



FISHERIES INFORMATION IN ASIA:

Needs and Opportunities

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Fisheries Information in Asia: Needs and Opportunities

Yong-Ja Cho



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SIFR (Strategy for International Fisheries Research) was established in 1992 to develop mechanisms for matching the research priorities of developing countries with the interests of donors. SIFR seeks to encourage the coordination in fisheries research for the sustainable development of living aquatic resources. High priority is given to strengthening the capacity of research institutions in developing countries to conduct applied research at the local and regional level. In addition, SIFR seeks to encourage support for strategic research through the CGIAR centres involved in living aquatic resource management.

SIFR is guided by a Steering Committee composed of representatives of the World Bank, UNDP, FAO, Commission of European Communities, IDRC, and NORAD. SIFR established a secretariat in 1993 to assist in the implementation of the SIFR strategy.

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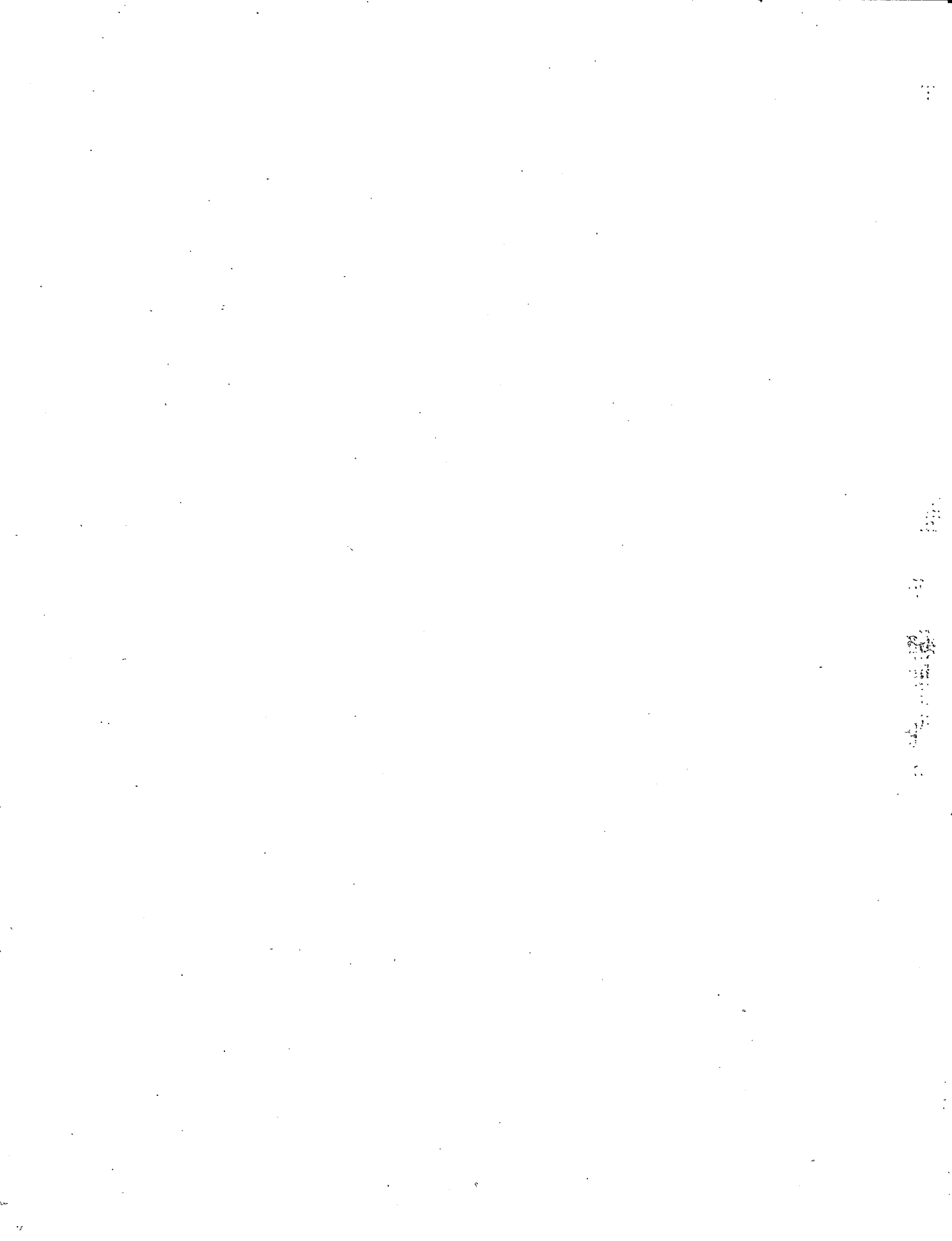
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Foreword

The SIFR (Strategy for International Fisheries Research) Secretariat was established to assist in the coordination of research between donors, ICLARM, and national programs working in the fisheries sector. One of SIFR's initial objectives¹ was to determine the degree to which the lack of information was an impediment to effective fisheries management and development. In spite of successful efforts by several international and regional research institutions, the information necessary to introduce innovations and changes in aquatic resource management has not been widely disseminated to the majority of actors in the sector. Action is needed to review information needs in developing countries and to formulate appropriate projects. Disseminating research information relevant to the development of improved management of aquatic resources, and facilitating consultation between donors, international, regional, and national agencies are important functions of the SIFR Secretariat. This book is an example of our efforts to promote the use of information and consultations to improve the management of aquatic resources.

Formulation of demand-driven information programs requires an understanding of the ability of existing initiatives to meet identified needs. The SIFR Secretariat initiated three studies that examined: the relevance and utility of international and regional information sources and services in relation to information needs; the complementarity of regional and national information sources; and the information tools that could be used to manage the information needed for aquatic resources management. With the support of IDRC, UNDP, and the World Bank, three consultants were hired during the latter half of 1993.

A Regional Workshop on Fisheries Information and Statistics, organized by SEAFDEC and FAO/RAPA in collaboration with eleven international and regional bodies concerned with aquatic resources, provided an excellent opportunity to disseminate and use the findings of these studies. The studies were used as the background documents for the meeting in January 1994.

The key findings of the studies and deliberations of the workshop were consistent with the conclusions of the original SIFR study. Although existing efforts are relatively successful in organizing and disseminating published scientific and technical literature, they are not effective in meeting the information needs of the key actors in aquatic resource management (administrators, managers, policymakers and planners, coastal communities, and aid and development agencies). Inappropriate and inadequate presentation, both of contents and communication medium, and lack of effective mechanisms for cooperation and collaboration hamper the impact of these information

¹ World Bank, UNDP, CEC, and FAO. 1992. A Study of International Fisheries Research. World Bank Policy and Research Series 19, Washington, DC, 103 p.

sources. Information must be integrated and packaged in the context of user needs, and disseminated through locally appropriate communication media.

SEAFDEC, FAO/RAPA, the Mekong Secretariat, NACA, BOBP, and SIFR are collaborating in implementation of the recommendations of the regional workshop. The first step, preparing project concept documents, is underway, in close consultation with the target user communities to ensure that need-driven programs are developed. Final concept papers, endorsed by the participating countries, will be submitted to the donor community. Full proposals will be prepared on the basis of donor response.

The most critical component is the commitment and will of national programs and donors to invest in information programs. The original SIFR study noted that a prerequisite for institutional innovation and change is that the key actors must be informed about concepts, methods, and experiences in sustainable development and management of aquatic resources. An effective information program is, therefore, basic to development research and action. Those who supported the original SIFR study and follow-up activities are commended for initiating the process. We should not, and cannot afford to, abandon the process we have begun.

F. Brian Davy
Executive Secretary
SIFR

Introduction

Over the past few decades there has been steady growth in information programs and services that support fisheries resource management. However, in spite of these efforts by national, regional, and international agencies, there are lingering doubts about the relevance and effectiveness of these programs and services, particularly in support of the needs of developing countries. There are also concerns about the sustainability of information programs and services in developing countries.

Many recent studies (e.g., 8, 9, 12, 34, 38) have pointed out that reliable, relevant, accurate, and timely information is a prerequisite for sound fisheries management and planning. Further, these studies have suggested that first priority be given to strengthening national capacity to collect, analyze, package, and disseminate fisheries data and information and to develop appropriate skills of national personnel.

The decisions of UNCED, as stated in the relevant chapters of Agenda 21, emphasize the needs to improve national capability to manage and use information for sustainable development. Chapter 17 places particular emphasis on the need to provide analyzed and interpreted information to decision-makers regarding oceans, seas, and coastal areas and to share data and information in support of marine sciences and the management of coastal areas. International cooperation and coordination to support and supplement national efforts toward integrated management and sustainable development of coastal and marine areas is critical. Support is essential to enhance the capabilities of developing countries in the areas of information, science and technology, and the development of human resources. With assistance from the international community, developing countries will be able to participate effectively in the conservation and sustainable use of the coastal resources under their national jurisdictions.

SIFR (38) noted that access to information was a prerequisite for research and development, and recommended "a comprehensive review of fisheries research information needs in developing countries" and the formulation of "proposals to meet the needs". To implement these recommendations, the SIFR Secretariat, in collaboration with IDRC, ICLARM/UNDP, and the World Bank Trust Funds, initiated three studies in 1993 to address issues related to effective and efficient dissemination and use of information that could be used to improve management and development of the fisheries sector. To increase efficiency, these reviews were tackled on a regional basis. Because of the contributions that fisheries makes to the economies, food supplies, and livelihoods of people in Southeast Asia, this region was chosen as the first geographic focus of the studies. The experience gained in Asia will be invaluable to future studies in other regions.

To ensure wider dissemination, and to support the regional initiative taken by FAO/RAPA and

SEAFDEC, the findings from the three consultancies were presented at a Regional Workshop on Fisheries Information and Statistics in Asia held in Bangkok, Thailand, 18-22 January 1994. At this workshop, subregional action plans were formulated to improve the accessibility and availability of fisheries information needed to facilitate innovation and improvement of aquatic resource management. Furthermore, FAO/RAPA, SEAFDEC, and SIFR agreed to cooperate in the publication and distribution of the results of the studies and the recommendations of the regional workshop.

In the subsequent sections, the findings of the consultants' reports have been highlighted. The first report examines fisheries information needs in developing countries, with special emphasis on the relevance and utility of international fisheries information resources in relation to the needs and constraints of countries in Southeast Asia. The second report deals with compatibility and complementarity of regional and national fisheries information resources and services in Asia. The third report reviews information management tools that are applicable to the fisheries sector. These reports were used as background documents at the regional workshop and facilitated the formulation of the action plans that arose from the discussions during the workshop. The subregional action plans and the recommendations that were adopted by the participants of the workshop are also summarized.

Fisheries Information Needs in Developing Countries: Issues, Constraints, and Opportunities

[This is the main text of a report by Yong-Ja Cho. The full report is available from SIFR, c/o IDRC, P. O. Box 8500, Ottawa, Ontario, Canada K1G 3H9. Fax 1-613-567-4349]

Processes in Fisheries Resources Management

Before discussing information needs, it is useful to review the processes involved in fisheries resources management and the information environment of the fisheries sector. Figure 1 shows a highly simplified overview of these processes to illustrate the major steps involved. It does not indicate the complexity and the interactions and interrelationships between the processes, inputs, and outputs. The lines indicate the processes; the circles the outputs of the processes. Each process requires information as an input, not only from the adjacent circle, but also from other circles. Each process may collect data required for specific analysis, diagnosis, and interpretation.

Outputs of surveys and data collection are generally captured as fisheries statistics and socioeconomic data by centres that organize and provide access to information. Outputs of other processes are normally recorded in documents, reports, journal articles, manuals, books, pamphlets, directories, and catalogues. These outputs are usually captured by information and documentation centres (hereafter referred to as information centres) and libraries that organize and provide access to sources of data and information. It should be noted that fisheries data and statistics are often available in the collections of information centres and libraries as statistical bulletins, summaries, or reports. The information environment of the fisheries sector is rather complex, and it has similar characteristics to other resource sectors, e.g., agriculture, forestry, and water resource management.

First, in common with other resource management sectors, fisheries resource management is location specific. At the same time, fisheries resources and water, the medium in which these resources live, are mobile and cover both inland freshwater, coastal areas, and the high seas. Therefore, fisheries resources management requires location-specific information not only in one location or country, but in a number of neighbouring countries because fish migrate and change their environment. The sharing of data and information among the countries that share water bodies and fisheries resources is essential for aquatic resource management.

Second, fisheries management is highly interdisciplinary, intersectoral, and multijurisdictional. It requires basic, strategic, applied, and adaptive research that addresses the problems and demands of society. Therefore, fisheries information programs must cover and integrate many aspects of scientific, environmental, economic, legal, regulatory, sociocultural and technical information.

