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# STATUS OF FISHERY INFORMATION AND STATISTICS IN ASIA

**Proceedings of the Regional Workshop on  
Fishery Information and Statistics in Asia**

Bangkok, Thailand  
18-22 January 1994

**Volume II: Papers Presented at the Workshop**

**The Secretariat  
Southeast Asian Fisheries Development Center  
Bangkok, Thailand**

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*Jointly sponsored by SEAFDEC Secretariat, ASEAN-EEC Aquaculture Development and Coordination Programme (AADCP), Asia and Pacific Commission on Agricultural Statistics (APCAS), Bay of Bengal Programme (BOBP), FAO Fisheries Department, FAO Regional Office for Asia and the Pacific (FAO/RAPA), Mekong Committee, Network of Aquaculture Centres in Asia-Pacific (NACA), and Strategy for International Fisheries Research (SIFR).*

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# **STATUS OF FISHERY INFORMATION AND STATISTICS IN ASIA**

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**Volume II: Papers Presented at the Workshop**

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## FOREWORD

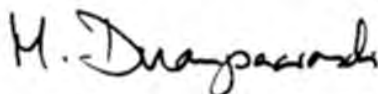
Cognizant of the need to improve fishery data and information services in Asia, the SEAFDEC Secretariat in collaboration with FAO and with financial assistance from the government of Japan, organized the Regional Workshop on Fishery Information and Statistics in Asia from 18 to 22 January 1994, in Bangkok, Thailand.

SEAFDEC has been active in promoting the compilation and dissemination of fishery information and statistics in the South China Sea area. It has published the annual Fishery Statistical Bulletin for the South China Sea Area, and the annual Regional Bibliography on Fisheries and Aquaculture in Southeast Asia. SEAFDEC has also organized a number of fishery statistics workshops since 1976 and seminars on fishery and aquaculture information systems.

As a sequel to the various fishery information and statistics workshops, this Workshop had a wider mandate and broader geographical coverage. More than 90 international, regional as well as national experts on fishery statistics and information attended the Workshop, which aimed to: review the current status of fishery information programs and services available in Asia; discuss the requirements for improving collection, compilation and dissemination of fishery and aquaculture statistics in the region; and recommend ways and means for international cooperation and coordination in support of national efforts in information dissemination.

The Proceedings of the Workshop is divided into two volumes. Volume I which was printed in April 1994, constitute the report on the workshop including summary of the discussions, action plans, recommendations, and the list of participants. On the other hand, this volume (II) includes a summary of the Workshop proceedings, the papers presented at the Workshop, and also the action plans, recommendations, and the list of participants.

This publication will be useful to administrators, policy-makers, and planners in this area of the world. The Workshop as well as this publication were made possible through the assistance of the Government of Japan, the collaborating agencies and the SEAFDEC Secretariat staff.



Maitree Duangsawasdi  
Secretary-General  
SEAFDEC

PROCEEDINGS OF THE  
REGIONAL WORKSHOP ON FISHERY INFORMATION  
AND STATISTICS IN ASIA

Bangkok, Thailand  
18-22 January 1994

Volume II: Papers Presented at the Workshop

SUMMARY

The Regional Workshop on Fishery Information and Statistics in Asia was convened by the SEAFDEC Secretariat in Bangkok, Thailand, from 18 to 22 January 1994, in collaboration with the ASEAN-EEC Aquaculture Development and Coordination Programme (AADCP), the Asia and Pacific Commission on Agricultural Statistics (APCAS), the Bay of Bengal Programme (BOBP), the FAO Fisheries Department, the FAO Regional Office for Asia and the Pacific (FAO/RAPA), the Mekong Committee, the Network of Aquaculture Centres in Asia-Pacific (NACA), and the Strategy for International Fisheries Research (SIFR).

The Workshop was attended by 45 participants from Australia, Bangladesh, Brunei Darussalam, Cambodia, the People's Republic of China, India, Indonesia, Japan, Laos, Malaysia, Maldives, Nepal, Pakistan, the Philippines, Sri Lanka, Taiwan, Thailand, and Viet Nam, as well as 40 representatives for AADCP, the Economic and Social Commission for Asia and Pacific (ESCAP), FAO, FAO/RAPA, the International Center for Living Aquatic Resources Management (ICLARM), the Intergovernmental Organization for Marketing Information and Advisory Services for Fishery Products in the Asia and Pacific Region (INFOFISH), the Indo-Pacific Tuna Development and Management Programme (IPTP), the Mekong Committee, NACA, the South-East Asian Programme in Ocean Law, Policy and Management (SEAPOL), SIFR, the Western Pacific Fisheries Consultative Committee (WPFCC), and key officers of the Secretariat and the Departments of SEAFDEC, namely, Training Department (SEAFDEC/TD), Marine Fisheries Research Department (SEAFDEC/MFRD), Aquaculture Department (SEAFDEC/AQD) and the Marine Fishery Resources Development and Management Department (SEAFDEC/MFRDMD). There were also observers from the private sector. The List of Participants and Observers is included as part of this Volume.

