extending them and, through a phased realignment of resources, integrating them on a common base for the common good. Many aspects of the cooperative programme and exchange mechanisms ASFIS seeks to establish, or formalize, have been created in a related field for data exchange between oceanic data centres; in a sense ASFIS simply seeks the same type of solution for non-numerical information transfer.

The implementation will also be greatly facilitated by the fact that at least the foundations of many much needed specialized services also exist in various guises. The Marine Biological Association of the United Kingdom has built up an impressive collection of papers on marine and estuarine pollution, a large proportion of which have not been exposed in existing abstracting services. The Association thus already has a base on which to build specialized services dealing with pollution, but needs the means and vehicles to make them generally available. One might ponder whether the wealth of information generated in the programme to eradicate the sea lamprey in the Great Lakes of North America provides a basis for specialized services dealing with the control of unwanted aquatic species. As one would expect, many agencies in the U.S.A. are potential seats for specialized services, but developing countries too house potentially valuable reservoirs of information. FAO's CARIS project, which examined the agricultural information resources of several West African countries, found an unexpected accumulation of uncatalogued and inaccessible information, much of it relevant to contemporary problems and research programmes.

There is no evidence to suggest that the results would be any different if marine science laboratories were combed. However, while activating these resources has special significance for the developing nations, it also presents special problems. As with integrated research programmes, Third World involvement in integrated information processing activities postulates the existence of means (particularly trained manpower), and facilities that are only just emerging in many parts of the developed world. The much needed participation of developing countries in ASFIS would therefore require various forms of technical and mutual assistance.

Unquestionably, however, some problems will call for significant new resources over short duration. There is no way many of the files and specialized services can be established in a reasonable time span without "crash" programmes. A significant short-term effort will also be needed to establish a comprehensive and truly international basis for the bibliographic system. The working paper presented to the Seventh Session of IOC outlined FAO's considerable experience in this type of work, first through several years' production of Current Bibliography for Aquatic Sciences and Fisheries and, more recently, with the monthly journal, Aquatic Sciences and Fisheries Abstracts. VNIRO in the Soviet Union recently agreed in principle to join the ASFA partners (FAO, Bundesforschungsanstalt für Fischerei in Hamburg, Institut national de la Recherche agronomique in Biarritz, and Information Retrieval Limited in London). They will monitor 60 Soviet scientific journals and supply bibliographic descriptions of relevant papers. Hopefully national institutions in the U.K. and U.S.A. will shortly be in a position to give similar support. Resolutions and recommendations on the FAO work have been adopted by several inter-agency and internationally constituted committees.

But while FAO appreciates this display of confidence and is willing to continue to provide the required input in the further development of the system, the limited resources available will not permit this development to proceed at the required pace. If a fully comprehensive, truly international information system, embracing the various aspects of marine science, compatible with the UNISIST proposals and therefore with systems serving other missions (nuclear, agricultural, industrial development, etc.) is accepted as a desirable goal, it will only be realized through direct investment from the interested national and international agencies. For example, the thesaurus lies at the heart of an information system; it determines both the tactics by means of which information is entered and the strategy by which it is subsequently retrieved. Its development will call for opinions from a wide range of subject specialists, many of them well beyond the scope of FAO's direct interests.

Of course, the FAO Department of Fisheries has a vital interest in the consolidation and broadening of such a system, both in connection with its specific responsibilities towards fisheries, and also as part of its support - as an ICSPRO agency - to IOC. Information dissemination figures prominently in the Organization's Terms of Reference, but the effort it has expended and the direction that effort has taken has resulted from pressing needs rather than just statutory requirements. As a UN agency with well established lines of communication, FAO stands ready to exploit its good offices and resources to the fullest extent possible in promoting its existing systems to serve the entire spectrum of marine science and its applications, and to provide the focus for the development of the ASFIS network. Extra-budgetary resources and/or the secondment of personnel with relevant skills are therefore required during implementation. Contributions and effective support, particularly by Unesco, are required in the broadening process. When the programme has gained momentum, further development and services will probably best evolve in a small financially independent, perhaps even self-sufficient unit under the joint sponsorship of FAO and other major participating agencies.

Actions suggested for the Commission

- (1) Endorse the concept of a comprehensive information system embracing marine science and its applications (ASFIS)
- (2) Encourage member states to participate in and contribute to the FAO "network" as far as their means and facilities permit, including the association of relevant existing units and the creation, as necessary, of new units
- (3) Invite FAO to ensure that in taking the responsibility among ICSPRO agencies in this work that the entire field of marine science and its applications is covered both by scientific discipline and by the various uses of ocean space and its resources
- (4) Invite other ICSPRO agencies, especially Unesco, to cooperate with FAO in ensuring the development of the system and contributing to it according to their means and the scope of their interests.
- (5) Requests the Commission's advisory bodies to continue to assist, as required, in the development of the system.
- (6) Identify possible sources of extra-budgetary funds, such as the UN Environment Fund, and recognize the need for support in kind by participants to permit developmental "pilot" activities of growing parts of the system, and to continue coordinating services at the required level

- (7) Establish an Advisory Board, with members drawn from ICSPRO agencies participating in the integrated system, the IOC Secretariat and major cooperating national and other bodies to provide overall policy and guidance, with FAO providing the Secretariat and managing the system.