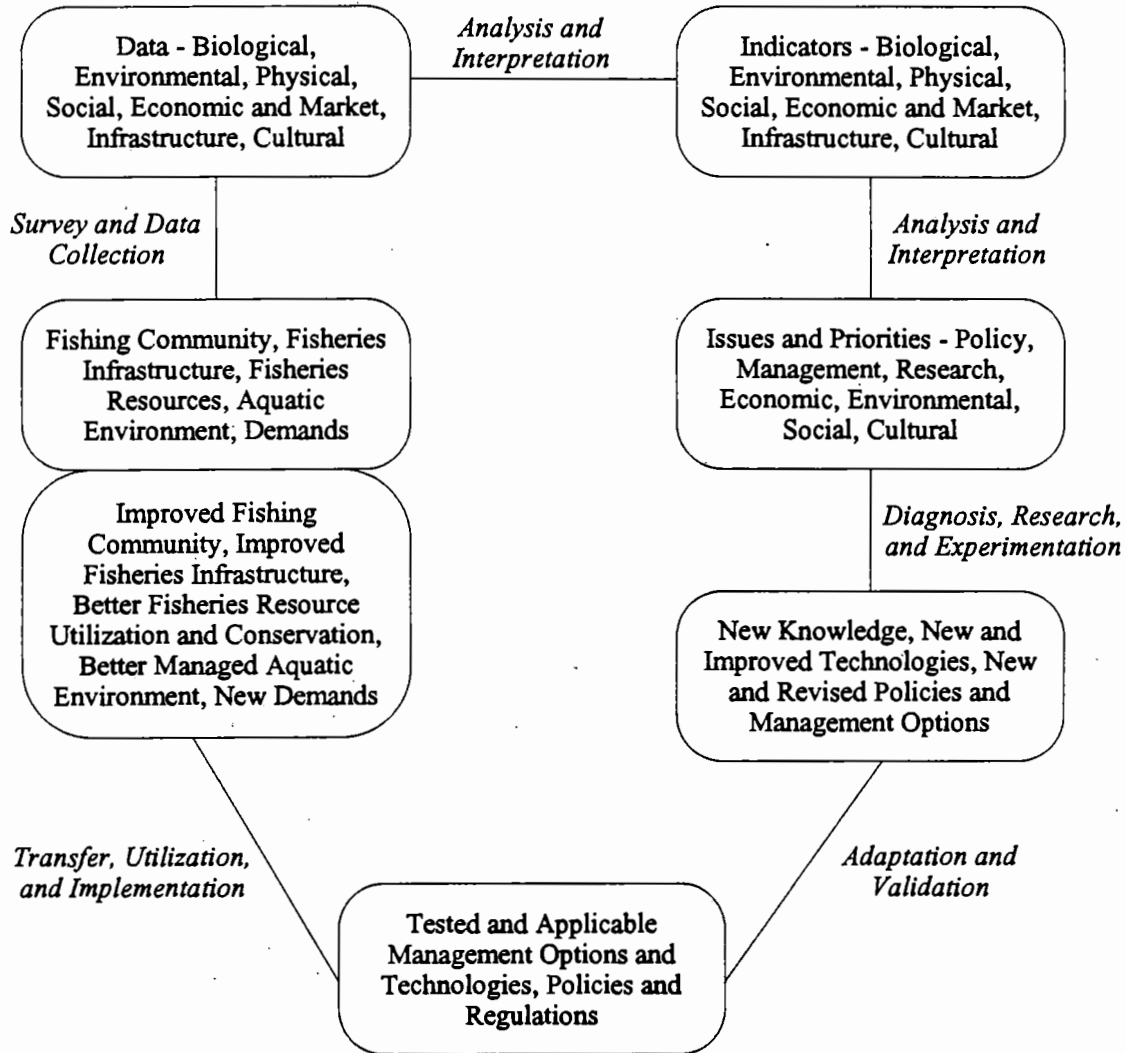


Figure 1. Processes in management of fisheries resources.

The lines indicate the processes and the circles the outputs of each process. Each process requires information as an input, not only from the adjacent circles, but from the other circles. Each process may collect additional data required for specific analysis, interpretation, diagnosis, research, and experimentation.

The outputs of survey and data collection, i.e., data and statistics, are generally captured by fisheries statistics and socioeconomic data centres that organize and provide access to data. The outputs of other processes are normally recorded in documents, reports, journal articles, manuals, books, pamphlets, directories, and catalogues. These are usually captured by information centres and libraries that organize and provide access to various sources of information.

Third, the management of the fisheries sector requires a tremendous amount of nonbibliographic, and nonresearch information. Fisheries statistics and biological, environmental, physical, social, and economic data constitute a vast amount of factual information. Therefore, cooperation and collaboration among the specialized information programs in the fisheries as well as other related sectors are essential to meet the information needs required for sector management.

Fourth, a large number of fisheries information users are in nonresearch communities, and have different information-seeking behaviour than researchers. Furthermore, the information used by users in nonresearch communities is often mission- or client-oriented, rather than discipline- or subject-oriented. There are special requirements for the packaging and presentation of locally appropriate information for users in nonresearch communities.

Information Requirements and Acquisition Channels

By examining the issues and areas of research identified in the SIFR report (38), one can easily realize that a variety of types of information are required to manage and develop the fisheries sector. A number of studies (e.g., 18, 27, 30, 35) have also reported diversified information requirements for sector management. This need for diversified types of information (e.g., biological data, environmental and market indicators, fishermen's knowledge, scientific literature, and policies and regulations) is confirmed by this study. The types of information needed are closely related to the job functions of the users. For example, policies, regulations, and resource management options and approaches are priorities for the majority of policy makers and planners; whereas, the key types of information used by a majority of researchers are scientific and technical literature and biological data and indicators.

Activities and efforts of researchers, planners, policymakers, legislators, and industries generate vast amounts of data and information that must be used as inputs to future activities and efforts. These data and information are disseminated in a variety of ways, including reports, professional meetings, and personal contacts. However, published literature (either on paper or electronic media) is still the most commonly used medium for dissemination of fisheries data and information.

To be effective, the literature (both on paper or electronic media) must be available and accessible, and its contents must be known to potential users. Access to fisheries information is provided in many different forms (e.g., card catalogues in libraries, directories, abstracts, and databases that can be searched on-line or are available on CD ROM) and is facilitated formally through the services of information centres and libraries that perform the following general functions:

- Develop information resources through collection and organization of various primary and secondary information sources;
- Create access tools through analysis of the content of the collections and identification of specific information sources of potential interest and importance

- to users; and
- Disseminate information and initiate and provide information services.

Common primary information sources are books, journals, documents, reports, thesis, reprints, conference proceedings, audiovisual materials, information on computer disk or in files containing biological, economic, environmental, social, and technological data related to aquatic resources and environment. Secondary information sources, such as library catalogues, indexes, abstracts, bibliographies, and databases, provide access to the information content of the primary sources. Most fisheries information centres and libraries have some secondary sources in their collection, and they use them as tools for information retrieval and services, usually resulting in a list of bibliographic references.

The other commonly used secondary information sources are directories and inventories of data files, institutions, experts, data sets, projects, equipment and facilities, industries, markets, producers, and suppliers. Information centres and libraries, particularly those with national, regional, and international mandates, are often involved in the preparation and production of these directories and inventories.

Information centres and libraries interact and cooperate with information users, and have linkages with other related programs at national, regional and international levels, as well as publishers and producers of both primary and secondary information sources. Fisheries information users seem to depend highly on informal information channels to obtain needed information. The survey conducted during this study indicated that most of the respondents had a relatively good personal collection of core materials in their subjects or work areas, and a network of personal contacts. A good number of the policy makers and planners receive complementary copies of publications of interest to their work. It is important to note that a good portion of the extension specialists and policy makers and planners consider this media to be an important information channel for acquisition. Extension specialists indicated that attendance at workshops, training courses, and seminars was an important way to be kept up to date and stay in touch with fellow professionals in the field.

High dependency on informal information channels was also reported in the study of the Asian Fisheries Science community (4). The members of the Asian Fisheries Science community consider scientific and technical journals as the most important source of information, followed by libraries, abstract journals, personal contacts, and reprints. However, the majority (66%) of the scientists have no personal subscriptions to international journals. The highly used journals are publications of national fisheries societies, indicating that these scientists rely on the national publications, i.e., what is available locally. Half of the respondents indicated their satisfaction with the services of their libraries. However, the international or regional information sources and services are used poorly. Only 9% of the respondents indicated that they have used Selective Fisheries Information Service (SFIS - ICLARM), Southeast Asian Fisheries Information system (SEAFIS - SEAFDEC/HQ), or Brackishwater Aquaculture Information System (BRAIS - SEAFDEC/AQD), and only 3% indicated they had used Aquatic Sciences and Fisheries Abstracts

(ASFA). The international information sources and services are not used because the users are not aware of their existence, the unavailability of the nearby information services, the absence of the need to use them, and the high cost of these services. These reasons are highly consistent with the responses received during this study.

At the local level, a majority of users are served by the information centres and libraries in the institutions to which they are affiliated, or by the research institutions, universities, and government agencies that are locally accessible. At this level, the collections and services of the libraries are normally maintained to satisfy the information needs of the institutional staff and programs. Personal collections are often built through the services of the local libraries.

Libraries and information centres with national mandates make their collections and services available not only to staff of the affiliated institutions and agencies, but also to wider users in the country. Depending on national information policies and infrastructures, various mechanisms and linkages are used to meet national needs, including production of various information products (e.g., directories of institutions and experts, union lists of collections available in the countries, methodological guidelines for information handling and management, and information management tools, including computer software).

Work outputs of the participants in this study have been affected greatly by lack or unavailability of appropriate information. Frequently mentioned negative effects were: work done may not be what is needed; work duplicates efforts elsewhere; inappropriate advice or recommendations are made; inaccurate assessments are made of critical resource problems; or difficulties are encountered in responding to government policies and needs of fishing communities. It appears that ineffective use of information contributes not only to wastage of scarce financial and human resources, but also to inappropriate management of fisheries resources, which results in further management problems and damage to the resource base.

Information Sources and Services

Appendix 1 provides a brief description of fisheries information sources and services available internationally and in Southeast Asia. Information services at the international level are normally provided by international agencies such as United Nations agencies and international research centres. A number of commercial publishers produce information sources such as indexes, abstracts, and special bibliographies, and provide worldwide source-document delivery services.

The most important and widely used international fisheries information system is ASFIS (Aquatic Sciences and Fisheries Information System), the international cooperative system coordinated by FAO (Food and Agriculture Organization), and its products ASFA. Other information products that contain significant amounts of literature of interest to the fisheries sector are:

- AGRIS (International Information System for the Agricultural Sciences and Technology) International

- Biological Abstracts (BIOSIS Preview)
- CABI (Commonwealth Agricultural Bureau International) Abstract Journals
- Current Contents: Agricultural, Biological, and Environmental Sciences (CCABES)
- Fish and Fisheries Worldwide
- Food Science and Technology Abstracts (FSTA)
- Zoological Record

In addition, there are a number of international and regional organizations that facilitate and organize studies, workshops, and conferences, and publish and widely disseminate the findings and outcomes of their activities. Many of the publications of these organizations are captured by, and included in, these international information sources.

There are also a number of international and regional institutions that have a strong information program specifically designed to provide services to developing countries. They include the Bay of Bengal Programme (BOBP), FAO, International Center for Living Aquatic Resources Management (ICLARM), INFOFISH, Network of Aquaculture Centres in Asia (NACA), and Southeast Asian Fisheries Development Center (SEAFDEC).

Although fishery project information can be found in such databases as FIPIS (Fishery Project Information System), CARIS (Current Agricultural Research Information System), and IDRIS (International Development Research Information System), the coverage of each database is rather limited. FIPIS, covering the fisheries projects supported by 26 multilateral and 20 bilateral donors, was developed for internal use by FAO to coordinate donor activities in the fisheries sector. CARIS is an agricultural project information system coordinated by FAO, but includes over 900 fishery projects. IDRIS, a list of projects supported by seven donors, includes about 100 active fishery projects.

Limited information bases for policymaking and planning also exist. At the global level, FIPDAT (Fisheries Policy and Planning Databank), which was developed by FAO for internal use, integrates various aspects of fisheries statistics and socioeconomic data for planning. An example of a local planning information base is GISAMP (Geographic Information System for Coastal Resources Management), which was developed to support management of the Lingayen Gulf area in the Philippines. It integrates various socioeconomic and environmental data necessary for the development and management of coastal resources and communities.

Information sources and services specifically designed to serve the fisheries industries are GLOBEFISH and INFOFISH. They provide market reports, investment profiles, and trade news, and form a worldwide fish marketing information network that includes members in Africa (INFOPECHE), Arab countries (INFOSAMAK), and Latin America (INFOFESCA).

In addition, databases such as FishBase and ReefBase, consolidate various data and information on aquatic species (e.g., biological data, habitat and culture system, and bibliographic information

sources) are being developed by ICLARM in collaboration with FAO. International referral services such as MEDI (Marine Environmental Data and Information) and INFOTERRA (International Environmental Information System) are also available.

However, there is no clear evidence that these services are actively and fully used by information users or providers in Southeast Asia. Only a few national fisheries libraries in the Southeast Asia have international information sources such as ASFA, AGRIS, BIOSIS, Current Contents, GLOBEFISH, and FIPIS. Of the twelve national libraries in six countries that the consultant visited, one has an ASFA subscription and four have access to ASFA through other libraries in the same city. No national fishery library has direct access to Fish and Fisheries Worldwide or FISHLIT. Services of international or regional information centres and libraries are infrequently used by the users, although they are located in the same city. On the whole, the fisheries information centres and libraries in Asia operate independently or in isolation. The providers are aware of other information resources and services, but they are preoccupied with day-to-day operations. Planning ahead or initiating proactive services remain on the list of tasks to be carried out because these tasks require extra effort and resources.

Fisheries information networks exist at national, regional, and international levels, with varying degrees of success. To promote and facilitate regional exchange of fisheries information in Southeast Asia, three regional information networks (BRAIS, SAFIS, and SEAFIS) were established under the coordination of SEAFDEC as projects funded by the International Development Research Centre (IDRC), Canada. Four national information systems, i.e., Indonesian Fisheries Information System (INFIS), Malaysian Fisheries Information System (MALFIS), Philippine Aquatic Sciences and Fisheries Information System (PASFIS), and Thai Fisheries Information System (THAIFIS), participated in the regional networks. It was expected that these regional activities, initiated with donor support, would be continued and maintained in one form or another after the financial contribution of the donor ceased. Unfortunately, since the completion of the projects, these regional information programs have been operating at less than a minimum level and without a regional role. The main reasons for the inactivity are financial constraints and the low priorities given to the information programs by their parent institutions. Of the four national fisheries information systems, three systems created within the SEAFIS project, i.e., Malaysia (MALFIS), Philippines (PASFIS), and Thailand (THAIFIS), have been inactive since the SEAFIS project was completed in 1989. The only active national system is INFIS in Indonesia. The success and sustainability of INFIS may be attributed to the strong leadership and commitment provided by its parent institution, Directorate General of Fisheries of Indonesia.