## **Fishery Information**

An overview of the fishery information and services in Asia, based on the findings of a study conducted in August and October 1993 in Indonesia, Malaysia, the Philippines and Thailand, was presented. The study identified the various fishery information sources and services available in the region. It also noted that these sources and services have not been fully utilized for reasons which are related to the contents and coverage of the information sources, language and professional barriers, and the way the information is organized and presented which affected mostly the non-research community.

The study was also able to identify issues and constraints that affect the effective and efficient utilization of fishery information, based on which actions required to improve the utilization of fishery information were recommended. Although the study covered Southeast Asia only, the experience gained could be eventually utilized in the other regions. The needs, issues and constraints observed in Southeast Asia could equally be applied to the other countries in Asia, as confirmed during the Workshop.

Finally, the study recommended that regional and sub-regional information programs should be formulated along the following themes: development of national fishery information resources and services, analysis and synthesis of fishery resource management information, and fishery technology transfer.

The country representatives outlined the status of fishery information in their respective countries, concentrating on the relevance and utility of information services, factors affecting use and non-use of fishery information, priority information needs that are not met, and difficulties in meeting the information needs of users. Based on the statements and after the discussions, they prioritized the main issues and constraints concerning the status of their respective national fishery information programs.

As identified by almost all the national participants, the major constraints were lack of funds and language barrier. A question was raised on whether English should be used as a common language in information dissemination.

The other constraints identified according to priority, were (a) lack of trained information staff and expertise, (b) lack of appropriately packaged information for fishery resource management, (c) lack of appropriately packaged information for extension and technology transfer purposes, and (d) lack of standard, information handling methods and tools.

Geographically, the specific constraint common in South Asian countries was the lack of packaged information for fishery resource management and for extension and technology transfer. For Indo-China, the major constraints included lack of trained information staff and expertise, and poor national or local information handling methods and tools. The same constraints were also considered common in Southeast Asia, followed by lack of timely programs, lack of packaged information for extension and technology transfer purposes, and for fishery resource management.

From the issues and constraints, action plans were formulated by the country representatives, who were grouped into three sub-regional areas. The Indo-Chinese countries comprising Cambodia, Laos and Viet Nam; South Asian countries comprising Bangladesh, India, Pakistan, Sri Lanka, Maldives and Nepal; and Southeast Asian countries comprising Brunei Darussalam, Indonesia, Malaysia, the Philippines and Thailand. Australia, China, Japan and Taiwan served as the resource and reference group.

The Action Plan for Indo-China stressed the need to formulate a national policy for strengthening the information systems to support national research and development, and to establish national information centers and sub-centers to form the fishery information network. This network should be linked to the Asian regional system in order to facilitate exchange of information. The Indo-Chinese countries required an international assistance to be able to implement their fishery information programs.

The Action Plan for South Asia addressed a mechanism required for improved collection and dissemination of fishery information in the sub-regional level, including the implementation of the fishery resources survey system (FRSS), strengthening of existing information services, cooperation and coordination among agencies concerned at both national and regional levels, and assistance in training and upgrading manpower and facilities.



The Action Plan for Southeast Asia identified priority programs geared at strengthening national and regional fishery information systems. The following programs were proposed: reactivation of national fishery information centers, analysis and dissemination of fishery resource management information, and fishery technology transfer and extension. Regional bodies such as SEAFDEC and FAO/RAPA were asked to take the leading role in formulating, disseminating and coordinating the exchange of information in the region.

In addition to the Action Plans (pp 142-149), the Workshop adopted various recommendations (pp 150-151) for the improvement of the fishery information programs in Asia.

### Fishery Statistics

The outlook of fishery statistics in Southeast Asia was presented. It was noted that the collection and compilation of fishery statistics in the region has greatly improved since 1976, with the active participation now of the national fishery departments. The capabilities of the staff have been upgraded while the data processing facilities have either been acquired or upgraded. However, there were still problems encountered in the collection and compilation of fishery statistics in the region.

Problems likewise affected the compilation of inputs for the annual Fishery Statistical Bulletin for the South China Sea Area, by SEAFDEC/TD. Specifically, the main problems encountered were (a) long delay in the submission of data and (b) incomplete and inaccurate data submitted by participating countries.

The country participants presented the current status of fishery statistics in their respective countries, including problems and constraints encountered in the collection and compilation of fishery data. The most common constraint identified was the shortage of trained manpower. This constraint starts from the field for data collection to the offices for data processing. If ever manpower is available, it is possible that they have not undergone a systematic and organized training in statistics collection and data processing. For this reason, it was suggested that a training course in fishery statistics including design and compilation of useful statistics as well as on economic analysis of fisheries, should be conducted for all statisticians and information staff in the region.

in the region have also established their own national fishery statistical standards. The national standards may have to be reviewed and improved in order to conform with the standards of other countries as well as the classifications and definitions provided by SEAFDEC.

FAO suggested one solution to the problems related to the data collection schemes, i.e., the introduction and maintenance of efficient sampling programs. FAO for its part was asked to improve the instructions for completing the FAO questionnaire on fishery statistics, by giving more guidance on the definitions and classification standards.