ANNEX I

Components of the ASFIS concept already in existence and in
various stages of automation and integration

Marine Science Contents Tables - MSCT. A joint FAO/Unesco monthly periodical reproducing the tables of contents of core journals on marine science. At present some 100 journals are included, and some 2000 copies of MSCT are distributed each month.

Aquatic Sciences and Fisheries Abstracts - ASFA. A monthly abstract journal with over 1000 entries per month taken from some 2000 core and fringe journals. Author, taxonomic, geographic and subject indexes are included, and through a computer system now being developed and expected to be implemented in 1974, computer-oriented services for the selective dissemination of information and eventually retrospective search will be feasible. ASFA is compiled under a collaborative agreement between FAO and Bundesforschungsanstalt für Fischerei in Hamburg, Institut National de la Recherche Agronomique in Biarritz and Information Retrieval Limited in London. The All-Union Institute of Marine Fisheries and Oceanography (VNIRO) of Moscow recently agreed in principle to cover Soviet literature.

Register of Experts in Aquatic Sciences and Fisheries. An FAO-maintained register containing the names and information on the qualifications and experience of some 12000 aquatic scientists from around the world. Originally established to facilitate recruitment for FAO Department of Fisheries, the register was extended a few years ago through collaboration with Unesco, and the Scientific Committee on Oceanic Research of ICSU, and provided the basis for a formal publication, the International Directory of Marine Scientists and an informal List of Specialists in Marine Pollution. The file is now being converted to digital form, and a computer-oriented file-query system is being implemented.

Register of Aquatic Science and Fishery Institutions. An FAO-maintained register of several thousand institutions involved in relevant research. A directory will shortly be published of those institutions with training programmes and facilities.

International Marine Science Newsletter - IMS. Formerly a joint Unesco/FAO newsletter, its publication was suspended in 1970 after seven years. IMS was reinstated in February 1973. Present circulation is about 3,000 copies.

World List of Aquatic Science and Fishery Periodicals. An FAO-maintained file of (at present) some 8000 journals and report series publishing relevant material either consistently or occasionally. The file was published as a World List in 1964 and is at present being prepared for republication using computer techniques.

Register of Aquatic Science/Fishery Meetings. An FAO-maintained list of meetings anywhere in the world relevant to aquatic sciences and fisheries. The register is maintained by monitoring a wide variety of sources for information, and imminent meetings in the register are published monthly as a part of Marine Science Contents Tables.

Register of Aquatic Research Equipment. A register containing a brief description of the equipment, the manufacturers of the equipment and an evaluation of the performance of the equipment.

ANNEX II

(a) INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION
SEVENTH SESSION

(Unesco, Paris, 26 October - 5 November 1971)

RESOLUTION VII-11

INTEGRATED SCIENTIFIC INFORMATION SERVICE ON AQUATIC
SCIENCES AND FISHERIES

The Intergovernmental Oceanographic Commission,

Considering as of prime importance the task of establishing an integrated scientific information service on aquatic sciences which would include not only bibliographic services but also other important matters such as directories of specialists and institutions, training opportunities, various periodical reviews, etc.,

Considering the benefits of such an information system for developing countries and the possibility of requesting funds for support of this service from UNDP

Having reviewed doc. SC/IOC-VII/42 prepared in response to Recommendation 12.4 of the Bureau and Consultative Council containing a first outline of an Information System on aquatic sciences,

Recognizing the important activities of the Fishery Resources Division of FAO in this field over the last ten years and their significance for the Commission and its Member States,

Also recognizing that the FAO system forms a nucleus around which an integrated system can be built and with which Member States, as a first step, should be encouraged to collaborate in order to increase its efficiency and reduce its costs,

Noting with appreciation, in this connection, the support given by the Federal Republic of Germany and France to FAO,

Noting further the contribution that the Unesco Office of Oceanography has begun to make to this work,

Instructs the Secretary to prepare in close co-operation with representatives of FAO a second and comprehensive draft plan for the establishment of an Integrated Information System on Aquatic Sciences insofar as this pertains to marine research, to be presented to the first session of the Executive Council,

Further instructs the Secretary to communicate this Resolution to the executive office for UNISIST and ensure co-ordination as appropriate of the above plan with activities towards the establishment of a World Science Information System.

(b) First Session of the IOC
Working Group on Training, Education and Mutual Assistance

(Unesco, Paris, 7-13 March 1973)

Agenda Item 4.2: Educational Materials and Directories

Directories of Training Institutions and Experts

The Working Group on Training, Education and Mutual Assistance,

Having considered the importance of institutional and expert directories and the list of periodicals in aquatic sciences for training and education and research purposes,

Recognizing that IOC Resolution VII-31 specifically requests that such services be provided on a continuing basis,

Noting that IOC Resolution VII-11 acknowledges that the FAO scientific information system forms a nucleus around which an integrated system can be built,

Further recognizing that the Food and Agriculture Organization of the United Nations has already a series of computer oriented registers and information systems in operation,