Some national bibliographies or directories of the current years exist at the national level, e.g., Thai Abstracts published by the Thai National Documentation Center of Thailand Institute of Scientific and Technological Research, which contains approximately twenty entries on fisheries each year. However, many information providers at the national level frequently rely on outdated bibliographies and directories. Examples are:

- FAO. 1985. *A Bibliography of the Fishery Resources of the Indo-Pacific Region*. FAO Fisheries Circular 785. FAO, Rome.
- UNEP Regional Seas. 1984. *1972-1981 Bibliography of the Marine Environment: East Asian Seas*. FAO, Rome.
- SEAFDEC. 1992. *Regional Bibliography on Fisheries and Aquaculture in Southeast Asia, 1989*. Compiled by Kitchaluksana, S. and R. Saranyapipat. SEAFIS (SEAFDEC), Bangkok, Thailand.
- SEAFDEC. 1989. *Mud Crab Abstracts*. Compiled by BRAIS Staff. BRAIS (SEAFDEC), Iloilo, Philippines.
- Chua, T. E., M. A. A. Agulto, F. Y. Guarin, and S. C. Guerrero. 1989. *Directory of Institutions and Scientists in the ASEAN Region Involved in Research and/or Management Related to Coastal Areas*. ICLARM, Manila, Philippines.

Information providers in Southeast Asia do not actively use international information sources. The key reasons include: (1) the information sources and services are not well known to many information providers; (2) access to the sources is not convenient; (3) language and professional barriers make it difficult to effectively use international sources and services; and (4) materials found in the international sources are not relevant to the needs of their users.

In the absence of alternative information sources, and the status that comes with having an international database on compact disc, both information users and providers said that "yes, it would be useful to have access to ASFA or a database on CD ROM". However, the same users and providers seldom use the databases that are available at minimum cost from other information centres and libraries in the same city or country. Therefore, the question that must be asked is: "If use of ASFA and other databases is important, why are the databases and services available in the same city or country not used?"

Relevance and Utility

Relevance and utility can only be assessed in relation to well-defined information needs of users. Because only a small portion of the survey respondents of this study indicated their use of, and satisfaction with, international information sources such as ASFA, AGRIS, BIOSIS, and FIPIS, no conclusive assessment can be made. It is possible that many information users access these international information sources through their local libraries, and are unaware of the sources of their information.

It was equally difficult to assess the relevancy and usefulness of international information sources from the information providers because: (1) only a few international, regional, and national libraries have convenient access to these sources, and (2) the answers given by providers are their view, not the view of the information users. The providers explained that international information sources are not as useful as they appear to be because of language and professional barriers, and insufficient coverage of locally appropriate materials. At the same time, the providers were

generally content as long as they could give something to their users, particularly a computer printout, and there was little concern about the relevancy of the information provided to the users.

Nevertheless, on the basis of the feedback received during group and individual discussions, it is possible to observe that certain segments of users, particularly the research community, have been quite well served by international and regional fisheries information sources such as ASFA, Current Contents, and INFOFISH publications and services.

Many of the researchers who participated in this study indicated that information gathering is part of their research activities. They are willing to spend time and efforts in pursuit of information. They also indicated that publications from related organizations, such as FAO, ICLARM, SEAFDEC, and INFOFISH, are important and frequently used information sources. Many indicated that they have minimal difficulties obtaining information through personal and informal information channels. Their main frustration is the time-lag in obtaining original articles through interlibrary loans.

Two international information sources mentioned frequently during the discussions were ASFA and Current Contents: Agriculture, Biology, and Environmental Sciences. The researchers are aware of other key information sources and access them through the libraries of their current and former institutions. This indicates that: (1) research information is relatively well organized; (2) the research community has relatively good access to sources of research information; and (3) the format, organization, and presentation of research information are suitable for use by researchers. The question becomes: Why the concern over accessibility, availability, and underutilization of existing information.

First, those researchers in institutions that do not have a library or information centre equipped with adequate information resources have difficulties with accessibility and availability of information. Unless researchers have access to some types of retrieval services from a local library, they do not know of the existing information sources, or where to send a request for original articles or documents.

Second, many of the fisheries information users are outside the research community, and the existing information sources do not effectively meet the information needs of the nonresearch communities. On the whole, research information remains within the research community. To manage and develop fisheries resources, results of research must be available to, and used by, researchers as well as policymakers and planners, extension specialists, and the fishing community, i.e., by those directly involved in management and development of aquatic resources. This need was pointed out by SIFR (38, p.50), "Achieving the necessary institutional innovations will first require wide dissemination of the theoretical concepts underlying the innovations, the methods to implement them, and accounts of new experiences. The majority of actors in the sector — including national fishery administrations, investment banks, aid and development agencies, the fishing industry, and the small-scale sector — need to share a new understanding of the necessity for and the modes of change before the proper actions can be taken."

Third, management of aquatic resources requires a variety of information about the aquatic environment and resources, including economic, scientific, regulatory, sociocultural and technical information at all levels. Availability of analyzed and integrated multidisciplinary and multisectoral information is very limited because a multidisciplinary and ecosystem approach to aquatic resource management is a relatively new concept.

ASFA is an important information source in the fisheries sector. However, considering the estimated sizes of the literature (13, 25), the fisheries sector does not appear to have a comprehensive international system that collects, organizes, and provides access to the literature of the sector. It has been suggested that to cover the literature adequately, ASFA needs to double the annual inputs from 8,000 to 20,000 entries (26).

It appears that fisheries literature is scattered (e.g., 15, 22, 24, 28) by subjects or fields, e.g., biological and life science, environmental sciences, fish farming and aquaculture, food sciences for post harvest processing and handling, and engineering sciences for vessels and equipment. Furthermore, information sources tend to specialize according to the orientation of the literature, e.g., subject-oriented or mission-oriented. The danger of relying on a single information source, even if it is a major international one such as BIOSIS or ASFA, and assuming that one database search extracts all the relevant references, have been pointed out (28). The same study reports poor coverage of grey literature, particularly from the developing countries, in international databases. Specialization by fields is not necessarily negative if the users and providers of information are fully aware of the uniqueness of each information source and have efficient access to them. Unfortunately, the information users and providers in the fisheries sector suffer from a lack of awareness of information sources and services. It has been pointed out (25) that until recently most fisheries and related literature was published in biological or life-sciences publications, and that the use of the term "fisheries" is a relatively recent development. This evolution of the sector may explain the somewhat slow development of a comprehensive international fisheries information system.

The relevancy and utility of international information sources to the needs of developing countries remains questionable. The majority of international information products is developed and produced by the developed countries in North America and Europe, and the main sources of information for these products are international scientific and technical journals, books, and conference proceedings produced and published in the developed countries. It has been reported that much of the information generated in developed countries may not be appropriate to the needs of developing countries (37, 39).

One should be reminded that collection and organization of literature from developing countries is not the main objective of many international sources of research information. Furthermore, one should appreciate that there are difficulties in collecting and organizing literature from developing countries. The difficulties include: (1) literature from developing countries often does not meet the "scientific" or "research" criteria used by most of the international database producers; (2) the types of information needed by users in nonresearch communities often fall outside the coverage

Table 1. Coverage of literature from selective countries in Asia.

	ASFA						AGRIS		
	Whole Database ^a			Fisheries ^b			Category M ^c		
	1990	1991	1992	1990	1991	1992	1990	1991	1992
China	615	620	565	99	138	108	—	191	98
Indonesia	63	67	50	28	26	20	293	87	88
Malaysia	47	32	51	25	17	18	61	38	61
Philippines	59	44	51	28	24	17	238	257	246
Thailand	41	105	32	21	56	17	139	181	81

^a Number of records combined with publication year and the name of the country in all fields.

^b Number of records combined with publication year and the name of the country and key words [aquacultur*, aquatic*, fish*, living(3w)resource* or living(3w)marine*] in all fields.

^c Number of records in the category M - Fisheries and Aquaculture, combined with the name of the country in all fields for each calendar year.

of "research" databases; (3) language barriers; and (4) limited availability of literature from developing countries because they have less systematic methods of publication and distribution.

Coverage of literature from developing countries in the international and regional abstracts, indexes, and databases is still rather limited. For example, a majority of the ASFIS/ASFA partners, i.e., ASFA input centres, are still in industrialized countries; only three (China, Mexico, and India) of the fifteen ASFA input centres are in developing countries. The evaluation of ASFA carried out in 1991 (21, 26, 36), noted that: (1) only about 25% of the literature included in ASFA is in the main fisheries category; (2) only about 50% of the references listed in the various bibliographies commissioned by FAO and ICLARM are found in ASFA; and (3) a relatively small portion of the main fisheries literature in ASFA is current compared with other international abstracting services. Table 1 gives a crude indication of the coverage of fisheries literature from five Asian countries in two international information sources.

It should be stressed that the above numbers are indicative figures. The actual number of records related to fisheries in both databases could be higher because the searches were not exhaustive. It should also be noted that the contents of the records that were retrieved were not examined.

FAO has been dealing with issues related to the coverage of literature from developing countries (14, 19, 21) and to improved distribution of ASFIS products. An attempt is being made to increase the number of ASFA input centres in developing countries, to increase the number of

ASFA products available to developing countries, and to strengthen national capabilities to participate in the international information system. It is anticipated that implementation of the results of the current negotiation between the ASFA producer and FAO will begin in 1994 (21). Results of this study reveal the poor coverage of locally appropriate information by the international information sources, particularly for resource-base management and technology transfer. However, the causes for this inadequate coverage should not be attributed entirely to the producers of the international information sources. The fundamental causes are lack of data and information appropriate for local use, and lack of systematic efforts to analyze, synthesize, digest, and present the data and information in the context of local needs and problems. In spite of their usefulness, most existing efforts, e.g., publications of FAO, SEAFDEC, Bay of Bengal Programme (BOBP), and national extension agencies, are too little and too ad hoc in relation to the needs.

The majority of policymakers, planners, and managers indicated the need for synthesized overviews of policy and management options and approaches. There are several established reviews in fisheries and related fields, e. g., *Advances in Marine Biology*, *Annual Review of Ecology and Systematics*, *Marine Ecology Progress Series*, and *Oceanography and Marine Biology: an Annual Review*. The review papers that appear in international publications are normally captured by ASFA and other international abstracting services. However, most of the review papers are subject- or discipline-oriented, and tend to deal with narrow scientific topics. Fewer review papers give an overview of the problems in fisheries resource management relevant to developing countries, and the management and policy options. To some extent, publications of various international and regional fisheries bodies, e.g., FAO and its various commissions, ICLARM, SEAFDEC, Network of Aquaculture Centres in Asia-Pacific (NACA), and BOBP, have filled these gaps. However, there is no concerted and systematic effort to provide the policymakers and managers with analyzed and synthesized management options and approaches.

Although the potential benefits of fishery projects and planning information are recognized, information users do not see the special usefulness of existing FIPIS and FIPDAT. Understandably, the users found that the data and information gathered for use by the international agencies are often unsuitable for local management purposes. Local resource management information bases, such as GISCAMP, are still in the development and testing stage and are not readily available to the local planners and managers. When widely available, databases such as FishBase and ReefBase will be useful information sources, particularly for academic and scientific communities, because they will be comprehensive electronic encyclopedias about fisheries.

Causes of Poor Relevance and Utility

Information captured in the international information sources is underutilized, particularly by the users in nonscientific or nonresearch communities. The main reasons are:

Content and coverage

- Much of the information needed and used by nonresearch communities does not meet the selection criteria, i.e., scientific standards, that are used by the international information programs. Therefore, the international information sources are not as useful to nonresearch communities as they are to the research community.
- There exist few information sources and libraries that specialize in collection, organization, and provision of extension information, technology digests, policy, and regulatory information.
- Nonresearch information is relatively difficult to collect. Unlike research information that appears in refereed journals, conference proceedings, technical reports, and books, which are formally published and widely distributed, nonresearch information is largely produced by public or nonprofit institutions in the form of pamphlets, leaflets, or manuals that are distributed to a limited number of people without marketing or promotion.
- Existing information sources are organized by discipline and information is fragmented. Availability of integrated information, which combines biological data and information with environmental, economic, social, regulatory, and technological information, is severely limited.

Presentation and communication

- Research outputs are packaged and presented for the use of researchers; little or no attention is given to the needs of other groups of users (11, 29, 38). Research outputs are often written in scientific terminology and jargon that is not easily understood by nonresearchers. Also, most research papers or reports deal with specialized and narrow aspects of a scientific problem, and the information is not presented in the context of local management problems and needs.
- The different information-seeking behaviour of the users in the nonresearch communities requires different approaches in information delivery. Users in nonresearch communities tend to be information receivers rather than information seekers. Passive information dissemination through abstracts, bibliographies, and databases is not an effective delivery mechanism for information receivers.

Bureaucratic language and professional barriers

- The process of information flow and utilization in decision-making and policymaking and planning is not well understood. There is little understanding of the patterns of information seeking by users in the nonresearch community.
- The trickling down process, from research to utilization, takes too long; there is little concerted and coordinated effort to bridge the gap between the research, extension, policy, planning, and information communities.

- The language used by the research community and international information sources, i.e., English, is not the working language of most information users and providers in Asia.
- The distribution mechanisms and infrastructure do not facilitate wider accessibility and use of information products. Complementary copies of publications from international and regional organizations are often sent to the heads of the institutions or to individual researchers and remain on the shelves of those individuals. The same applies to extension materials sent to provincial or district offices. These extension materials often get lost in offices and do not reach the fishing community.

Issues and Constraints

Table 2 summarizes the main issues and constraints to effective use of information in the fisheries sector. The difficulties and problems in obtaining and using information in the fisheries sector are not too different from those in other sectors, e.g., agriculture (10, 16). They seem to confirm the statement that in order to take full benefit of the information society, one must speak English and live in an industrialized country (17).