On the other hand, participating countries were encouraged to submit complete and accurate data, and for them to make use of the database packages developed by FAO and SEAFDEC for faster reporting of data. Based on the aforementioned constraints, the Workshop adopted recommendations (pp. 383-389), in order to improve the collection and compilation of fishery statistics in Asia.

#### Conclusion

The Workshop agreed that concept papers on the development of effective fishery information programs in Asia should be formulated. To be able to accomplish this, a five-day consultation meeting among representatives of the sub-regional groups as well as collaborating agencies, should be convened as early as possible. The concept papers will be submitted for funding, to donor agencies through SIFR. Moreover, a follow-up workshop should also be organized in due time, in order to assess the implementation of the recommendations adopted during the Workshop.



FISHERY INFORMATION

Proceedings of the Regional Workshop  
on Fishery Information and Statistics  
in Asia (Vol. II)

**OVERVIEW OF INFORMATION PROGRAMS AND SERVICES  
IN DEVELOPING COUNTRIES\***

by

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**INTRODUCTION**

Over the past few decades, information programs and services supporting fishery resources management have grown steadily. However, in spite of the increasing number and efforts of national and international agencies, there exists a lingering doubt about relevance and effectiveness of these programs and services, particularly in support of the developing countries' needs. Additionally, there is a concern about the sustainability of these information programs and services in developing countries.

A number of studies have reported some findings on information users, needs, constraints, systems and services in the fisheries sector (2, 3, 5, 9, 11, 12, 21, 22, 23), and in general (1, 4, 6, 7, 8, 10, 14, 19). However, they do not examine information requirements for development and management of the fisheries sector comprehensively. An in-depth study was therefore conducted in August and October 1993, on data and information required for sustainable development and management of the fishery resources in the developing countries, and to explore viable options for effective provision of required data and information.

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\* Extracted from the report on the study "Fisheries information needs in developing countries: issues, constraints and opportunities," to be published by the Strategy for International Fisheries Research, in 1994

Considering the time available for the study, a regional approach was undertaken in assessing the relevance and utility of existing international and regional information sources and services, focusing in Southeast Asia. This approach would also allow an opportunity to eventually utilize the experience gained in Southeast Asia to the other regions, in which studies could be conducted later.

In identifying the information needs for fishery management and development, no attempt was made to limit the needs by types of information. The users were asked to express their information needs regardless of type. However, in examining information sources and services, the study limited itself to non-statistical information. Consequently, a separate study on statistical information has been recommended.

This study focused on the information needs of three groups of the users, namely, policy-planners, researchers, and extension specialists. The policy-planners who participated in the study comprised a group of information users whose primary job function is policy planning or advising policy-planning bodies in the government departments, and managers of fishery research and training institutions. Researchers included a group of information users who are involved in all types of research related to fisheries. They came from government as well as international and regional research institutions and programs, and universities. Extension specialists were from government extension agencies, at the national, regional or provincial levels, and extension and training programs of regional institutions.

The study was carried out over a two month period from August to October 1993. The main international and regional information sources and services in fisheries were identified through documents and reports. Facts on information needs, and issues and constraints in obtaining needed information were gathered through group meetings, individual discussions, and surveys of information users and providers. The group meetings and individual discussions were held with the planners, researchers, extension specialists, and information specialists, including the researchers and program managers working on international and regional projects and programs, in Indonesia, Malaysia, the Philippines, and Thailand. Survey forms were distributed during the group meetings and individual discussions.

## INFORMATION NEEDS AND COMMUNICATION CHANNELS

### Types of Information Required

A number of studies (13, 15, 16, 17, 18, 20, 23) has reported a diversified information requirement for the fisheries sector management. The need for diversified types of information, e.g., biological data, market indicators, fishermen's knowledge, policies, regulations, was confirmed in this study. Although the same types of information were required, the types of information needed by majority of the users in each group differed, since information requirement is closely related to job functions.

Access to fishery information was provided in many forms, e.g., card catalogs of libraries, indexes, abstracts, and databases which can be searched on-line or available on compact discs. Such functions could be facilitated through the services of information centers and libraries that perform general services.

Primary information sources such as books, journals, documents, reports, theses, reprints, conference proceedings, AV materials or information on computer discs, formed the basis of information sources. Secondary information sources such as library catalogs, indexes, abstracts, bibliographies, databases provided access to the information contents of the primary information. Most of the fishery information centers and libraries had some secondary sources in their collection, and these are used as tools for their information retrieval and services, usually resulting in a form of list of bibliographic references.

The other commonly used secondary information sources are directories and inventories of institutions, experts, datasets, projects, equipment and facilities, industries, markets, producers, and suppliers. Information centers and libraries, particularly those with national mandates, often participate in the preparation and production of these directories and inventories. Information centers and libraries interact and cooperate with users, and have linkages with other related programs at national, regional and international levels, as well as publishers and producers of abstracts and databases.