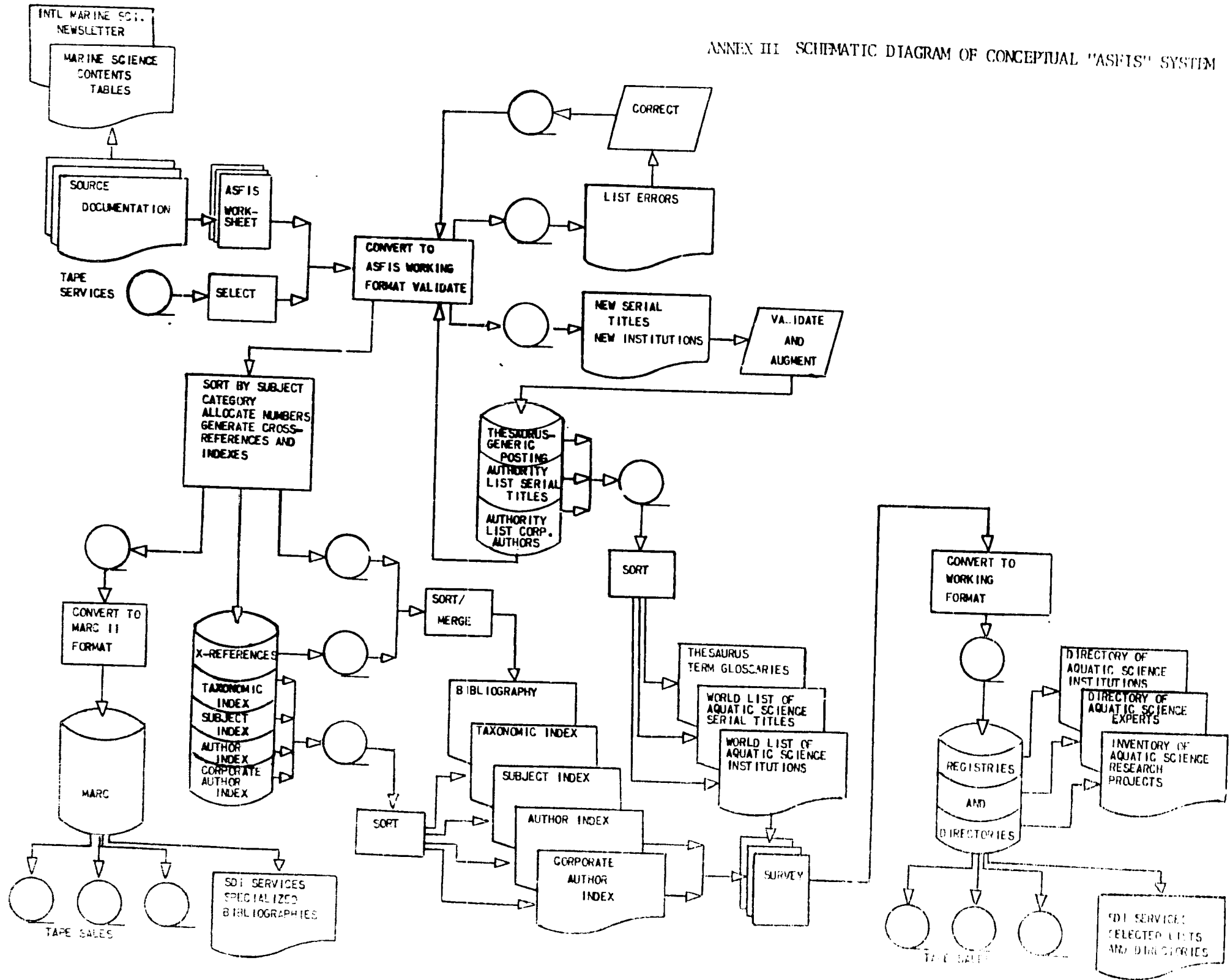
Recommends that the IOC Secretariat, with the assistance of FAO and Unesco, and where required, with the co-operation of other ICSPRO Agencies, as a service to IOC Member States and to the world community concerned with marine science and its applications, compile and disseminate such directories and reference materials as soon as possible, and no later than mid-1974, at the same time taking adequate measures to strengthen the services required to maintain such directories up to date

Suggests that in view of the short deadline, the funding of the additional compilation to attain a better coverage of disciplines of relevance and the printing of such supplementary material be made through the IOC Trust Fund.

ANNEX III SCHEMATIC DIAGRAM OF CONCEPTUAL "ASFIS" SYSTEM

```

graph TD
    IN[INTL MARINE SCI. NEWSLETTER] --> SD[SOURCE DOCUMENTATION]
    MSCT[MARINE SCIENCE CONTENTS TABLES] --> SD
    SD --> ASW[ASFIS WORK-SHEET]
    ASW --> CFW[CONVERT TO ASFIS WORKING FORMAT VALIDATE]
    TS[TAPE SERVICES] --> S[SELECT]
    S --> CFW
    CFW --> SBC[Sort by Subject Category Allocate Numbers Generate Cross-References and Indexes]
    SBC --> XREF[(X-REFERENCES)]
    SBC --> CMF[CONVERT TO MARC II FORMAT]
    CMF --> MARC[(MARC)]
    MARC --> TSales[TAPE SALES]
    MARC --> SS[BIBLIOGRAPHIES]
    XREF --> SM[Sort/Merge]
    SM --> BIB[BIBLIOGRAPHY]
    SM --> TI[TAXONOMIC INDEX]
    SM --> SI[SUBJECT INDEX]
    SM --> AI[AUTHOR INDEX]
    SM --> CAI[CORPORATE AUTHOR INDEX]
    BIB --> S2[Sort]
    TI --> S2
    SI --> S2
    AI --> S2
    CAI --> S2
    S2 --> SUR[SURVEY]
    SUR --> TSG[THE SAURUS TERM GLOSSARIES]
    SUR --> WLAST[WORLD LIST OF AQUATIC SCIENCE SERIAL TITLES]
    SUR --> WLAI[WORLD LIST OF AQUATIC SCIENCE INSTITUTIONS]
    TSG --> CWF[CONVERT TO WORKING FORMAT]
    WLAST --> CWF
    WLAI --> CWF
    CWF --> RD[(REGISTRIES AND DIRECTORIES)]
    RD --> DAI[Directory of Aquatic Science Institutions]
    RD --> DAE[Directory of Aquatic Science Experts]
    RD --> IARP[Inventory of Aquatic Science Research Projects]
    RD --> TSales2[TAPE SALES]
    RD --> SS2[BIBLIOGRAPHIES]
    RD --> SLSL[SOL SERVICES SELECTED LISTS AND DIRECTORIES]
    CFW --> COR[Correct]
    COR --> LE[LIST ERRORS]
    LE --> CFW
    CFW --> NST[NEW SERIAL TITLES NEW INSTITUTIONS]
    NST --> VAA[VALIDATE AND AUGMENT]
    VAA --> CFW
  