Inadequate financial and human resources to develop and sustain fisheries information programs are one of the most common constraints in Asia. Most of the information centres and libraries supporting the fisheries sector, particularly at the national and subnational levels, do not have the financial and human resources to develop information resource bases and services. Because the financial resources allocated to information programs are totally inadequate, the development of collections relies mostly on donations, gifts, and exchanges. As a result, the information providers tend to add whatever they receive to their collection regardless of the relevance and utility of the materials.

The value of information is recognized by the researchers and information professionals. However, this recognition is not always shared among senior managers, policymakers, and donor agencies. Senior managers often believe that support for experiments, training of scientific staff, and equipment supplies are more important than good information services for research. There is lack of understanding that the collection, analysis, organization, and dissemination of information are costly operations that must be sustained for a long period. Subsequently, information programs rarely receive adequate support and commitment from managers and policymakers (2, 20), and whenever there is funding shortage, support to information programs is often the first to be cut, although the resources that are allocated are minimal and inadequate to begin with.

One of the fundamental constraints that is not widely recognized, but is critical to effective access to and use of information, is the narrow view of information programs held by the senior managers and policymakers. Most senior managers and policymakers associate information programs with the documentation centres, libraries, and collections of books and journals. They overlook the fact that information packaging and dissemination activities, such as production of

Table 2. Issues and constraints to effective use of information in the fisheries sector.

ISSUES	CONSTRAINTS
• Accessibility, Availability, and Timeliness of Services	<ul style="list-style-type: none"> • Poor local or institutional information resources and services • Unawareness of accessible information resources and services • Lack of qualified information staff • Lack of locally appropriate and usable information • Dispersed information among many agencies and programs • Language, bureaucratic, and professional barriers • Poor local communication and transportation infrastructure • Cost of service and lack of financial resources • Lack of integrated information across all disciplines that affect aquatic resources
• Compatibility, Reliability, and Currency of Information	<ul style="list-style-type: none"> • Lack of cooperation among related programs and institutions • Lack of systematic methods and mechanisms for collection, organization, analysis, synthesis, and dissemination • Lack of qualified information staff
• Appropriateness, Completeness, Relevancy, Suitability, and Utility	<ul style="list-style-type: none"> • Poor local information resources and services • Lack of understanding of users, user needs, and processes in flow of information • Lack of subject knowledge on the part of information staff • Lack of digested, integrated, and appropriately packaged information • Lack of locally appropriate information • Lack of qualified information staff • Language, bureaucratic, and professional barriers
• Sustainability and Cost	<ul style="list-style-type: none"> • Lack of support and commitment of senior managers, administrators, and policymakers • Lack of funds and financial resources • Lack of leadership
• Qualifications of Information Staff	<ul style="list-style-type: none"> • Lack of trained professional staff • Lack of training opportunities • Narrow view and definition of information program • Low salary and status of information staff

extension materials and special briefs, development communications, and extension of research information, are part and parcel of information activities (see inner box, Figure 1). Lack of this recognition has delayed and prevented development of wholesome information programs and qualified personnel in the field.

The qualifications and training requirements of information professionals have been misunderstood for a long time. Because of this narrow view of information activities, it is often thought that persons who like to read are suitable information specialists. Until recently, little or

no attention was given to qualifications such as professional competence, initiative, resourcefulness, leadership, and ability to work with people. Consequently, the need for professional training has not been well recognized, and this has limited training opportunities. Librarians and information specialists do exist, but their training is often limited to the areas of bibliographic information control, and their status closer to support staff than professional staff. There are few trained information resource managers, scientific editors, writers, and communication specialists within the information programs. Information management and dissemination is complex and requires a broad range of professional expertise.

Because aquatic resources are affected by many human activities both on land and water, development and management of the resources must take account of activities in related sectors. Unfortunately, no effective cooperative linkage mechanisms exist among the related programs and sectors. Until recently, fisheries sector management took a disciplinary approach, and generally depended on biological data and information. Policy planning and resource base management have been adversely affected by the lack of integration of fishery data and information with environmental and socioeconomic data and information and by the lack of appropriate analytical tools.

Lack of appropriately packaged and integrated information was one of the most serious constraints identified by users. Research results are available, but the users in nonresearch communities are not able to benefit because the information is not integrated, synthesized, and presented in the context of local problems and needs. Furthermore, information is fragmented by discipline and sector. Professional barriers are another key constraint. On the whole, fisheries research information remains within the research community, and the research community makes no significant effort to make research results accessible and useful for solving management problems in the fisheries sector. Researchers are recognized for their "research" or "scientific" work by their peers, i.e., other researchers. They are not well rewarded for their efforts to make their research results available and known to the nonresearch community. Therefore, the main concerns of most researchers are to produce good "scientific" publications that are recognized by the research community. Few researchers identify policy planners, extension specialists, and the fishing community as their clients or users of their research findings.

An important challenge is to demystify research results and make them available to the fishing and fish-farming communities. Recognizing the importance of agricultural extension, international and national programs have invested considerable efforts and resources to develop agricultural extension infrastructure and human resources. Unfortunately, the fisheries sector has not received the same level of support and investment as land-based agriculture. Programs are needed to facilitate collaboration and cooperation between extension, research and information communities for the management and development of fisheries and aquatic resources.

Fisheries information services and systems in Southeast Asia have made considerable progress in the past decades. However, because of these constraints, they are not effective in meeting the needs of their users, and there is a leadership gap in facilitating and promoting cooperation and

collaboration among the related programs and institutions. Since completion of the SEAFIS project in 1989, the region has been without a coordination mechanism that facilitates and promotes fisheries information services and information exchange. The region does not have one active participating institution in the international fisheries information system, ASFIS/ASFIA. The national capabilities developed during the SEAFIS project have stood still over the past 4 years.

In addition, the fisheries sector in Asia does not have a clear understanding of the information needs of their target users, the information-seeking patterns of the users, the role of information in solving management problems, the flow of information, the relationships between various information acquisition channels, and the factors affecting use and nonuse of information. Better understanding of fisheries information flow and utilization in the processes of decision-making and problem-solving is needed to guide formulation of a strategy to establish and strengthen proactive, need-driven information programs.

Information users are discouraged by the amount of time and effort required to obtain the needed information, and incomplete, insufficient, and fragmented information and services frustrate the users. The respondents in this study pointed out that: (1) the fundamental problem is appropriateness of information and timeliness of services, not the lack of information; and (2) what is needed is useful information, not bibliographic listings, publications, or articles. It must be understood that information users generally accept what is provided. Lack of criticism should not be interpreted as user satisfaction. It is generally known that the more services that are provided, the more demanding the users become. Improved accessibility and availability of existing international abstracts, indexes, or databases in developing countries will certainly remove some of the constraints and improve availability of research information. However, **in view of the lack of locally appropriate and relevant materials covered by existing information sources, priority must be given to accessibility and availability of relevant and useful information, not just to accessibility and availability of existing information sources.**

Options for Action

These recommendations reflect urgent needs during a period when the global community is concerned with conservation and the sustainable exploitation of aquatic resources.

Prerequisite

Effective dissemination and use of information involves a series of carefully planned activities: generation and gathering; organization; analysis; packaging; distribution and provision; and utilization. The process requires a variety of expertise and substantial financial resources. Importantly, improvement in use of information requires the commitment and willingness of the fisheries sector to invest in information programs. It is, therefore, necessary to recognize these prerequisites for the establishment and implementation of effective and sustainable fisheries information programs and services:

- Information is an essential input to development plans and actions at all levels.
- Management of the fisheries sector requires a broad range of information, including biological, economic, environmental, infrastructure, legal and regulatory, policy, scientific, sociocultural, and technical aspects.
- Dissemination of research outputs is as important as research, and investments in facilitating and promoting use of research outputs are as essential as investments in research.
- Information programs encompass a broad range of activities: collection, processing, organization, analysis, packaging, distribution, dissemination, and provision.
- Fisheries information programs must have a framework and strategy.
- Information programs and services must be need-driven.
- Leadership, expertise, and qualified professionals are required to initiate, design, implement, and manage need-driven fisheries information programs.

The issues and constraints highlighted in this study clearly show that immediate action is required on several fronts. Understanding of the processes of information flow, the relationships among various information and communication channels, and the factors affecting the use and non-use of information is essential for formulation and implementation of effective information programs. Countries must have national information resources that can effectively meet local and national information needs, and regional cooperation and collaboration are needed to support and supplement national efforts and to facilitate sharing and exchange of data and information essential to the management of common aquatic resources. Relevant and usable information must be available and accessible to support research activities as well as to support policy planning, management, the fisheries industries, and the fishing and fish-farming communities. Effective tools and methods must be developed not only to manage disciplinary data and information, but also to manage and analyze multidisciplinary and multisectoral data and information that combine the biology, ecology, economics, engineering, and social sciences that affect aquatic environment and resources. **Countries must have the capability and capacity to formulate, implement, and sustain national information programs and participate in international programs.**

Development of national fisheries information resources and services

Addressing the issues and constraints related to accessibility, availability, cost, and timeliness of services, the goal of this program is to ensure the availability of national information bases from which source information and referral services can be provided. Equipping every fisheries library or information centre with adequate information and financial and human resources may be ideal, but it is not a practical solution. However, it is practical and feasible to establish a few well-equipped special libraries and information centres in each country, and to use them as national resources (10, 23). The main objectives of this program should be:

- To establish a few selected specialized information centres and libraries at the national or subnational level;

- To develop and strengthen information resource bases through acquisition of appropriate international, regional, national, and local information;
- To compile and produce new information access tools such as comprehensive directories or inventories of fisheries institutions, experts, research and development projects, information centres and resources, and funding agencies;
- To acquire the facilities necessary to provide services;
- To establish a network of information resources and services both at the regional and national level and at the subnational level;
- To develop and strengthen the skills of information staff;
- To initiate proactive information services, including current awareness, document delivery, and referral and technical backup services to other libraries, and user-orientation programs; and
- To ensure long-term viability of information program through establishment of appropriate mandates and policies.

It should be noted that the national fisheries information programs in Asia are at different stages of development and, therefore, require different levels of support and approaches. For example, Indo-Chinese countries require development and establishment of basic information infrastructure (facilities, resources, and personnel); whereas, Southeast Asian Nations (ASEAN) countries require improvement in the effectiveness of existing programs. Program planning and design, choice of methodology, and technology must take into account local needs, conditions, capacity, and capability.

Analysis and synthesis of aquatic resource management information

The goal of this program is to provide packages of policy options and management approaches that will enhance sustainable use of aquatic resources. The packages may include analysis and overviews of policy issues related to management of coastal resources, applicable regulatory measures and incentives, and implications of each management option. Systematic provision of synthesized and integrated information on resource management would assist not only in formulating appropriate policies and management measures, but also in identifying further research and policy requirements. The main objectives of this program should be:

- To analyze and interpret data and information in the context of regional, national, and local resource management issues and needs;
- To prepare and produce a series of overviews of management and policy options and approaches;
- To disseminate the synthesized information widely and to promote public awareness of issues related to sustainable management of fisheries and aquatic resources through appropriate media and languages;
- To facilitate and promote exchange and use of policy and regulatory information through establishment of appropriate linkages among the related programs and agencies in the region; and

- To strengthen national and regional capabilities in the preparation and production of reviews and briefs, including information analysis, scientific editing, writing, and effective presentation.

Attention needs to be given to the establishment of incentive mechanisms for scientists and researchers to present their research results in the context of local management issues and problems, and to develop programs through which scientists and technical people can improve their skills in information packaging and presentation. Research and scientific communities must recognize that their responsibility includes conducting research as well as making the research outputs understandable and useful to the society.

Development of analytical tools for aquatic and coastal resource management

This program is closely related to *analysis and synthesis of aquatic resource management information*, but emphasizes development and use of information tools. Decisions and problem solving in aquatic resource management must be supported by effective and efficient tools to integrate, analyze and model multidisciplinary and multisectoral data. The goal of this program is to accelerate availability of analytical tools for coordinated planning and management, particularly at the local level. In recent years, GIS and remote sensing have been widely applied in many areas of resource base management. However, application of such tools in aquatic and coastal resource management is still relatively new and is largely used for the production of cartographic maps. The main objectives of this program should be:

- To develop a prototype information tool to integrate and analyze data and information essential for coastal resource management using selected pilot sites;
- To demonstrate application of such information tools as GIS for integration, analysis and modelling of multidisciplinary and multisectoral data and information in support of policymaking and planning and management decisions;
- To evaluate, recommend, and disseminate management and policy options based on the analysis;
- To facilitate and promote the use of common and compatible methods of data and information collection and exchange among related agencies and programs;
- To facilitate and promote data and information exchange through establishment of appropriate cooperative mechanisms and networks both at the national and regional levels;
- To disseminate and make available the experiences and results of these activities; and
- To strengthen national and regional capabilities in the use of the information tools, and the analysis and interpretation of multidisciplinary and multisectoral data for aquatic and coastal resource management.

The emphasis of this program should be on: (1) adaptation and application of the tools that are readily available; (2) making the tools available to the local resource managers and planners, e.g.,

provincial and district levels, including both GOs and NGOs; (3) building the local capabilities and capacities to integrate, analyze and interpret data from multidisciplinary and multisectoral sources; and (4) recommending and disseminating management and policy options, including implications of various decisions.