### Information Acquisition Channels

In obtaining the needed information, fishery information users seemed to depend highly on an informal information channel. Most of the respondents appeared to have a relatively good personal collection of core materials in their subjects or work areas and a network of personal contacts. Majority of the respondents utilized informal communication channels such as personal collection, friends or colleagues in order to obtain information, and a good portion of the policy-planners (70%) received complimentary copies of publications which are of interest to their work. Still a good portion of the extension specialists (65%) and policy-planners (61%) considered the media as an important information channel. On the other hand, extension specialists (20%) indicated that workshops, training courses and seminars kept them updated on recent developments and be in touch with fellow professionals in the field.

High dependency on informal information channels was also reported in the study. However, only 9% of the respondents indicated that they have used the Selective Fisheries Information Service (SPIS) of the International Center for Living Aquatic Resources Management (ICLARM), the Southeast Asian Fisheries Information System (SEAFIS) of the Southeast Asian Fisheries Development Center (SEAFDEC) or the Brackishwater Aquaculture Information System (BRAIS) of the SEAFDEC Aquaculture Department (SEAFDEC/AQD), and only 3% indicated using the Aquatic Sciences and Fisheries Abstracts (ASFA). The main reasons for not utilizing international information sources and services were (a) unawareness of the information sources and services, (b) unavailability of nearby information services, (c) absence of the need to use the information sources and services, and (d) high cost of the services.

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

Libraries and information centers with national mandates make their collections and services available not only to the staff of the affiliated institutions or agencies

but also to a wider user in each country. Depending on national information policies and structures, various mechanisms and linkages were utilized to meet the national needs including production of various information products such as directories of institutions and experts, union lists of collection available in the countries, methodological guidelines for information handling and management, and information management tools including computer software.

Work outputs of the participants of this study were affected greatly by lack or unavailability of appropriate information. Frequently mentioned negative effects were (a) work done may not be what is needed, (b) duplicated work as work may already have been done elsewhere, (c) inappropriate advice or recommendations may have been made, (d) inaccurate assessment of critical resource problems may have been made, and (e) difficulty in responding to government policies and fishermen's needs. Due to the ineffective utilization of information, not only scarce financial and human resources were wasted but also inappropriate management of the fishery resources may have been undertaken contributing to further management difficulties or damages of the resource base.

#### INFORMATION SOURCES AND SERVICES

Information services at international level are normally provided by international agencies such as the United Nation agencies or international research centers. A number of commercial publishers produces information sources such as indexes, abstracts, special bibliographies, and provides document delivery services worldwide.

A number of international and regional organizations also facilitates and organizes studies, workshops, and conferences, and publishes and disseminates findings and outcome of their activities. Many of the publications of these organizations are captured by and included in the above noted international information sources.

Many international and regional institutions have strong information programs specifically designed to provide services to developing countries. They include the Food and Agriculture Organization (FAO), ICLARM, and SEAFDEC. However, there is no clear evidence that their services are actively and fully utilized by the information users or providers in Southeast Asia.



International information sources such as ASFA, AGRIS, BIOSIS, Current Contents are available in only a few privileged fisheries libraries in the Southeast Asian countries. Of the twelve national libraries in six countries visited, only one has ASFA subscription while four have access to ASFA through other libraries in the same city. No national library has direct access to Fish and Fisheries Worldwide or Fishlit. They infrequently utilize the services of international or regional information centers and libraries unless they are in the same city. On the whole, fishery information centers' libraries operate independently or in isolation. The providers are aware of other information resources and services, but they are pre-occupied with their day-to-day routines. Planning ahead or initiating pro-active services remain on the list of tasks to be carried out as these tasks require extra-ordinary efforts and resources.

Fishery information networks exist at the national, regional and international levels, with varying degree of success. In order to promote and facilitate regional exchange of fishery information, three regional information networks, i.e., BRAIS, the Southeast Asian Fisheries Information Service (SAFIS) and SEAFIS, were established under the coordination of SEAFDEC in the 1980s as projects funded by the International Development Research Centre (IDRC) of Canada. Four countries, namely, Indonesia, Malaysia, Philippines, and Thailand participated in the networks. It was expected that the regional activities initiated by the donor support would be maintained in one form or another, after the financial contribution of the donor ceased. However, these regional information programs have not been active for the past several years mainly due to the financial constraints and low priority given to the information programs by their parent institutions.

Four countries in Southeast Asia have a national fishery information system, while three countries, namely: Malaysia (MALFIS), Philippines (PASFIS), and Thailand (THAIFIS) have established the national fishery information systems under SEAFIS. However, these national systems have been inactive since 1989 when SEAFIS became inactive. It was noted that many users indicated that they have been using the services of BRAIS and SEAFIS at least occasionally or regularly. This result may have been influenced by the number of users indicated by the SEAFDEC staff. The only active national system is INFIS in Indonesia, whose success may be due to the strong leadership and commitment of its parent institution, the Directorate-General of Fisheries of Indonesia.