```



ANNEX IV

LIST OF POTENTIAL USERS OF THE ASFIS BIBLIOGRAPHIC SERVICE

INSTITUTIONS

International Agencies and their inter-agency bodies

International Documentation Centres/Networks

National Documentation Centres

Topical Documentation Centres

Libraries

Book trade

Research institutions

Government

Decision-makers

Regulatory bodies

Development Management institutions

Industry

Operators

Research

Development

Economic Field, Banks, Business, World Bank

Education

Universities

Training

Extension Institutions

INDIVIDUALS

Scientists, Researchers

Experts in Field

Fishery Operators



Distribution: limited

IOC/INF-194 rev.
Appendix I to IOC-VIII/18
PARIS, 11 October 1973
English only

UNITED NATIONS EDUCATIONAL,
SCIENTIFIC AND CULTURAL ORGANIZATION
INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION

Eighth Session of the Assembly
(Unesco, Paris, 5-17 November 1973)

AQUATIC SCIENCES AND FISHERIES INFORMATION SYSTEM (ASFIS)
A COMPUTER-ORIENTED SYSTEM OFFERING INTEGRATED INFORMATION SERVICES

SECRETARIAT NOTE

By Resolution VII-11 (Annex I), the Secretary was instructed to prepare, in close co-operation with the Food and Agriculture Organization of the United Nations, a second and comprehensive draft plan for the establishment of an Integrated Information System on Aquatic Sciences.

The attached paper, which has been prepared by the Fishery Resources Division, Department of Fisheries, FAO, may be considered to be the first draft of such a plan. It was circulated to members of the Executive Council at their second session for information only and in order to provide them with an extended opportunity to study the proposals therein before the matter comes up for discussion during the VIIIth session of the Assembly (item 8.3 of the Provisional Agenda for IOC-VIII).

The basic text of this document is identical to that in IOC/INF-194. One paragraph entitled 'Actions suggested for the Commission' and two Annexes have been extracted; revised versions of these will be found in the main text of document IOC-VIII/18 and in Draft Resolution 8.

SUMMARY

In accordance with resolution IOC VII-11, this paper outlines the proposed development of an integrated information system to service the requirements for various types of information in the entire field of aquatic sciences and fisheries to be based on the existing FAO information services. It illustrates that much more than the volume of scientific information is at the root of modern information problems, and establishes that many of the specialized information requirements inherent in modern scientific activity can only be met by highly specialized mission-oriented services. Because of the widely dispersed nature and international character of marine science, these services will demand vastly improved access to world-wide sources of relevant information. In turn, this requirement demands that a broader international collaborative programme be developed, through voluntary participation of interested national and other institutions to bring those information resources under good consistent bibliographic control, and to pool facilities and resources in order to provide a more economical and comprehensive service.

17 OCT. 1973

SC-73/CONF.215/INF.4

INTRODUCTION

A working paper entitled "Scientific Information System on Aquatic Sciences and Fisheries" was prepared by the Fishery Resources Division of FAO in consultation with the IOC Secretary, and presented to the Seventh Session of the Commission (26 October to 5 November 1971).^{*} It reviewed the scientific information activities of FAO Fishery Resources Division, centred around files originally set up to meet in-house needs but made more generally available in response to extra-mural demands. As a result a resolution was adopted (Resolution VII-11, see Annex I) instructing the Secretary and FAO to prepare a comprehensive draft plan for the establishment of an integrated information system on aquatic sciences and fisheries to be presented to the IOC Executive Council. This paper has been prepared in response to that request.

Obviously, a working paper of this sort cannot hope to give detailed treatment to the specialized services needed (or projected) for a field as broad as marine science. Indeed, identifying the need for, and defining the scope of such services is the responsibility of the potential user. The short history of information science in its modern context is replete with failures because a system designer, usually frustrated by lack of a clear definition of what was needed, gave his clientèle what he thought they needed. On the other hand, it can be unequivocally stated that a prerequisite to the use of the new information processing technology for information retrieval is vastly improved information access. It is to this theme that this paper is largely addressed. Techniques and technology far in excess of our present capacity to capitalize on them already exist. The immediate need is to build up and support the level of international co-operation necessary to take advantage of the new technology as applications arise.