Establishment of technology transfer network

The goals of this program are to facilitate dissemination and use of research outputs by fishing and fish-farming communities. Use of environmentally sound methods of exploiting aquatic resources, fishing, fish-farming, and postharvest handling is severely limited because of limited transfer of technology to the people who are directly involved in exploitation and use of aquatic resources and a lack of awareness of alternative methods. Therefore, the main objectives of this program should be:

- To facilitate adaptation of technologies, policies, and regulations;
- To systematically collect, organize, and disseminate fisheries extension and technology packages;
- To digest and repackage technical, policy, and regulatory information in a form of fisheries extension and technology transfer packages that are locally appropriate and in local languages;
- To facilitate and promote the exchange of fisheries extension and technology packages through establishment of appropriate networks at the national and regional levels;
- To strengthen and develop national capabilities in the areas of development communication, production of extension materials, and repackaging of information;
- To collect, organize, and disseminate local and indigenous knowledge, and provide feedback to the research community and policymaking bodies; and
- To establish a feedback linkages through which needs of the fishers and fish-farmers and the conditions of aquatic resources could be communicated to the research community and policymaking bodies.

Important challenges in this program are to make research results and management measures known to fishing and fish-farming communities, to strengthen collaboration and cooperation between the extension, research, and information communities, and to build national capacity in development communication and information packaging. Special consideration must be given to local needs, conditions, and user characteristics.

Flow of information in aquatic resource management

We have some understanding of the information-seeking behaviour of researchers and scientists and the flow of information and communication within the research and scientific communities. However, little is known about how information flows and is used in nonscientific communities.

Most of the existing fisheries information programs have been established under the assumption that information flows sequentially from research to use, and mainly to support the information need of the scientific and research communities. To answer questions related to the effectiveness and efficiency of existing information programs and services, it is essential to acquire a better understanding of the processes of information flow and utilization.

To support these programs, an in-depth study is required to investigate the flow of information during processes of policymaking and problem-solving in the fisheries sector and in fishing and fish-farming communities. The study should examine who needs to use what information and how and when, the sources of information, the role of existing information sources and services, the factors affecting use and non-use of information, the key nodes or points where information converges and diverges from, and the relationships among formal and informal information channels. The findings of the study could guide the development of dissemination mechanisms and the design of appropriate information packages.

Approaches for Implementation

Coordination and leadership

It is obvious that concerted efforts at the regional, subregional, and national levels are required to improve the availability of relevant information to support sustainable aquatic resource management and utilization. It is also clear that building national information capability, in collaboration with regional and international programs, is essential to achieve the global goals of sustainable development. However, in a period when national information programs are in a developmental stage, regional collaboration and cooperation will be more effective and efficient in supporting and supplementing national efforts. To implement these programs, regional bodies and organizations with the appropriate mandates must provide leadership.

An example of this regional leadership is the organization of the Regional Workshop on Fisheries Information and Statistics in Asia, held in January 1994, by SEAFDEC and FAO/RAPA in collaboration with twelve international and regional bodies. Another example is the collaborative efforts of BOBP, the Mekong Secretariat, NACA, SEAFDEC, FAO/RAPA, and SIFR to facilitate the implementation of the recommendations adopted at the regional workshop.

Selective and subregional approaches

Within the overall regional framework, program formulation should take a progressive or gradual approach that is based on shared water bodies, e.g., Bay of Bengal, Mekong River Basin, and the South China Sea. A subregional approach would facilitate active participation and cooperation among the participants and ensure formulation of a need-driven program that addresses issues in the use of common resources. In addition, existing regional and subregional fisheries bodies could be used to coordinate information programs.

Program formulation

The fisheries information program is designed to meet the information needs of the sector. Therefore, it is essential that the strategy of the information program is closely related to the strategies of the sector. Furthermore, fisheries information programs must position themselves between the fisheries communities and their information needs, and should play the role of an active information broker, promoter, and disseminator. Therefore, before investing in regional programs, it is necessary for participating countries to carry out an in-depth assessment of national information needs, capabilities, and capacities, and to analyze the flow of information in the fisheries sector. Outputs of such assessments should guide the specific objectives, activities, and methodologies of the regional programs.

Success of regional initiatives is affected by many factors. A number of studies (e.g., 1, 2, 3, 5, 6, 7, 31, 33) report experiences in developing and designing information programs and projects as well as in networking. Lessons from past experiences, particularly the experiences of the regional fisheries information projects such as AGRIASIA, SAFIS, SFIS, BRAIS, and SEAFIS, should be kept in mind in designing and formulating new information programs. The basic factors that must be considered include:

- **Mandates** - Information program must have appropriate mandates.
- **Host institution** - The mandates and missions of the information programs should be consistent with the mandates and missions of their host. Furthermore, the host institutions must have the necessary capabilities, commitment, and resources to support and sustain information programs.
- **Framework and partners** - A clear and concise framework for the program must be spelled out, and potential partners must be identified.
- **Needs** - Information programs should be driven by user needs. The target users and their needs, the needs to be addressed, the objectives, the scope of the activity, the general methodologies, and the short-term and long-term directions must be clearly identified and stated.
- **Compatibility and complementarity** - This should be applied to the program content, methodology, and procedures. Cooperative programming and specialization should be encouraged to avoid unnecessary duplicated efforts.
- **Multiplier effect** - Benefits of the investment should be ensured.
- **Resources** - Resources necessary to implement and sustain program activities must be secured.
- **Feedback mechanisms** - Interactions and interfaces with users must be maintained to receive regular inputs and establish support mechanisms.

Regional information networks

The objectives of the regional and subregional programs are to support and supplement national efforts. Apart from its indispensability for effective fisheries information exchange, establishment

of a regional information network is particularly desirable because the network helps to muster regional commitment and energies for strategic planning and implementation in a manner that an individual information centre or program cannot inspire. Therefore, regional information network(s) must be developed with these objectives:

- To mobilize national and regional commitment and efforts to promote use of information for the sustainable development and management of fisheries resources;
- To support national efforts to formulate fisheries information strategies and frameworks;
- To develop regional information resources, services, and technical capabilities that complement and back-up national resources, services, and capabilities;
- To develop and promote the use of common and compatible methodologies and tools for information management;
- To assess and coordinate training needs and programs at the regional level;
- To facilitate and promote effective and efficient information exchange and flow at the regional and international levels, including promotion of close collaboration with international information systems; and
- To provide a professional forum to assess information needs, issues, and constraints, and to explore appropriate solutions to the constraints identified.

Information technology

Selection of appropriate information technologies should be determined according to needs and local conditions and capabilities. There was a general tendency to look at CD ROM as the technological solution for accessibility and availability of information in developing countries. In light of rapid progress in information technology and other flexible access and communication mechanisms such as electronic networking that are presently available, the decision on applicable technologies should be made after an in-depth study of the feasibility, advantages, and disadvantages of various mechanisms for accessing and delivering information, e.g., use of paper copies, on-line databases, CD ROM, and electronic networking systems such as Internet that offer access to many databases and document delivery mechanisms. In this context, it is possible for the developing regions to benefit from "technological leapfrogging".

Compatibility and Complementarity of Nonstatistical Information in Asia

[The full report by J. Maclean was published in Volume II of the Proceeding of the Regional Workshop on Fisheries Information and Statistics in Asia, held in Bangkok, Thailand on 18-22 January 1994. The proceedings are available from SEAFDEC (Contact: Dr. Maitree Duangsawasdi, Secretary-General, SEAFDEC, Bangkok, Thailand. Fax. 66-2-308-2462), FAO/RAPA (Contact: Dr. Veravat Hongkul, Regional Fisheries Officer. Fax. 66-2-280-0445), and SIFR (Contact: Dr. F Brian Davy, Executive Secretary. Fax. 1-613-567-4349)]

There are 27 major international, regional, and national information sources, and some 200 other institutions that offer information to the fisheries community in Asia. Publications are the most commonly used information source in the fisheries sector. Many national and regional fisheries research networks and societies supply literature and serve as mechanisms for information exchange.

At the regional level, information sources are organized more topically, e.g., agricultural aspects (AGRINFONET), postharvest (AFHB), marketing (INFOFISH), brackishwater aquaculture (BRAIS), and seaweeds and invertebrates (SICEN), or geographically, e.g., Southeast Asia (SEAFIS) and Pacific Islands (PIMRIS). A number of countries, e.g., Indonesia, Malaysia, Thailand, Philippines, Sri Lanka, China, and India, have national fisheries information services and systems and maintain national bibliographies in fisheries and related fields.

The study points out that most fisheries information sources aim to serve different but overlapping user groups, with different purposes. As a result, there is considerable overlap among the sources. The two main international bibliographic databases (i.e., AGRIS and ASFA) and the two databases on brackishwater aquaculture (i.e., BRAIS and SFIS) overlap, as do the two project databases (i.e., CARIS and FIPIS). Overlap also exists among subregional bibliographic databases (e.g., AGRINFONET and SEAFIS; and PIMRIS and PRAIS).

At the same time, there are gaps in the coverage of grey literature in the tropics, and in information about locally funded projects. It has been suggested that ASFA and ICLARM's Naga database may have to double their annual inputs to comprehensively cover the literature in the sector. Project databases such as FIPIS must include all externally and internally funded projects, not just the projects of major donors.

The major issues related to regional fisheries information services are:

- Geography - Indo-Pacific, the definition used by FAO and ASFA, should be used instead of Asia. Use of the term Indo-Pacific would enable users to think of a bounded area supported by a definable set of literature.

- Access - Access to bibliographic information can be improved through the use of common management tools and the creation of information-access tools such as a union catalogue. Use of CDS/ISIS, a commonly used database management software in Asia at the national level, and regional consolidation of national databases would be an economic way to create and maintain a regional fisheries database.
- Timeliness - Timeliness of information on projects in progress could be improved by cross-referencing documents and literature with the projects and by incorporating project information into ASFA.
- Relevance - Low relevance of existing information to needs in Asia is mainly due to lack of information on tropical fisheries, language barriers, and the emphasis on subject-oriented research papers. Given the ecosystem approach now being used in research, ASFA is commended for its farsightedness in including all aspects of literature dealing with aquatic resources. However, ASFA is urged to be more thorough in its coverage and to broaden its scope to cover project information. An issue related to relevance is the language barrier. ICLARM has experimented with machine translation between English and French and machine translation between Asian and European languages is a matter of time.

Donor funded projects are extremely useful, but they generally last only for the duration of the project. As an alternative, the study suggested that a wealthy agency in the region (e.g., in Australia) could assume a responsibility for maintaining a regional database that merges national databases.

To improve access and availability of information for the management of fisheries resources in Asia, the study recommends:

- The Indo-Pacific faunal zone should be used rather than Asia.
- China, Korea, and Japan should form a separate group.
- CDS/ISIS should be used as a common tool to manage national bibliographic databases, and copies of national database might be provided to a single agency to be merged and redistributed.
- Regional databases should be merged with ASFA, and FIPIS should broaden its scope and merge the data into ASFA.
- Existing loose networks of library and information services and programs should be formalized.
- The members of the network should join IAMSLIC and form an Asian Branch of IAMSLIC.
- All information services and programs should use FishBase and ReefBase.

Information Tools for Fisheries Resource Management

[The full report by Jørgen Rubek Hansen was published in Volume II of the Proceeding of the Regional Workshop on Fisheries Information and Statistics in Asia, held in Bangkok, Thailand on 18-22 January 1994. The proceedings are available from SEAFDEC (Contact: Dr. Maitree Duangsawasdi, Secretary-General, SEAFDEC, Bangkok, Thailand. Fax. 66-2-308-2462), FAO/RAPA (Contact: Dr. Veravat Hongskul, Regional Fisheries Officer. Fax. 66-2-280-0445), and SIFR (Contact: Dr. F Brian Davy, Executive Secretary. Fax. 1-613-567-4349)]

The analysis and identification of functional relationships among various units within the fisheries sector can be assisted by use of a prototype of a Reference Model for Integrated Fisheries Resource Management (IFRM). The suggested reference model follows the IDEF (Integrated Computer Aided Manufacturing Definition) Methodology.

Deficiencies in existing efforts to develop fisheries information systems in Asia are caused mainly by:

- Lack of conceptual modelling of common functions and objectives.
- Ambiguity in organizational structure about functional responsibilities for overall coordination and control.
- Lack of documentation of existing activities and methodologies.
- Lack of standardized methodology for modelling of functions.
- Most outputs of fisheries activities have been produced without clearly defined users.
- Inappropriate presentation and communication medium for data. Publications, the most commonly used communication medium in the fisheries sector, are not always appropriate for data exchange.

Many computer software programs that are commercially available can be applied, with relatively few modifications, to manage the information essential for aquatic resource management. Software is available to manage data and information in such areas as database management, communication and networking, financial management, statistical analysis, word processing and desktop publishing, graphical presentation, GIS, project control and management, and function and data modelling.

To develop effective information systems for management of the fisheries sector, the study recommends that:

- A system architecture for integrated fisheries resource management be developed.
- An organization be identified to be responsible for the coordination of the activities

required to develop the system.

- The role of all functional units within the fisheries sector be determined.
- A common communication model be extracted and compiled.
- Data models and systems be developed on an incremental base, by adapting commonly available software.
- The system be implemented and extended on selected water bodies.

Regional Action Plans

The objectives of the Regional Workshop on Fisheries Information and Statistics in Asia (32), held in Bangkok, Thailand, 18-22 January 1994, were to review the current status of fisheries information programs and services available to users in Asia, to identify requirements for improvements, and to explore ways and means for improved regional cooperation and coordination.

Forty-four participants from 17 countries and 40 representatives from 13 regional and international bodies addressed a variety of topics related to the management and use of information in fisheries sector. To improve the availability and promote the use of fishery information in Asia, it is essential to produce appropriate information products for target user groups (e.g., policymakers and planners, fishing and fish-farming communities, extension community and research community) to disseminate information through locally appropriate media and languages, and to improve the methods and skills needed to manage and share information resources.

Constraints to Effective Use of Information

The participants identified common issues and constraints to effective and efficient dissemination and use of fisheries information. Table 3 shows that limited financial resource and language barriers are the common constraints in all countries. It also shows that the geographically closer countries tend to have relatively similar constraints. For example, the main issues and constraints of Indo-China are:

- Lack of trained information staff and expertise;
- Poor national or local information resources and services; and
- Limited information processing capabilities and facilities.