Some national bibliographies or directories of the current years exist at national level, e.g., the Thai Abstracts published by the Thai Documentation Center, Thailand Institute of Scientific and Technological Research, contains approximately twenty entries on fisheries. Many information providers at the national level still frequently rely on the outdated bibliographies and directories.

International information sources are not actively or fully utilized by the information providers in Southeast Asia. Some of the main reasons for this are (a) the information sources and services are not well known to a number of information providers, (b) access to these sources is not convenient, (c) language and professional barriers make it difficult to effectively utilize international sources and services, and (d) materials found in international sources are not very relevant to the needs of the users.

In the absence of alternative information sources, and the privileged status that comes with having an international database on compact disc, both information users and providers said that it would be useful to have access to ASFA or a database on CD-ROM. However, the same users and providers seldom utilize the database search services available from other information centers and libraries in the same city or country. A question remains to be answered regarding the importance of ASFA or any database for that matter. An equally disturbing question on why databases and services available in the same city or country are not utilized, has to be answered.

#### RELEVANCE AND UTILITY

Although it is quite difficult to measure the relevance and utility of information sources, these can be assessed in relation to the well defined information needs of the users. In the survey, only a small portion of the respondents indicated their use of, and satisfaction with the international information sources such as ASFA, the International Information System for the Agricultural Sciences and Technology (AGRIS), or the Biological Sciences Information System (BIOSIS). Thus, no conclusive assessment could be made. It is possible that many information users access these international information sources through their local libraries and are aware of the sources of the information.



It was equally difficult to assess the relevance and usefulness of international information sources from the point of view of the information providers, because (a) only a few international, regional and national libraries have convenient access to these sources, and (b) the providers' answers were their own views and not those of the users. The providers however, explained that international information sources are not as useful as they appear to be mainly because of language barriers on the part of the users and insufficient coverage of locally appropriate materials. At the same time, providers are generally content with as long as they could give something to their users particularly a computer print out, and there was little concern about relevance of the information provided to the users.

On the basis of the feedback received during the group and individual discussion, it was observed that certain segments of the fishery information users, particularly the research community, have been served quite well by the international and regional fishery information sources such as ASFA, Current Contents, and the publications and services of the Intergovernmental Organization for Marketing Information and Technical Advisory Services for Fishery Products in the Asia and Pacific Region (INFOFISH).

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

Two international information sources mentioned frequently during the discussions were ASFA and Current Contents: Agriculture, Biology and Environmental Sciences (CCABES), although researchers are aware of other key information sources and how to access them, mainly through their current or former institutional libraries. This indicated that research information is relatively well organized, that research community has relatively good access to research information sources such as ASFA and CCABES, and that the format, organization and presentation of research information were suitable for researchers' use.

Thus, it was possible to conclude that international abstracts, indexes, and databases covering scientific and technical literatures are providing a useful service to the research community.

Regarding the question on accessibility, availability and under-utilization of existing information and knowledge, researchers in institutions that do not have libraries or information centers 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 would not know the existing information sources or where to send a request for original articles or documents. Secondly, many of the fishery information users are outside the research community and the existing international information sources are not effective in meeting the information needs of the non-research community.

From the survey results and feedback of the discussions, it was observed that user groups who are not adequately served by the international and regional information sources are those from the non-research community. There has been little organized effort to provide integrated and synthesized information to policy planners or technology digests to extension specialists and field workers. In spite of their usefulness, most of the existing efforts such as those done by FAO, the Association of Southeast Asian Nations (ASEAN), in this area, are too little or too *ad hoc* in relation to the needs.

There are several established reviews in fisheries and related fields. These reviews which appear in international publications are normally captured by ASFA and other abstracting services. However, most of the review papers are subject- or discipline-oriented, and deal with narrow scientific topics. Few review papers give broad overview of topics in fishery resource management problems relevant to developing countries. To some extent, publications of various international and regional fishery bodies, e.g. FAO, ICLARM, SEAFDEC, the Network of Aquaculture Centres in Asia-Pacific (NACA), the Bay of Bengal Programme (BOBP), have filled in the gaps in this regard. However, there is no concerted and systematic efforts along this area.

### Causes of Poor Utilization

Some of the reasons for the under-utilization of research information captured in international information sources, by the users in non-scientific or non-research community are:

#### a) *Contents and coverage*

Most of the information needed and used by the non-research community does not meet the selection criteria, i.e., scientific standard used by the international information programs. Here, the international information sources are not as useful to non-research community as it is to the research community.

Extension information or technology digest is seen as inferior information sources compared with research information. There exist few information sources and libraries actively collecting, organizing and providing access to these materials.

Non-research information is relatively difficult to collect. Unlike research information which appears in refereed journals, conference proceedings, technical reports and books, formally published and widely distributed, non-research information is by and large, produced by public or non-profit institutions in a form of pamphlets, leaflets or manuals and are distributed in a limited number without marketing channels or promotion.

#### b) *Presentation*

Research information or research outputs are packaged or presented for researchers' use while little or no attention is given to the needs of other groups of users. Research outputs are often written in terminologies which are not easily understandable by non-researchers. Also, most of the research papers or reports deal with highly specialized and narrow aspect of a fisheries problem. Moreover, information in most of research papers is not presented in the context of local needs.