THE MARINE SCIENCE SCIENTIFIC INFORMATION PROBLEM

The "crisis" caused by the "information explosion" is due in part to the often overlooked implications of exponential growth. With a "doubling time" of 8 to 10 years, the production rate and accumulated volume of scientific literature have increased a thousand-fold since conventional, discipline-oriented (i.e. Society and journal-oriented) abstracting and indexing services were born - about the turn of the century; the number of scientists seeking access has similarly grown. Because the growth has been exponential, most of the files are recent and therefore very active; the vast majority of all the scientists that ever lived, are alive and practising. Yet, surprisingly perhaps, conventional services still adequately service vital sections of the scientific community. Most scientists working on the frontiers of pure research are blissfully ignorant of the information crisis.

^{*} Doc. SC/IOC-VII/42

In many fields of scientific endeavour, the secondary effects of primary growth have the more serious consequences - the exponential arrival of new information means exponential obsolescence of old information. Quantitative techniques applied to biological systems obfuscate sacred concepts and devalue the credibility of textbooks and reference works almost overnight. Any selected bibliography not only demands more resource to generate and maintain - it also disseminates more obsolete information. The more controversial papers are frequently obsolescent by the time they are published via the conventional route, let alone by the time a bibliographer spots them. Linguists tell us that the increasing complexity of society and its needs introduce tens of thousands of new words and meanings to the English tongue each year. If only a fractional percentage of these are of potential value in indexes, it is little wonder that this year's results cannot be entered in last year's index structure.

But just as subtle as the consequences of exponential growth have been the consequences of changes in the over-all "organizations" of research. The post Second World War period has seen the arrival of "big" science predicated on the wartime demonstration of the enormous potential of carefully co-ordinated research programmes. As a result, research has become predominantly mission-oriented and interdisciplinary, the bulk of it carried out in government laboratories or under government sponsorship. Thus "topical" reports (mostly government publications) have grown in volume and importance relative to journal literature; they are increasingly the best source for up-to-date information and (because of the restrictions imposed on journal papers) frequently the only source of complete information. But because of difficulties in acquisition and difference in style, these non-conventional sources are not covered adequately in conventional services. From the point-of-view of technological and economic application, rather than as a basis for further research, the information content of even journal articles has become vastly more complex.

This has particularly sad consequences for programme co-ordinators - a new kind of information seeker bred by integrated "big science". If anything, they are more interested in non-conventional sources - up-to-date interim, or even negative, but intent-oriented results - than in the two-or-more years old confirmed results he finds in current journals accessed via conventional indexes based on content. By their very nature, conventional services alone give him a distorted perspective; yet his only alternative is to pore through copious quantities of substantive copy - if he has been lucky enough to acquire any. In any event, increasingly acute problems can be expected for the marine sciences, where we have interdisciplinary growth not just for one but for several uses of ocean-space, with growing interaction between those uses.

Another problem in most fields of science is the unprecedented dispersal of information sources. Gone is the colonial era when virtually everything was reported to meetings and society publications in a few western capitals. The newly independent nations have set up their own academies, programmes and publications. As their research capacity expands and improves, so their

contributions to the world literature increase in volume and importance. Their need for information increases simultaneously. Advances in transportation and communications technology are helping to iron out some of the wrinkles engendered by this dispersal, but few librarians or scientists would claim that the situation will ever be as "convenient" as in the old days - and none can ignore the much higher inherent costs. Here too, the international and highly dispersed nature of marine science research can be expected to give rise to increasingly acute problems.

Frequently, the "exponential arrival" of scientific advances creates special information problems. The principal demand of a computer-oriented information management system is for a logical and systematic approach to the users' jurisdiction. This requirement has revolutionized the traditional collection and "style" of many kinds of information - and in the process has revolutionized management itself. Marine science has no immunity to these requirements. The growing field of aquaculture already calls for information services dedicated to fish introductions; "clean" access to information on the growing impact of man on his environment in areas such as the depletion of aquatic resources, marine pollution, is another pressing need.

This motley of confusing "primary" events has had profound impact on the tools used by the information sleuth - traditionally the reference librarian. Much of his basic reference material - world lists, directories, catalogues - is obsolete before it is received. Cumulative indexes are received months and sometimes years after the effective date of cumulation. They have become extremely expensive; many have ceased publication. Bibliographic and information services have proliferated not only in number, but regrettably also in style; bibliographic descriptions are frequently so vague and inconsistent that separate references to the same report appear to be distinct; translations and non-conventional documents, particularly, suffer in this regard. Likewise, the rush to make non-romance language material generally accessible has produced a plethora of schemes for transliteration and abbreviation. Thus at a time when budgetary restrictions have forced libraries to rely increasingly on external resources (inter-library loan) the tools through which identification and acquisitions of substantive material must proceed have become increasingly stubborn.

In a very real sense, then, the information crisis is an environmental problem. We are suffering because the "production emphasis" has virtually blinded us to the need for sustained investment in monitoring, regulation and control. And the crisis is now so deeply felt because in the "global village" scientific and technical information have acquired the status of a vital resource, eagerly sought by an ever-growing and diversifying body of individuals and institutions, as well as practising research scientists for whom the prevalent style and reporting procedures were devised.