The main concerns in South Asia are:

- Lack of synthesized and packaged information for fishery resource management;
- Lack of digested and packaged information for extension and technology transfer purposes;
- Limited information processing capabilities and facilities;
- Lack of standard information handling methods and tools; and
- Lack of trained information staff and expertise.

The main concerns in Southeast Asia are:

- Lack of trained information staff and expertise;
- Lack of standard information handling methods and tools;

Table 3. Issues and constraints to effective use of fishery information in Asia.

Issues and Constraints	Countries
Poor national or local information resources and services	Cambodia, Laos, Indonesia, Maldives, Philippines
Lack of coordination and collaboration among related programs	Nepal, Philippines, Vietnam
Lack of standard information handling methods and tools	Bangladesh, Brunei, Malaysia, Maldives, Indonesia, Pakistan, Philippines
Language barrier: Common language - English?	All countries with different degree of difficulties
Lack of timely information services	Bangladesh, Brunei, China, India, Indonesia, Malaysia
Limited information processing capabilities and facilities	Bangladesh, Cambodia, China, Indonesia, Maldives, Nepal, Pakistan, Vietnam
Lack of trained information staff and expertise	Bangladesh, Brunei, Cambodia, China, Indonesia, Laos, Malaysia, Nepal, Pakistan, Philippines, Thailand, Vietnam
Lack of funds for information programs	All countries
Unawareness of information programs and services	China, Philippines
Ineffective regional cooperation	Malaysia, Thailand
Low priority given to information programs, (i.e., lack of support and commitment)	Bangladesh, Cambodia, Malaysia, Pakistan, Philippines, Thailand
Poorly organized information	Philippines
Lack of packaged information for extension and technology transfer	Bangladesh, India, Indonesia, Malaysia, Maldives, Pakistan, Philippines
Lack of packaged information for fishery resource management	Bangladesh, India, Indonesia, Malaysia, Maldives, Pakistan, Philippines, Sri Lanka

- Lack of synthesized and packaged information for fishery resource management;
- Lack of digested and packaged information for extension and technology transfer purposes;
- Lack of timely information services; and
- The low priority given to information programs (i.e., lack of support and commitment).

Given the fact that each subregion had relatively similar constraints, shared aquatic resources, and subregional fisheries bodies and programs linking the countries, the participants decided that subregional approaches would be more viable than an Asia-wide approach to formulating action plans. On the basis of the priority needs of the countries, the participants formulated three subregional action plans, i.e., Indo-China (Cambodia, Laos, and Vietnam), South Asia (Bangladesh, India, Maldives, Nepal, Pakistan, and Sri Lanka), and Southeast Asia (Brunei, Indonesia, Malaysia, Philippines, and Thailand).

Because the conditions and issues in Australia, China, Japan, and Taiwan are sufficiently different from the other countries, they were not considered as direct participants in the subregional action plans. However, the representatives of those countries supported the subregional action plans, and expressed a strong interest in establishing linkages with the subregional information programs.

Action Plans for Indo-China (Cambodia, Laos, and Vietnam)

- (1) To formulate a national policy to strengthen information systems in support of national research and development.
- (2) To establish national information centres and sub-centres located in different regions of the country to form a fishery information network.
- (3) To strengthen the information network by setting up suitable libraries in the centres and subcentres with appropriate facilities for development, processing, and dissemination of information and training of staff to allow them to function effectively.
- (4) To build up the targeted national fishery information to meet the user needs by conducting a fishery census, proper statistics activity, and required research for appropriate decision-making on development (and) management.
- (5) To link the Indo-China and Asian regional systems to be able to exchange information through the coordination of NACA and the Mekong Committee.
- (6) To link the different fishery information centres and services (e.g., FAO, ICLARM, SEAFDEC, AIT, and INFOFISH).

(7) To obtain immediate international assistance for the first and second items in this proposed action plan, long-term assistance for the third item, and the fourth item specifically for Cambodia and Laos.

(8) FAO, NACA, and Mekong Secretariat to assist the Indo-Chinese countries in preparing project proposals based on these action plans.

Action Plans for South Asia (Bangladesh, India, Maldives, Nepal, Pakistan, and Sri Lanka)

The South Asian subgroup enumerated the constraints encountered on fishery information in the participating countries and came up with priorities on certain constraints that were peculiar to some of them and some constraints that were common to all of them. These priorities, and the suggestions for their solution, are:

(1) **Mechanisms for collection and dissemination of information** - Poor national and regional information on resources and services. A Fishery Resources Survey System (FRSS) should be reorganized through a frame survey. Coordination of information at one place for compilation and dissemination should be developed. Existing computer facilities should be improved in the participating countries.

(2) **Trained expertise** - Absence of adequate skilled and trained human resources and infrastructure for the fishery information system is a great hindrance in all participating countries except India. The national institutes should be extended the necessary assistance by international and regional bodies.

(3) **Compilation, processing, and reporting of data** - Absence of a central information unit in some participating countries is a hindrance to framing fishery information. This will enable countries to compile, process, and report data from different agencies involved in data collection.

(4) **Cooperation and collaboration with international agencies** - Absence of regional offices of ICLARM, SEAFDEC, BOBP and other international and regional offices in some participating countries is also a hindrance to the proper collection of fishery information. These offices should be set up in the participating countries, and existing offices should be strengthened.

(5) **Strengthening of information services** - Existing library facilities in connection with fishery information in some countries are not adequate. These should be strengthened.

(6) **Necessity of information tools** - Inadequate transport and other equipment and

facilities needed for data collection are also a great hindrance to fishery information. These facilities should be developed.

(7) **Finances** - Absence of adequate funds necessary to undertake programs in connection with fishery information is a common constraint. Adequate funds should be made available to overcome this problem.

(8) **Necessity of liaison with international regional bodies** - Inadequate liaison with international and regional fisheries bodies also hinder the formulation of a proper fishery information system. The liaison should be strengthened by organizing seminars and workshops in the participating countries and by supplying them with all publications.

(9) **Cooperation of fisheries information** - Lack of coordination among participating countries is another constraint. Member countries should have national coordinators who should meet regularly to exchange fishery information.

(10) Agencies like FAO, BOBP, and SEAFDEC will be approached to assist the South Asian countries strengthen their information systems.

Action Plans for Southeast Asia (Brunei Darussalam, Indonesia, Malaysia, Philippines and Thailand)

(1) **Introduction** - The participants from Southeast Asia representing Brunei Darussalam, Indonesia, Malaysia, Philippines, and Thailand identified common issues and constraints and formulated a common approach or action plan.

(2) **Priority actions identified** - Various issues and constraints common to the group were identified. The more important and critical issues and constraints to be addressed are:

- Inadequate national or local information resources and services.
- Poor coordination and collaboration among related programs (local, national, or international).
- Poor and ineffective information handling methods and tools.
- Inadequately trained expertise and staff.
- Lack of high level commitments and support.
- Inappropriate packaged information for extension and resource management.
- Unavailability of timely information services.

(3) **Regional program** - The issues and constraints that were identified were further related to the programs:

- Implementing and strengthening national fishery information resources and services.
- Analysis and dissemination of fishery resource management information.
- Fisheries technology transfer and extension.

(4) Objective of program - The group identified the objectives for each program. The main objectives to be addressed were also identified.

- **Reactivation of national fisheries information centres** - The issue requires the reactivation of existing national fishery information systems (MALFIS, THAIFIS, INFIS, and NFIS) and the establishment of a new national fishery information system in Brunei Darussalam. This involves proper training of personnel and the commitment of the national leadership to support the centres.
- **Analysis and dissemination** - There is a national need to analyze and disseminate fishery information for resource management purposes, for both the policymakers and researchers. These should be effectively disseminated in a uniform format for timely use of the information.
- **Technology transfer and extension** - The group felt the need to have national fishery information obtained, properly analyzed, and packaged ready for extension. The packaged information should be transferred in a timely fashion to relevant target groups within the national framework.
- **Regional transfer and exchange** - There is a need for effective regional transfer and exchange. The existing system of information transfer and exchange (SEAFIS) could be reactivated and enhanced for the timely transfer of information.

Actions to be taken at the national level:

- To establish or strengthen a focal point for the national fishery information system with a definite national policy.
- To encourage the exchange of fishery information among the national agencies through a national fishery network.
- To improve national efforts for an effective national fishery system through adequate financial and human resources support, facilities, and regular training of staff.
- To establish an effective system for compilation, dissemination, and information exchange and distribution.

Actions to be taken at the regional level:

- To establish an effective regional centre for fishery information.
- To provide training on information technology and management for

information staff.

- To strengthen information exchanges within the region and outside the region.
- To develop appropriate information input tools and methods.
- To conduct a regular review on the progress, problems, and constraints of information programs in the region.

Action to be taken at international level:

- To assist participating countries in developing and strengthening the national information input capability.

(5) National and regional needs

- The group felt that there was a need for a strong national fishery information program to provide leadership and coordination and to develop and implement training programs in the areas of information management, development communication, and information repackaging both at the national and subregional levels.
- Nationally, the group felt that there is a need for the existing national information system to be reactivated. Information staff at the national level should be retrained; whereas, at the grass-root level, intensive training should be given regularly to staff.
- There is a need for a strong leadership at the regional level to coordinate, formulate, and disseminate exchange of information program. In this respect, regional bodies (SEAFDEC and FAO/RAPA) could take the leading role.
- Appropriate software should be developed and an effective networking linkage should be evolved to resolve the problem of time lapses in information.

(6) Follow-up procedures - The group urged appropriate regional agencies, namely SEAFDEC and FAO-RAPA, to engage an appropriate consultant to look into the needs for an effective information program with proper terms of reference. The group also urged the regional agencies in conjunction with appropriate international agencies, e.g., SIFR, for funding and expertise support.

Recommendations of the Regional Workshop

To ensure implementation of these Subregional Action Plans, the participants made the following recommendations for consideration by participating governments, regional fisheries bodies, and international organizations and donors:

(1) Actions recommended to be taken at the national level:

- To establish or strengthen the national fishery information system with a definite national program.
- To encourage exchange of fishery information among the national agencies through a national fishery (information) network.
- To improve national efforts for an effective national fishery (information) system through adequate financial and human resources support, facilities, and regular training of staff.
- To establish an effective system of compilation, dissemination, and information exchange and distribution.

(2) Actions recommended to be taken at the regional level:

- To establish or strengthen effective subregional and regional fishery information systems in close collaboration with the national fishery information programs of the participating countries.
- To coordinate and provide training on information technology and management for national information staff.
- To develop appropriate information tools and methods.
- To promote and facilitate regional cooperation and collaboration in the exchange and management of fishery information.
- To conduct a regular review on the progress, problems, and constraints of information programs in the region.

(3) Actions recommended to be taken at the international level:

- To support and supplement national efforts to develop and strengthen their national information capability.
- To promote and facilitate international cooperation and collaboration in the exchange and management of fishery information.

(4) Project proposals for subregional and regional fishery information programs should be developed on the basis of the options and action plans prepared by the three subregional working groups, and be submitted for consideration and support by the participation governments in the region.

(5) Technical assistance from international organizations and programs (e.g., FAO, SEAFDEC, INFOFISH, NACA, BOBP, and the Mekong Secretariat) was recommended to facilitate the preparation of project proposals on the development of effective fisheries information programs for possible funding by donor countries or agencies. FAO/RAPA was asked to coordinate these efforts.

(6) Project proposals on fishery information in the region should be submitted to the donors for their consideration through SIFR.

(7) The report of the workshop should be disseminated and distributed to the participating governments for their support and a follow-up workshop or seminar should be convened by the organizations concerned to discuss the implementation of the proposed action plans.

Conclusion

The studies discussed in this publication do not add new knowledge; rather, they consolidate the needs, issues, and constraints and highlight the urgent need for action. **SIFR (38) and others (e.g., 8, 9, 12, 34) have pointed out the same issues and needs and urged immediate actions. The question is: Why does it take so long to take action to remove these often-cited constraints?**

SIFR (38) stated that "... considerable improvements can be made on the basis of information presently available ..." (p. 26) and that "... in most cases, the information presently available is sufficient to undertake the necessary changes ..." (p. 27). It was also pointed out that "Achieving the necessary institutional innovations will first require wide dissemination of the theoretical concepts underlying the innovations, the methods to implement them, and accounts of new experiences. A majority of actors in the sector ... need to share new understanding of the necessity for and the modes of change before the proper action can be taken. Different media and languages will be needed to reach these targets." (p. 50).

Information is available, but not in a form that suits user needs. The "change" and "improvement" noted in the SIFR report will be difficult to achieve if research results are not made available in a usable form to the people who are directly involved in the management and development of fisheries resources.

On the whole, existing fisheries information resources and services are driven by suppliers rather than by needs and demands. The existing information programs in Asia are passive and reactive and tend to operate in isolation. There is a regional leadership gap in supporting and supplementing national information efforts and in coordinating related information activities.

Remarkable progress has been achieved in collecting, organizing, and retrieving information using modern information technology, and existing systems have been relatively successful in organizing and delivering published information to the research community. However, these efforts have not been able to make appropriate and relevant information and technologies available to policymakers, resource-base managers, and the extension and fishing communities. It should be kept in mind that research has no practical value if its outputs are not used by society, and that sustainable resource management cannot be achieved without addressing management problems and sustainability at the local level.

Availability and accessibility are not in themselves sufficient. The most critical point is how effectively the available information is used. Many international and regional information programs and databases exist. Although they are useful, their effectiveness in meeting the information needs of the fisheries sector in developing countries is limited because their products do not address locally identified needs. There is an urgent need to develop national capacity to make effective use of information to manage resources.