Different information-seeking behavior of the users in the non-research community poses another problem.

Traditionally, most of the research outputs are available in written form, and extension specialists and fishermen seemed to lack intensive reading habits, thus constituting an inappropriate medium of communication and presentation.

c) *Language and professional barriers*

The trickling down process, from research to utilization, takes a long time. There is little concerted and coordinated effort to bridge the communication gap between the research, extension, policy planning and information communities.

Language used by the research community and international information sources, i.e., English, is not the working language of most information users and providers.

## ISSUES AND CONSTRAINTS

### Issues

The difficulties and problems in obtaining and using information in the fisheries sector are not different from those in other sectors, e.g., agriculture.

a) *Accessibility, availability, and timeliness of services*

This is constrained by (i) poor local or institutional information resources and services, (ii) unawareness of the accessible information resources and services, (iii) lack of qualified information staff, (iv) lack of cooperation between information programs particularly at national and regional level, (v) high cost of information, (vi) language, bureaucratic and professional barriers, (vii) poor local communication and transportation infrastructures, and (viii) inadequate coverage of literature of developing countries in international information sources.

b) *Compatibility, reliability, currency of information*

This is constrained by (i) lack of cooperation between information programs, (ii) lack of systematic methods and mechanisms for collection, organization, analysis, synthesis, and dissemination, and (iii) lack of qualified information staff.

c) *Appropriateness, completeness, relevancy, suitability, utility*

This is constrained by (i) poor local information resources and services, (ii) lack of knowledge and understanding of users and users' needs, (iii) lack of subject knowledge on the part of information staff, (iv) lack of digested, integrated and appropriately packaged information, (v) lack of locally appropriate information, (vi) lack of qualified information staff, and (vii) language and professional barriers.

d) *Sustainability*

This is constrained by (i) lack of support and commitment of senior managers, administrators, and policy makers, (ii) lack of funds or financial resources, and (iii) lack of leadership.

e) *Qualification of information staff*

This is constrained by (i) lack of trained professional staff, (ii) lack of training opportunities, (iii) narrow view or definition of information program, and (iv) low salary and status of the positions of information staff.

### **Constraints**

Most of the information centers and libraries in fisheries, particularly at national and sub-national levels, do not have any capability to develop their information resources. As the financial resources allocated to the information programs are totally inadequate, collection rely mainly on donations, gifts and exchanges. As a result, providers tend to add whatever they receive to their collection regardless of relevance and utility of the materials.

The value of information is recognized by research staff and information professionals. However, this awareness is not always shared among senior managers, policy-makers, and donor agencies who often see that support for conducting experiments, training for scientific staff, and supply of equipment are more important for research than for good information. Subsequently, information program rarely receives the adequate support and commitment of



managers and policy-makers. So that when there is funding shortage, information support is often the first to be cut, in spite of the fact that resources allocated for information are already minimal and inadequate.

One fundamental constraint that is not widely recognized, but is considered critical, for improved information utilization, is the narrow view demonstrated by senior managers and policy-makers on information activities and programs. Most senior managers and policy makers usually associate information programs with libraries and collection of books and journals. They overlook the fact that information packaging and dissemination activities such as production of extension materials and special briefs, development communications, and dissemination and extension of knowledge and information, are part and parcel of information activities. Absence of such recognition has delayed and prevented the development of a wholesome information program as well as qualified personnel in the field.

Qualifications and training requirements of information professionals have been misunderstood for a long time. The narrow view on information activities made people think that any person who likes to read are suited to become information specialists. Until recently, none or perhaps little attention was given to the qualifications of an information specialist, such as professional competence, initiative, resourcefulness, leadership, and ability to work with people. Consequently, the need for professional training has not been well recognized, thus limiting training opportunities for information staff.

While librarians and information specialists exist, their training is often minimum while their status is considered more as support staff rather than as professional staff. Added to this is the fact that there are only few trained information resource managers, scientific editors, writers, and communication specialists within the information programs.

Lack of appropriately packaged information products is one of the serious constraints identified by the users. Research results may be available, but users in non-research community are not able to benefit because the information is not integrated, synthesized nor digested in the context of local needs. Firstly, information users are discouraged by the amount of time and effort required to obtain the needed information. Secondly, incomplete, insufficient, fragmented

and inappropriate information and services frustrate the users. The respondents pointed out that the fundamental problem is appropriateness of information and timeliness of services and not lack of information, and that what is needed is useful information and not a publication nor an article.

It should be understood that information users generally accept what is provided. No demand nor criticism does not usually mean satisfaction by the users. It is generally known that the more services 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 appropriate types of materials in the international information sources, improved access to those sources would not necessarily address many aspects of the issues and constraints related to locally relevant information, digested and useful technology packages, integrated and synthesized reviews, language barrier, cost of services, and qualification of information staff. Therefore, attention must be given to accessibility and availability of relevant and useful information and not just accessibility and availability of the information.