A BLUE-PRINT FOR IMPROVEMENT

It is axiomatic that any modern vehicle for the communication of scientific information be not only aimed in the right direction, but also carry only information relevant to the mission it is intended to serve - the system must not push mountains of information in all directions leaving the unfortunate recipient to sort the wheat from the chaff. Rather it must enable the user to pull the information he needs. Mission-oriented science demands the support of mission-oriented information services.

This has long been recognized in other "modern" research areas. During the last 15-20 years, nuclear and space programmes have spawned an incredible number and variety of specialized information centres that have collected, organized, and brought to life vast amounts of information relevant to their respective missions.

The establishment of a network of interconnected specialized information services must be considered as an eventual and essential objective in a systematic solution of marine science information problems. Because of their contribution to the international community, through their participation in the system, some national institutions acting as specialized centres - particularly in developing countries and regions - may require international support or assistance as their products and services should be readily available to the world community of marine experts, and marine science agencies and institutions. Since the level of information analysis required to support such specialized services demands an in-depth knowledge of the relevant subject matter and its broad conceptual relationship to the other areas of aquatic science, it is desirable that specialized information centres be associated with research institutions pursuing relevant research. In this way, scientists who are among the major users and have a vital role to play in the functioning and development of the centre, will be close at hand. Apart from the services one traditionally expects, such centres may, in certain cases, undertake, as part of their overall responsibility, the preparation of specialized bibliographies, compilations, summaries and reviews on either a regular or ad hoc/contractual basis to meet the requirements of programme co-ordinators, regulatory bodies, and governmental and intergovernmental agencies.

But if specialized information centres are to function effectively they must themselves be alerted to and nurtured by basic information from world-wide sources. A more immediate objective to the solution of our problem, then, is to bring the world's marine science literature under good, consistent bibliographical control, and thereby improve its accessibility. To achieve this objective, it is obvious that close international co-operation will be needed. This was recognized by the UN Conference on the Human Environment (Stockholm 1972), and the Unesco sponsored Intergovernmental Conference for the Establishment of a World Science Information System, UNISIST (Paris 1971) spelled it out in detail.

Ideally, of course, an international information system should be completely open. Any institution wishing to contribute to it (and benefit from it) should be able to do so. Only in this way can the world's information resources be adequately tapped. This is particularly important in relatively new interdisciplinary areas of concern such as pollution, from which anything acceptable for publication in scientific journals does not usually materialize for several years. These delays do not necessarily affect those engaged in the tactical conduct of research, but for those engaged in its strategic management, for those in resource development, in regulation and control, in almost any other activity that involves scientists, significant amounts of valuable information lie relatively dormant in non-conventional reports. Beyond this there is a growing need for organized access to other sources of information - drawings, maps, films sound recordings, training manuals - reference to which, if found at all, is usually found by chance.

Accordingly, bringing all potentially valuable information resources under good, consistent bibliographic control will demand two types of input:

- conventional material, usually available through normal commercial channels
- non-conventional material, access to which is more difficult because, traditionally at least, it has not been a commercially viable product.

Bibliographic descriptions for the former are best submitted via input centres with designated responsibilities organized on a regional basis, more or less along linguistic boundaries. But since the bulk of the non-conventional material is a direct result of government-sponsored programmes, access to it must be maintained through direct links with national (governmental) institutions. Since only they are currently aware of its existence, only they have direct access to it, and only they can decide which items merit inclusion on qualitative grounds without raising political or proprietary problems, they are the only sources for input of non-conventional material.

The records created would be filed and processed in a central computer facility. It will be mandatory that all bibliographic descriptions be prepared for machine manipulation in full accordance with the emerging UNISIST proposals and other internationally accepted or emerging standards and cataloguing practices. In particular, the magnetic tape products of ASFIS should be written in the communication format (MARC-II) already adopted as a standard in the USA and the UK, as an ISO Recommendation and as a UNISIST Proposal. To achieve the desired flexibility, each record would be classified in a multi-dimensional scheme. Subject categorization would be guided by a subject authority list with scope descriptions. World-wide consistency in indexing terminology and depth, and thereby consistency in retrieval, would be achieved

through development of a comprehensive, structured thesaurus displaying term relationships. The thesaurus would be under constant review to maintain its viability as scientific terminology passes through its semantic gyrations. Check codes would identify documentary units by type (monograph, journal paper, maps, etc.) by "literary style" (data compilation, training manual, etc.), by principal area of application in order to facilitate the creation of sub-files for applied "information packaging". Useful ephemeral devices could be introduced - material relevant to pre-defined priority areas could be checked at input and weekly or monthly lists of items pertaining to those areas produced. Since the inclusion of non-conventional sources would introduce material of interim nature, it would be essential to include an up-date mechanism by means of which records for such material would be deleted as the final report becomes available, and thus keep the files "clean".

As might be expected, input preparation of this nature is time-consuming and calls for competent staff of scientifically mature judgement. Accordingly, input costs would be high. But because of the enormous capability of modern computer systems, this seemingly high input cost is substantially offset by low processing and output costs provided there is sufficient demand to exploit that capability. Herein lie both the challenge and the solution. Unless agencies with common interests pool resources to promote the further development of integrated systems, each will overlap high input costs without necessarily having output requirements to offset them. Furthermore, because of the need for a multi-disciplinary approach for the solution of modern problems, it is becoming increasingly important that systems serving different interests be at least compatible. Only then can information be "switched" from one system to another in a cost-efficient and time-efficient manner. But the high decentralized input preparation inherent in this proposal will disperse these costs, and apportion them on the basis of volume of literature created by the region or nation. Since the wealthiest nations are also the greatest producers and consumers of information, this is roughly in accordance with "ability to pay" and "benefits received".