Table 4. Issues and constraints, remedial actions, and areas requiring donor support to improve the availability of fishery information in Asia.¹

Region	Issues and Constraints ²	Remedial Actions ³	Areas Requiring Donor Support ⁴
Indo-China⁵	<ul style="list-style-type: none"> • Little or no fishery information infrastructure or resources. • Lack of trained information staff and expertise. • Poor national and local information resources and services. • Limited information processing capabilities and facilities. 	<ul style="list-style-type: none"> • Formulate and establish national fishery information programs. • Establish and strengthen local and national fishery information centres. • Initiate proactive, need-driven information services. • Develop infrastructure and human resources in all aspects of fishery information management. 	<ul style="list-style-type: none"> • National capacity building, including establishment and strengthening of fishery information centres, coordination mechanisms, and human resources development.
South Asia⁶	<ul style="list-style-type: none"> • Most countries have fisheries statistics programs and libraries. • Efforts and expertise are focused on collection; little effort or expertise in analysis, integration, synthesis, packaging, and dissemination of information. • Limited exchange and sharing of information and expertise because of poor linkages and lack of standards and compatible methods and tools. • Lack of integrated, synthesized, and packaged information for fishery resource management. • Lack of digested and packaged information for extension and technology transfer. • Limited capabilities and facilities for information processing. 	<ul style="list-style-type: none"> • Strengthen national fishery information programs and initiate proactive, need-driven information services. • Establish national fishery information networks and coordination mechanisms. • Establish common and compatible information-management methods and access tools. • Improve access to intersectoral and interdisciplinary information through establishment of appropriate linkages and information-sharing arrangements. • Produce and disseminate information packages designed to meet needs of target-user groups, e.g., policy-planners and fishing and fish-farming communities. • Develop human resources and tools for analysis, interpretation, packaging, and dissemination of fishery information. 	<ul style="list-style-type: none"> • Strengthening of the existing information infrastructure. • National capacity building in analysis, integration, packaging, and dissemination of data and information; development communications; standard tools and methods. • Development of national and regional mechanisms for information exchange and coordination.

Region	Issues and Constraints ²	Remedial Actions ³	Areas Requiring Donor Support ⁴
Southeast Asia ⁷	<ul style="list-style-type: none"> • Most countries have fisheries statistics programs and libraries. • National and regional fishery information systems exist, but most are inactive. • Efforts and expertise are focused on collection: little effort or expertise in the analysis, integration, synthesis, packaging, and dissemination of information. • Limited exchange and sharing of information and expertise because of poor linkages and lack of standards and compatible methods and tools. • Lack of integrated, synthesized, and packaged information for planning and management. • Lack of digested and packaged information for extension and technology transfer. 	<ul style="list-style-type: none"> • Strengthen and revitalize national and regional fishery information programs and initiate proactive, need-driven information services. • Establish and adapt common and compatible information-management methods and access tools. • Improve access to intersectoral and interdisciplinary information through establishment of appropriate linkages and information-sharing arrangements. • Produce and disseminate information packages designed to meet needs of target-user groups, e.g., policy-planners and fishing and fish-farming communities. • Develop human resources and tools for analysis, integration, synthesis, packaging, and dissemination of data and information. 	<ul style="list-style-type: none"> • National capacity building in analysis, integration, packaging, and dissemination of data and information; development communication; standard and compatible methods and tools. • Development of national and regional mechanisms for information exchange and coordination.

¹ This table highlights the deliberations and recommendations of the Regional Workshop on Fishery Information and Statistics in Asia, held in Bangkok, Thailand, 18–22 January 1994.

² Lack of financial resources and language barriers are common constraints in all countries, although the degree of seriousness varies.

³ Initiation and implementation of action plans are essentially national undertakings and need not be contingent on external or donor support. Countries that are unable to formulate and implement their action plans because of a lack of expertise or financial resources should seek donor support. The Asian Pacific Fishery Commission (APFIC), in cooperation with various regional fishery bodies such as BOBP/BOBC, FAO/RAPA, Mekong Secretariat, and SEAFDEC, could provide a regional coordinating mechanism for fishery information and statistics programs in Asia.

⁴ Role of donors is to support national initiatives. Level of donor support must be determined according to national needs and capacities.

⁵ The Mekong Secretariat has taken an initiative to formulate a project that addresses the issues and constraints related to lack of relevant, reliable, and timely data and information for the management and development of fisheries in the Lower Mekong Basin.

⁶ A BOBP Phase III project, implemented in late 1994, addresses issues related to promotion of public awareness and creation of extension information for coastal fisheries.

⁷ SEAFDEC, in cooperation with FAO/RAPA, is examining ways to implement the subregional action plans for countries in Southeast Asia.

Table 4 summarizes the issues, constraints, and remedial actions. In accord with the action plans adopted at the regional workshop, SIFR and several regional fisheries bodies (e.g., BOBP, FAO/RAPA, SEAFDEC, Mekong Secretariat, and NACA) are collaborating to implement the regional action plans adopted at the workshop held in January 1994. Examples of the subregional initiatives since the regional workshop noted above, are the BOBP phase III project, supported jointly by Denmark and Japan, that will promote public awareness and extension information for coastal fisheries of the Bay of Bengal countries, and the planned activity of the Mekong Secretariat that is concerned with formulation of data and information systems for the management and development of fisheries in the Lower Mekong Basin.

Asia is often cited not only for having rapid economic growth, but also for environmental and social conflicts that affect aquatic resources. Asian countries as a whole need an immediate program of action that will accelerate national capacity building in analysis, integration, packaging, and dissemination of information for management of fisheries and aquatic resources, and increase awareness of management options.

The success of any activity depends on the commitment and will of the people involved. Without commitment of national programs to facilitate and promote sharing and use of research results, much of the outputs of research will remain underused. It is necessary to recognize that investments in facilitating and promoting the use of research outputs are as essential as investments in fishery research. Action plans for improved availability of relevant and usable information for fisheries management have been developed. It is now necessary to consolidate our efforts and find ways to implement the plans.

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Appendix 1:

Selected Fisheries Information Resources and Services

In common with other disciplines and sectors, the fisheries sector needs an international information system that collects, organizes, and disseminates literature of the sector comprehensively and globally. ASFA, under the leadership of FAO and other international agencies, has become the major bibliographic information source in the field of fisheries. However, in today's complex world, it is difficult for one bibliographic information source to be effective in meeting diversified information needs of the sector. There are other information sources that also cover the fisheries sector, targeting different group of users. Although there are some overlaps among various information sources, they generally complement each other. These descriptions provide information on the main international fisheries information products such as abstracts, indexes and databases related to fisheries, and the international and regional organizations, professional societies and research networks that maintain a strong information program and active publication activity, focusing on Southeast Asia.

Information Sources and Services

ASFA (Aquatic Sciences and Fisheries Abstracts) is an abstracting and indexing service covering the world's literature on the science, technology and management of marine, brackish and freshwater environment. It is an output of ASFIS (Aquatic Sciences and Fisheries Information System), an international information system maintained jointly by four UN agencies, FAO, UNEP, UNOALOS, and IOC, and national partners in 11 countries, under the coordination of FAO, and published by the Cambridge Science Abstracts (CSA).

Approximately 400,000 records have been included in ASFA since 1971, with annual addition of about 35,000 new entries. Input to ASFA is provided by a network of ASFA participating organizations in Canada, China, France, Germany, Japan, Mexico, Norway, Portugal, UK, former USSR, FAO, UNOALOS, and CSA. Literature related to fisheries are covered mainly in ASFA-1, Biological Sciences and Living Resources. It is available in three media, (a) printed journals in three parts (ASFA-1, Biological Sciences and Living Resources; ASFA-2, Ocean Technology, Policy and Non-Living Resources; and ASFA-3, Aquaculture Abstracts), (b) ASFA database, and (c) ASFA database on compact disk (CD ROM). Two "spin-off" abstracts are ASFA Aquaculture Abstracts and ASFA Marine Biotechnology Abstracts.

Fish and Fisheries Worldwide produced by National Information Services Corporation (NISC) in Baltimore, U.S., contains over 200,000 worldwide bibliographic citations on fish and fish-related topics. Fish and Fisheries Worldwide combines several databases, i.e., computer file equivalent of Fisheries Review (U.S. Fish and Wildlife Service), FISHLIT database of JLB Smith

Institution of Ichthyology at Rhodes University in South Africa, Aquaculture file of NOAA (National Oceanic and Atmospheric Administration), and FISH HEALTH NEWS abstracts from U.S. National Fisheries Research Center at Leetown, WV. It is available on CD ROM.

AGRIS (International Information System for the Agricultural Sciences and Technology) coordinated and produced by FAO, is an abstracting and indexing service covering the world's agricultural sciences and technology literature. The AGRIS database contains more than 2,000,000 entries, with average annual addition of about 119,000 new entries. Input to AGRIS is provided by 149 national AGRIS centres and 24 regional and international centres. As a result of many developing countries' participation in the system, literature published in developing countries is particularly well represented in AGRIS database. Although the main emphasis of AGRIS is land-based agriculture, it covers literature in fisheries under Category M, and for number of developing countries, AGRIS has more on fisheries in general than ASFA. AGRIS is available in printed form (AGRINDEX), AGRIS database, and AGRIS on CD ROM.

CABI (Commonwealth Agricultural Bureau International) Abstract Journals - Although the various aspects of land-based agriculture are the main emphasis of the CABI abstract journals, literature on many aspects of aquaculture and fish farming such as fish genetics, nutrition and diseases, economics, marketing and trading of fish and fish products, aquasilviculture systems, are captured by the CABI abstract journals. It has been estimated that over 2,000 records in the fields of Aquaculture and Fish Farming are added to CABI databases annually.

FISHLIT - Produced by the J. B. L. Smith Institute of Ichthyology in collaboration with the South African Water Information Centre in Pretoria, it covers fish-related literature and is useful to ichthyologists, aquaculturalists, fisheries scientists, fishermen, and students. It puts emphasis on tropical areas, developing countries and Africa in particular. FISHLIT is available on CD ROM as a part of Fish and Fisheries Worldwide.

BIOSIS Previews (Biological Abstracts) - One of the key information sources in biological sciences, including biochemistry, food sciences, some biomedical and agricultural research. Literature in fisheries and related fields are covered under various subjects such as ecology (environmental biology), oceanography, oceanography and limnology, wildlife management, and food technology.

ZOOLOGICAL RECORD - Produced by BIOSIS, this is a unique information source in zoological research, including marine species, covering such subjects as behaviour, ecology, feeding and nutrition, parasitology, reproduction, and zoogeography. Its 6,500 sources includes journals, books, newsletters, and conference proceedings. It is available in printed form, database (from 1978-), and CD ROM.

Food Science and Technology Abstracts - Produced by International Food Information Service, this abstract contains over 420,000 citations of literature in food science and technology. Sources include more than 1,800 journals, as well as patents, standards, books, conference proceedings,

research reports, dissertations, and legislation. It is available on printed form, online database and CD ROM.

FISHFAX developed by U.S. National Seafood Inspection Laboratory, contains information on biological profiles, processing methods, nutritional values, economic considerations and public health information on a species specific basis.

ACQUIRE (Aquatic Information Retrieval) - Produced by Computer Science Corporation, it is an international database for finding aquatic toxicity information.

Environline - Produced by Congressional Information Services (CIS), it contains over 170,000 citations to broad ranges of issues and topics related to the environment and the management of natural resources, including oceans and estuaries.

Current Contents - Produced by Institute for Scientific Information, it provides bibliographic coverage of articles listed in the tables of contents of 6,900 leading journals in all sciences. The journals are grouped by broad subject areas, e.g., Current Contents: Agriculture, Biology and Environmental sciences, and it is available in printed form, online database, and on diskette.

Oceanic Abstracts (OA) - Produced by Cambridge Scientific Abstracts (CSA), it covers worldwide literature on oceanography and marine sciences, including biological and commercial aspects of fisheries and fishing activities, fishing methods and equipment, sport fisheries, catch statistics, aquaculture and mariculture, ships and shipping, and government laws and regulations. It is available in printed form and on-line database.

Pollution Abstracts - Produced by Cambridge Scientific Abstracts (CSA), it contains worldwide literature on pollution research, sources and controls, including marine and freshwater pollution. It is available in printed form and on-line database as part of CSA Life Sciences Collection.

SciSearch - Produced by Institute for Scientific Information, it provides bibliographic data plus citations to worldwide journal literature in scientific and technological discipline. It covers approximately 4,500 journals. It is available in printed form, online database and CD ROM.

Water Resources Abstracts - Produced by U. S. Geological Survey, it covers international literature in such subjects as aquatic sciences, hydrology, marine geology, oceanography, and pollution. It is available in printed form (Selected Water Resources Abstracts), database and CD ROM

FIPIS (Fishery Project Information System) produced by FAO-Fisheries Policy and Planning Division is a database of on-going fisheries projects funded by international donor agencies. The inputs are provided by 26 multilateral and 20 bilateral donors to FAO with the information about their fisheries projects. The main purpose of this file is to coordinate donor activity and use it as FAO's internal planning tool, but the database is available on diskettes free of charge.

FIPPDAT (Fishery Policy and Planning Databank) produced by FAO - Fishery Policy and Planning Division, is a combined database of various aspects of fisheries statistics and socioeconomic data in time series. Data come mainly from the databases of the UN systems (note: the original sources of most of UN statistics are the statistical offices of the countries), and are supplemented by the national statistical reports, field studies and other documents. Presently, it is used mainly internally within FAO, but is available on diskettes free of charge.

GLOBEFISH produced by FAO, provides information on the global fisheries market, including price, factors influencing supply and demand, and other trade related information. GLOBEFISH database covers news items, and statistics collected from approximately 150 trade journals and forty experts in various parts of the world, and is available on-line. GLOBEFISH publications include GLOBEFISH Highlights and GLOBEFISH European Fish Price Report. GLOBEFISH also provides information packages based on the GLOBEFISH Technical Information Center (TIC), and on printouts of the GLOBEFISH database.