In order that users in the developing countries could take advantage of the international fishery information sources, actions should be undertaken, such as (a) relevance of international information sources to the needs of the developing countries must be improved, (b) language and professional barriers should be removed, (c) core of skilled information specialists who are familiar with discipline, various relevant information sources and retrieval method, must be developed, (d) local communication and computer facilities must be improved, (e) document delivery service must be improved, so that references retrieved from the international information sources will be available when they are needed, and (f) cost of accessing international information sources must be within the means of individuals and institutions in developing countries.

Fishery information services and systems in Southeast Asia have made a considerable progress in the past decades. However, a variety of constraints exists in utilizing international and regional information sources and services. These include (a) low priority given to information programs, (b) lack of facilities and infrastructure funding

through securing adequate financial and management support of the parent institutions, and (g) developing the national capacity and capability in effective organization, dissemination, and repackaging of information.

#### RECOMMENDATIONS

a) *Development of National Fishery Information Resources and Services*

This is aimed at addressing the issues and constraints related to accessibility, availability, cost and timeliness of services. Equipping every library or information center with adequate information and human resources may be ideal, but it is not a practical solution.

Thus, the following suggestions should be considered:

- i. establishment of a few selected specialized information centers or libraries at national or provincial level
- ii. development and strengthening of the comprehensive information resources through acquisition of international, regional, national and local information sources
- iii. compilation and production of new information sources such as comprehensive directories or inventories of fishery institutions, experts, research and development projects, information centers and resources, and funding agencies
- iv. acquisition of facilities necessary for the services
- v. establishment of a network of information resources and services both at regional and national, and sub-national levels
- vi. development and strengthening the skills of the information staff
- vii. initiation of a pro-active information services including current awareness, document delivery, referral and technical backup services to other libraries, and user orientation programs



viii ensuring the long-time viability of information programs through appropriate mandates and fishery information policies.

It was noted that the national fishery information programs in many countries in Asia are at different stages of development, thus requiring different level of support and approaches.

b) *Analysis and Dissemination of Fishery Resource Management Information*

This addresses the issues and constraints related to appropriateness, relevance and utility by filling in the gaps in information products which are specifically integrated and synthesized in support of fishery resource management and policy planning. Systematic provision of comprehensive reviews and briefs on national and regional fishery management issues would assist not only in formulating appropriate management measures but also in identifying further research and policy requirements and directions.

The objectives of this are:

- i. to facilitate and promote the exchange and utilization of information relevant to fishery policy planning and management
- ii. to analyze, integrate and present information in the context of regional, national and local fishery resource management and policy planning needs
- iii. to establish national and regional network of fishery resource management information
- iv. to strengthen and develop national and regional capabilities in the preparation and production of reviews and briefs, including information analysis, scientific editing, writing, and effective presentation.

Regional cooperation and collaboration are critical in the identification of relevant issues and topics, preparation of reviews and briefs, sharing of expertise and workload, and wider dissemination of the outputs.

c) *Fishery Technology Transfer*

Application of conservation and environmentally sound methods of fishing and fish farming is severely limited because of limited transfer of information and knowledge to the directly involved users. This will therefore address the issues and constraints related to appropriateness, relevance, suitability, and presentation of information but focusing on the needs of technology transfer to the private sector and the fishing community. This concern is aimed at (i) systematically collecting, organizing, and disseminating fishery extension and technology packages, (ii) facilitating and promoting exchange of fishery extension and technology packages both at national and regional levels, (iii) establishing networks of fishery extension information, both at national and regional levels, (iv) digesting, repackaging and presenting information in the form of fishery extension and technology transfer packages that are locally appropriate and in local language, and (v) strengthening and developing national capability in the areas of development communication, production of extension materials, and repackaging of information.

The program design should take into consideration the local needs and conditions, user characteristics, and local capacity and capability. At the national and regional levels, translations of the information into local languages may be necessary. Regional cooperation and collaboration are also necessary to share outputs and workload.

This includes activities at the national as well as regional levels. While an active participation of the national programs in executing a bulk of the program activities is necessary, a strong regional leadership and coordination should be provided, with the following objectives:

- i. to develop regional information resource, services and technical capability that complement and back-up national resources, services and capabilities
- ii. to assess and coordinate the training needs and programs at the national level

- iii. to facilitate and promote an effective and efficient information exchange and flow at regional and international levels, including promotion of close collaboration with international information systems
- iv. to develop and promote the use of common and compatible methodologies and tools
- v. to provide a professional forum to assess information needs, issues, and constraints, and explore appropriate solutions to the constraints identified.

This indicate that libraries and information centers must move beyond their traditional functions and take a lead role in filling the gaps in information products and services. The approaches and activities of each program should be determined according to the capabilities, capacities and local conditions of the participating institutions and programs. Identification of the participating as well as coordinating institutions should take into account such factors as mandates, capabilities, existing activities, resources, commitment, and program directions of the institutions.

d) *Considerations for Formulating Information Programs*

Information program is designed to meet the information needs of a group of users in a sector or institution. Thus, it is essential that the strategy of information program should be closely linked with the strategies of the sector and the institution. Furthermore, fishery information programs must position themselves between the fishery communities and their information needs and should play a role as an active information broker, promoter and disseminator.