Output from this computerized processing would take a variety of forms. A routine product would be a monthly annotated bibliography of all material input, with items listed by broad subject category - a traditional-type service to meet the general needs of the whole marine science community. The bibliography would be printed for distribution and, at the discretion of particular groups of users, distributed on magnetic tapes for subsequent processing and listing at destination. More selective services would be provided to the specialized information centres, national and international institutions, and perhaps even individuals, by comparing an interest profile of the user against the monthly transactions, and transmitting only those records that match, again either printed or on magnetic tape. In addition to these routine alerting services, sub-files would be machine processed to provide retrospective searches to meet specific demands. Note that for these selective services, the type of documentary unit, the regional or national centre supplying the input, language, and so on can all be used as criteria for selection or rejection of a record, in addition to subject indexing. These seemingly simple devices greatly facilitate the tailoring of information access for special purposes.

Another form of output would be a periodically up-dated authority list for corporate entries, i.e. a list of institutions from which the non-commercially available substantive information referenced can be obtained. This is particularly important for non-conventional sources, and might even be augmented by establishment of depository collections of difficultly available material at regional centres, around which copying services could be built. This authority list would also provide the means for periodically up-dating the FAO Directory of Marine Science Institutions detailing the programmes and facilities of each institution. Similarly, authors publishing in various areas of the marine sciences would be listed with their affiliations to facilitate updating of the FAO International Directory of Marine Scientists, or for taking inventory of aquatic science research projects.

Since the system will be capable of accepting interim information, it will be possible to prepare and up-date periodic lists of translations in process or reviews being written. These can then be fed through the network. Similarly, maintenance of the FAO World List of Aquatic Science Periodicals - both scientific journals and report series published periodically - would be more or less routine. A World List of Aquatic Science Meetings and Conferences showing name, sponsor, place and date, a register of which FAO already maintains and publishes as part of Marine Science Contents Tables, could also be handled in this manner. The efficiency of traditional library services would be substantially reincarnated if basic reference material of this type were restored to its erstwhile utility. Since output of any variety is obtained by logical operations on the data elements uniquely identified at input, system capability is determined principally by the effort and resource brought to bear on input preparation.

But just as the specialized information services are augmented by secondary reviews and custom bibliographies, so the creation of a broadly based bibliographic service will not obviate the need for informative news services. Using newsletters and similar vehicles modelled on Unesco's "International Marine Science", the network of specialized, regional and national centres must be kept informed of basic information dealing with, say, new programmes, resolutions adopted, key results, contained in the documents being accessioned into their systems. All these different forms of output are interrelated. Since most of them can be interconnected in whole or in part through the bibliographic network, the potential pay-off in so doing is handsome. But this implies that participating institutions generating information of interest to the network accept some responsibility for its communication.

Implementation of ASFIS

It is important to recognize that a scientific information system is like a living organism that must constantly adapt to a whole range of influences and changes in its environment, or become useless. Furthermore, because of the subtleties of language, "perfect" retrieval is attainable by neither cerebral nor electronic processes. For the most part, then, implementation of the ASFIS concept will not involve drastic changes, but rather directing the evolution of existing FAO and other broadly-based services, by optimizing and/or extending them and, through a phased realignment of resources, integrating them on a common base for the common good. Many aspects of the co-operative programme and exchange mechanisms ASFIS seeks to establish, or formalize, have been created in a related field for data exchange between oceanic data centres; in a sense ASFIS simply seeks the same type of solution for non-numerical information transfer.

The implementation will also be greatly facilitated by the fact that at least the foundations of many much needed specialized services also exist in various guises. The Marine Biological Association of the United Kingdom has built up an impressive collection of papers on marine and estuarine pollution, a large proportion of which have not been exposed in existing abstracting services. The Association thus already has a base on which to build specialized services dealing with pollution, but needs the means and vehicles to make them generally available. One might ponder whether the wealth of information generated in the programme to eradicate the sea lamprey in the Great Lakes of North America provides a basis for specialized services dealing with the control of unwanted aquatic species. As one would expect, many agencies in the USA are potential seats for specialized services, but developing countries too house potentially valuable reservoirs of information. FAO's CARIS project, which examined the agricultural information resources of several West African countries, found an unexpected accumulation of uncatalogued and inaccessible information, much of it relevant to contemporary problems and research programmes. There is no evidence to suggest that the results would be any different if marine science laboratories were combed. However, while activating these resources has special significance for the developing nations, it also presents special problems. As with integrated research programmes, Third World involvement in integrated information processing activities postulates the existence of means (particularly trained manpower), and facilities that are only just emerging in many parts of the developed world. The much needed participation of developing countries in ASFIS would therefore require various forms of technical and mutual assistance.