AGRIASIA - Produced by AIBA (Agricultural Information Bank for Asia), Los Baños, Philippines, is a database of agricultural sciences literature, including over 6,000 records on fisheries of the five ASEAN countries. AIBA also maintains a directory file, CARIS-SEA, of on-going research in the Southeast Asian region. Although most of the entries in AGRIASIA and CARIS-SEA are found in the AGRIS and CARIS databases, AGRIASIA contains some unique records. In recent years, most countries in the Southeast Asia have been providing their inputs directly to the international AGRIS centre and receives the global database, i.e., AGRINDEX and AGRIS on CD ROM.

PIMRIS (Pacific Island Marine Resources Information System) - Managed by the University of South Pacific Library, PIMRIS is a regional database covering literature related to fisheries of the Pacific islands

Organizations and Programs with Strong Information Programs or Components

In addition to many international information products noted above, there are many international and regional organizations that are actively involved in publishing literature on fisheries that is important to the Southeast Asian countries. Publications of these institutions are frequently captured by international indexing and abstracting services, and database producers. Examples of organizations that have strong information programs include:

FAO (Food and Agriculture Organization of the United Nations) - FAO through its Fisheries Department, promotes national and international action program for the rational management and development of world fisheries. It assists member countries in formulating policies, objectives, and programs, and when appropriate, to establish infrastructures necessary for sustainable management of living aquatic resources.

One of the important activities of FAO is provision of information and statistics on various aspects of fisheries. It publishes many technical documents, circulars, and manuals, including current awareness publications such as Marine Science Contents Tables (MSCT) and Freshwater and Aquaculture Contents Tables (FACT). FAO maintains a wealth of information and data in many of its databases such as ASFA, FIDI, GLOBEFISH, FIPIS, FIPDAT, AGRIS, and CARIS. FAO also organizes and conducts training programs in data and information management in all FAO program areas, including fisheries, and develops standards and guidelines in collaboration with participating institutions.

It should be noted that FAO is in the final stage of making vast information resources collected and maintained by some 40 databases in FAO through WAICENT (World Agricultural Information Centre). Aspects of fisheries information available through WAICENT include production, products, utilization, marketing, commodity balance, and trade.

Indo-Pacific Fishery Commission (IPFC) - One of the Commissions established under the FAO constitution, IPFC has a mandate to promote the full and proper utilization of living aquatic resources. The objectives of the commission include to assemble or otherwise disseminate information regarding the living aquatic resources and fisheries. Through many of its subsidiary bodies, IPFC produces various publications, including technical reports and proceedings of meetings on various aspects of fisheries resource management.

Indian Ocean Fishery Commission (IOFC) - One of the Commissions established under the FAO constitution. In common with IPFC, IOFC is mandated to promote proper utilization of fisheries resources of the member countries through identification of management issues of relevance to the regions. IOFC's current program centres around fishery management problems. The Bay of Bengal Committee oversees the implementation of small-scale fisheries in the Bay of Bengal and adjacent areas through BOBP. IOFC also produces various publications, such as technical reports and reports of various meetings.

IOC/UNESCO (Intergovernmental Oceanographic Commission of UNESCO) - IOC and other UNESCO programs provide leadership in many areas of marine and ocean sciences and services, and facilitate and coordinate global efforts in collection, exchange and utilization of marine and oceanographic data. Examples of the programs include Global Ocean Observing System (GOOS) and related activities, Coastal Marine Research (COMAR) and Global Investigation of Pollution in the Marine Environment (GIPME) and related activities. Marine Information Management (MIM) and IODE (International Oceanographic Data and Information Exchange) are important programs of IOC through which international exchange of marine and ocean data and information is facilitated. Through its various activities and projects, IOC generates a number of marine information products such as MEDI (Marine Environmental Data Information Referral System), IOC manuals and Guides, Directories of Scientists, and IODE Handbook, and organizes training programs in marine data and information management.

UNEP (United Nations Environmental Programme) - Several activities of UNEP are directly

related to fisheries. Examples are the GRID (Global Resource Information Database) program that promotes application of tools such as geographic information systems in coastal area management and produces catalogues and databases of environmental information, and INFOTERRA (International Environmental Information System) that is an international referral system on scientific and technical data and information for environmental development and management.

ICLARM (International Center for Living Aquatic Resources Management) - One of the Consultative Group on International Agricultural Research (CGIAR), with the mission to contribute to sustainable improvements in productivity of fisheries ICLARM maintains a strong information program consisting of a library and publishing unit. The information service answers inquiries from around the world and maintains bibliographic databases, with emphasis on ICLARM program areas. A variety of technical publications and a regular newsletter, NAGA, are published. In collaboration with number of national and international organizations, ICLARM is undertaking the FISHBASE project, creating a database on 5,000 species of fish, including nomenclature, distribution, ecology, morphometrics, population dynamics, reproduction, diseases and parasites, genetics and aquaculture systems, as well as bibliographic references. The FAO's SPECIESDAB provides scientific and vernacular nomenclature as well as ecological and fisheries information on marine and brackish water species.

The ICLARM Library provides **SFIS** (Selective Fisheries Information Services), an in-depth information service in the areas of ICLARM program areas, e.g., finfish and mollusc culture, integrated animal or crop-fish farming, resource management, small-scale or traditional fisheries, coastal zone management. A list of bibliographic citations on the subject of inquiry is accompanied by selective key documents.

South Pacific Forum Fisheries Agency (FFA) - The agency is concerned with the policies related to fisheries management, and regional cooperation in surveillance and enforcement of EEZ, postharvest processing and marketing. One of the main functions of FFA is to collect, prepare, and disseminate information on fisheries.

SEAFDEC (Southeast Asian Fisheries Development Center) - An intergovernmental technical organization established in 1967, with the objective of promoting fisheries development in the Southeast Asia through mutual cooperation among the member countries. The SEAFDEC's many functions include (a) to collect and analyze information related to the fisheries in Southeast Asia and (b) to provide the members with the results of studies and researches by the Center and other information. SEAFDEC publishes technical reports and statistical bulletins.

SEAFDEC hosted three regional information systems, **SAFIS** (Southeast Asian Fisheries Information Services), **SEAFIS** (Southeast Asian Fisheries Information System), and **BRAIS** (Brackishwater Aquaculture Information System). BRAIS is a specialized information analysis centre in SEAFDEC-Aquaculture Department, that collects and disseminates brackishwater aquaculture information through a network of participating centres in Malaysia, Indonesia,

Philippines, and Thailand. SAFIS was a project that aimed to facilitate effective transfer of fisheries technologies through regional cooperation in collecting, producing, and disseminating extension materials. SEAFIS was established in SEAFDEC headquarters in Bangkok, Thailand, to strengthen regional collaboration and promote effective exchange of fisheries information within Southeast Asia. The SEAFIS project funded by IDRC, Ottawa, established a network of national information systems, established common methods of information handling in the region, provided equipment and training opportunities for national staff. However, since the project terminated in 1989, both SEAFIS and BRAIS have given priority to the needs of their parent institution, i.e., SEAFDEC, and have maintained little or minimum level of regional activities.

INFOFISH is an Intergovernmental Organization serving the fisheries industry of the Asia-Pacific (headquarters in Kuala Lumpur, Malaysia). INFOFISH services are available to subscribers in member countries. However, individual subscriptions to its publications and access to services are available to industries in nonmember countries at nonmember fee rates. INFOFISH publishes two regular publications, i.e., INFOFISH Trade News and INFOFISH International, and other publications such as special reviews, market reports, investments profiles, and directories. INFOFISH maintains close links with FAO worldwide fish marketing information network comprising INFOFESCA (Latin America), INFOPECHE (Africa), and INFOSAMAK (Arab countries), and has direct access to the GLOBEFISH (FAO) databank and FAO library in Rome.

NACA (Network of Aquaculture Centres in Asia-Pacific) - An intergovernmental organization established in 1990 to assist its member countries to expand Aquaculture development efforts. One of the program activities of NACA is to collect and disseminate data and information relevant to its members. NACA's publications include a regular newsletter, reviews, technical reports and studies, training manuals, and guidelines on various aspects of aquaculture.

AADCP (ASEAN Aquaculture Development and Coordinating Programmes) - A project funded by European Community (EC), beginning in 1990 for a 5-year period. Main objectives of the project are (a) to improve the socioeconomic conditions of the rural poor of ASEAN through aquaculture developments, (b) to improve the productivity and economic viability of ASEAN aquaculture, (c) to optimize available marine, coastal and inland resources for aquaculture, (d) to encourage long-term ASEAN regional collaboration in aquaculture research and development, training and extension, and (e) to foster long-term collaboration between EC and ASEAN.

AFF (ASEAN Fisheries Federation) - An organization established in 1989 with the objectives of (a) serving as an ASEAN body from the private sector to implement and deal with the problems of ASEAN cooperation in the fisheries industries, (b) assisting the member governments in implementing programs to conserve and manage the fisheries resources, (c) to facilitate the exchange of information and formulate programs and policies and other aspects relating to the fish and fish based products and marketing, (d) to develop joint strategies for increasing exploitation and consumption of fish and fisheries products in traditional and new market, (e) to seek the relaxation and removal of tariff barriers and other obstacles to trade, (f) to establish standardization of the quality and grading rules of fish and fish based products, and (g) to keep

under constant review development relating to supply, demand and prices of fish and fish based products.

ASEAN/Canada Post Harvest Technology Project (phase II) - A project funded by Canada beginning in 1992 for a 5-year period. The objectives of the project are (a) to strengthen and upgrade inspection, quality control, processing and production development systems in ASEAN countries, and (b) to assist in development and implementation of improved methods and technologies of fish processing, preservation and packing to enhance market opportunities. The project activity includes production and dissemination of a series of extension materials in post harvest handling and production.

ASEAN Food Handling Bureau (AFHB) - Functions of AFHB include establishment of a pool of information on appropriate food handling and distribution systems, through the collaboration of information and results of projects implemented. AFHB's technical information service, APEX, was set up in 1986 to provide current information according to specific subjects as required by the clients. In addition to various in-house databases, APEX utilizes relevant international databases, and the service is open to non-ASEAN countries. Fisheries is not one of the current program priorities of AFHB. Recently, AFHB has signed to be the regional distributor for International Food Information Service (IFIS), the producer of Food Science and Technology Abstracts.

BOBP (Bay of Bengal Programme), began as a project funded by SIDA, "Development of small-scale Fisheries in the Bay of Bengal" in 1979. The follow-up project "Small-scale Fisherfolk Communities" was funded by SIDA and DANIDA. The participating countries, Bangladesh, India, Malaysia, Sri Lanka and Thailand, provided contributions toward information services sub-project. Additionally, BOBP executed a number of projects funded by ODA, UNDP, AGFUND, IMO and SIDA. With the long-term objectives of improving the standard of living and the quality of life of small-scale fisherfolk, the BOBP addressed major issues of development and management of fisheries in the sub-region, through assistance to member countries in establishment of national priorities and promotion and coordination of national and regional fisheries programmes. BOBP maintained a strong information activity. The Phase III project, supported by Japan and Denmark, promotes public awareness and extension information for coastal fisheries in the seven Bay of Bengal countries.

SEAPOL (Southeast Asian Programme in Ocean Law, Policy and Management) - A multidisciplinary regional research programme in the field of ocean affairs based in the Sukhothai Thammathirat Open University, Nonthaburi, Thailand, SEAPOL promotes research in ocean affairs and facilitates and provides regional forum for information exchange and sharing through organization of conferences and workshops and its various publications.

SICEN (Seaweed Information Center) of the Marine Science Institute of the University of the Philippines, Diliman, is a specialized information analysis centre for information on seaweed. It collects and disseminates literature on seaweed, and baseline data for stock assessment, as well as produces state-of-art reviews on various aspects of seaweed culture and production.

Professional Societies and Research Networks

- IAMSLIC (International Association for Marine Science Libraries and Information Centres)
- Asian Fisheries Society
- Asian Fisheries Social Science Research Network (ICLARM)
- Aquaculture Genetics Network of Asia
- Southeast Asian Marine Science Association
- Mollusc Network
- Network of Tropical Aquaculture Scientists (ICLARM)
- Network of Tropical Fisheries Scientists (ICLARM)
- National fisheries and fisheries related societies

National Information Programs

Most countries in Asia have national or special libraries and information centres in fisheries and/or aquaculture. Four countries, Indonesia, Malaysia, the Philippines and Thailand, have national fisheries information system. Level of development and activities vary from country to country. Three national systems developed under the SEAFIS project are basically in an inactive mode since the regional coordination and leadership ceased to exist in 1989.

INFIS (Indonesian Fisheries Information System), coordinated by Directorate General of Fisheries (DGF), Ministry of Agriculture, collects, processes, and disseminates fisheries science and technology information in support of national fisheries development. INFIS provides training opportunities for the provincial and district information staff, and provides technical backup. It gives special attention to information needs for extension, and produces national fisheries bibliography, extension manuals and leaflets, code of practice and INFIS Newsletter.

MALFIS (Malaysian Fisheries Information System) was set up by the Department of Fisheries Malaysia under the SEAFIS project. MALFIS is a network of national information related agencies, coordinating collection and processing of both bibliographic and non-bibliographic information. Presently, the non-bibliographic information component of MALFIS is functioning, the bibliographic component is not.

In the Philippines, a framework of **PASFIS** (Philippine Aquatic Sciences and Fisheries Information System) with the focal point at the University of Visayas in Iloilo City, Philippines, was developed under the SEAFIS project. However, PASFIS did not get off the ground. At the moment, **NFIS** (National Fisheries Information System) project under the leadership of BFAR (Bureau of Fisheries and Aquatic Resources) is at an early stage of implementation, replacing PASFIS.

THAIFIS (Thai Fisheries Information System) coordinated by the Library of the National Inland Fisheries Institute of Department of Fisheries, Thailand, was established in 1985 under the

SEAFIS project. THAIFIS maintains a national fisheries bibliography and produces acquisition lists of materials from the contributing libraries. THAIFIS has not been able to provide effective national information service since the support from SEAFIS project was ceased in 1989.

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