Unquestionably, however, some problems will call for significant new resources over short duration. There is no way many of the files and specialized services can be established in a reasonable time span without "crash" programmes. A significant short-term effort will also be needed to establish a comprehensive and truly international basis for the bibliographic system. The working paper presented to the Seventh Session of IOC outlined

FAO's considerable experience in this type of work, first through several years' production of Current Bibliography for Aquatic Sciences and Fisheries and, more recently, with the monthly journal, Aquatic Sciences and Fisheries Abstracts. VNIRO, in the Soviet Union, recently agreed in principle to join the ASFA partners (FAO, Bundesforschungsanstalt für Fischerei in Hamburg, Institut national de la Recherche agronomique in Biarritz, and Information Retrieval Limited in London). They will monitor 60 Soviet scientific journals and supply bibliographic descriptions of relevant papers. Hopefully, national institutions in the UK and USA will shortly be in a position to give similar support. Resolutions and recommendations on the FAO work have been adopted by several inter-agency and internationally constituted committees.

But while FAO appreciates this display of confidence and is willing to continue to provide the required input in the further development of the system, the limited resources available will not permit this development to proceed at the required pace. If a fully comprehensive, truly international information system, embracing the various aspects of marine science, compatible with the UNISIST proposals and therefore with systems serving other missions (nuclear, agricultural, industrial development, etc.) is accepted as a desirable goal, it will only be realized through direct investment from the interested national and international agencies. For example, the thesaurus lies at the heart of an information system; it determines both the tactics by means of which information is entered and the strategy by which it is subsequently retrieved. Its development will call for opinions from a wide range of subject specialists, many of them well beyond the scope of FAO's direct interests.

Of course, the FAO Department of Fisheries has a vital interest in the consolidation and broadening of such a system, both in connection with its specific responsibilities towards fisheries, and also as part of its support - as an ICSPRO agency - to IOC. Information dissemination figures prominently in the Organisation's Terms of Reference, but the effort it has expended and the direction that effort has taken has resulted from pressing needs rather than just statutory requirements. As a UN agency with well established lines of communication, FAO stands ready to exploit its good offices and resources to the fullest extent possible in promoting its existing systems to serve the entire spectrum of marine science and its applications, and to provide the focus for the development of the ASFIS network. Extra-budgetary resources and/or the secondment of personnel with relevant skills are therefore required during implementation. Contributions and effective support, particularly by Unesco, are required in the broadening process. When the programme has gained momentum, further development and services will probably best evolve in a small financially independent, perhaps even self-sufficient unit under the joint sponsorship of FAO and other major participating agencies.

ANNEX I

(a) INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION
SEVENTH SESSION

(Unesco, Paris, 26 October - 5 November 1971)

RESOLUTION VII-11

INTEGRATED SCIENTIFIC INFORMATION SERVICE ON AQUATIC
SCIENCES AND FISHERIES

The Intergovernmental Oceanographic Commission,

Considering as of prime importance the task of establishing an integrated scientific information service on aquatic sciences which would include not only bibliographic services but also other important matters such as directories of specialists and institutions, training opportunities, various periodical reviews, etc.,

Considering the benefits of such an information system for developing countries and the possibility of requesting funds for support of this service from UNDP,

Having reviewed doc. SC/IOC-VII/42 prepared in response to Recommendation 12.4 of the Bureau and Consultative Council containing a first outline of an Information System on aquatic sciences,

Recognizing the important activities of the Fishery Resources Division of FAO in this field over the last ten years and their significance for the Commission and its Member States,

Also recognizing that the FAO system forms a nucleus around which an integrated system can be built and with which Member States, as a first step, should be encouraged to collaborate in order to increase its efficiency and reduce its costs,

Noting with appreciation, in this connection, the support given by the Federal Republic of Germany and France to FAO,

Noting further the contribution that the Unesco Office of Oceanography has begun to make to this work,

Instructs the Secretary to prepare in close co-operation with representatives of FAO a second and comprehensive draft plan for the establishment of an Integrated Information System on Aquatic Sciences insofar as this pertains to marine research, to be presented to the first session of the Executive Council

Further instructs the Secretary to communicate this Resolution to the executive office for UNISIST and ensure co-ordination as appropriate of the above plan with activities towards the establishment of a World Science Information System.

(b) First Session of the IOC
Working Group on Training, Education and Mutual Assistance
(Unesco, Paris, 7-13 March 1973)

Agenda Item 4.2: Educational Materials and Directories

Directories of Training Institutions and Experts

The Working Group on Training, Education and Mutual Assistance,

Having considered the importance of institutional and expert directories and the list of periodicals in aquatic sciences for training and education and research purposes,

Recognizing that IOC Resolution VII-31 specifically requests that such services be provided on a continuing basis,

Noting that IOC Resolution VII-11 acknowledges that the FAO scientific information system forms a nucleus around which an integrated system can be built,

Further recognizing that the Food and Agriculture Organization of the United Nations has already a series of computer oriented registers and information systems in operation,

Recommends that the IOC Secretariat, with the assistance of FAO and Unesco, and where required, with the co-operation of other ICSPRO Agencies, as a service to IOC Member States and to the world community concerned with marine science and its applications, compile and disseminate such directories and reference materials as soon as possible, and no later than mid-1974, at the same time taking adequate measures to strengthen the services required to maintain such directories up to date,

Suggests that in view of the short deadline, the funding of the additional compilation to attain a better coverage of disciplines of relevance and the printing of such supplementary material be made through the IOC Trust Fund.

ANNEX II SCHEMATIC DIAGRAM OF CONCEPTUAL "ASFIS" SYSTEM