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**FISHERY INFORMATION PROGRAMS AND SERVICES  
OF CAMBODIA**

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**INTRODUCTION**

The fishery information programs and services of Cambodia were organized during the French colonial period (around 1920-30) by a group of French scientists. Some publications and materials such as maps of fishing lots and demarcation of the inland fisheries were being used as reference by Cambodian undergraduate students in their practicum work to fulfil the requirements of their Bachelor's degree programs (around 1970-74).

The practicum papers, also called Memorandum, of the undergraduate students were compiled by the Agriculture University Information Services and the documentation and extension offices of the Department of Fisheries for further use later as scientific information. These information were kept in the libraries of these two institutions. However, some of the information were believed to have been destroyed during the period from 1975 until 1979.

Remaining fisheries documents from the French colonial period and after, were collected and kept in an underdeveloped information infrastructure of the Department of Fisheries. The usage of these information at the moment, is found negligible because of the absence of an appropriate dissemination system.



Efforts were made by government fisheries authorities to promote a proper collection and dissemination system of updated fishery information. However, it has been observed that reports of the government's bilateral research cooperation with the Soviet Union Fisheries Research Institute for marine fishery resource assessment of the EEZ (1983-85) and with the Vietnamese Fisheries Research Institute for inland fishery resource assessment (1985-88), have not been disseminated and never been used.

## FISHERY INFORMATION

### Users of Fishery Information

The present thrust of the government for the improvement of the socio-economic condition of the country, is on the agriculture sector. Thus, the development of fisheries is one of the major concerns, as fish is the basic food in the Cambodian diet next to rice. The development of the fishery sector requires adequate fishery information including the existing information system for proper management and planning.

Graduates as well as undergraduate students, who are at the moment working on different fields of fisheries in the country, are expected to be the appropriate fishery information users. Other users of the information are those engaged in planning and policy making, exploitation, conservation, enhancement of fisheries, processing, environment, research, economics, surveillance, and marketing.

### Marine Fishery

Includes status of marine and coastal fishery resources, stock assessment of shallow-water less than 20 m deep, stock assessment of exclusive economic zone (EEZ), existing fishing effort and its operation, navigation map of the sea territory, satellite map of coastal area, geographic assessment of coastal resource, cost of fishing enterprise and its output value, processing technology and quality-control analysis, fishery facilities including processing plants, fish distribution and marketing mix, and utilization of sea food.

### **Inland Fishery**

This includes information on the status of inland fishery resources, stock assessment, fishing effort and its operations, cost of fishery business and its output value, major impact of fishery environment, updated satellite map and geographic assessment of the fishery resource, processing technology and quality-control analysis, fishery facilities including processing plants, fish distribution and marketing mix, and utilization of freshwater fish.

### **Aquaculture**

This includes freshwater fish farming system, status of inland aquaculture, status of coastal aquaculture, status of mariculture, impact of aquaculture to the environment, status of aquaculture farms, socio-economics of aquaculture, technology used in hatcheries and species cultured, aquaculture inputs, marketing of fish seeds, marketing of aquaculture products, and utilization of aquaculture products.

The target users also require international fishery information relevant to Cambodian fisheries such as stock assessment management, oceanography, biology, taxonomy, fishing technology, fishery environment management, aquaculture environment management, aquaculture technology, fish nutrition, fish disease, genetics, quality control, fishery resource management, identification of aquatic animals, fish processing technology, and fishery economics.

### **Utilization of Information Services**

The fishery information services had been completely phased out in 1975 and since the re-establishment of the fishery administration in 1979, this activity was considered the least important. However, one small library was established at the Central Fisheries Department sometime in 1985 where several remaining books from the past regime donated by surviving fisheries staff are being kept. Thereafter, through donations from various sources such as the Food and Agriculture Organization (FAO), the International Center for Living Aquatic Resources Management (ICLARM), the Mekong Secretariat, bilateral donors, non-government organizations (NGOs), book inventory of this library consisted of some 300 documents in English, French, Russian, Vietnamese, and Khmer.



Dissemination of the fishery information in printed form has not been carried out because of lack of expertise in information services at the Department of Fisheries. Moreover, language, technology awareness and budgetary constraints of the fishery administration led to the non-implementation of the fishery information services in the country. The library only lends out documents to interested users, who are mainly students doing their practical work at the University.

In the organizational structure of the Department of Fisheries, the library is one of the components of the fishery resource affairs, aquaculture, extension and documentation. The absence of libraries at the provincial fishery levels has led to the absence of compilation and dissemination activities in the over-all fishery sector.

#### Use and Non-use of Fishery Information

In view of the non-existence of the required fishery information in many fields and the neglect of available fishery information such as stock assessment of the EEZ developed by the Soviet Union scientists, decisions on marine fishery sector development leads to the weak management of this sector.

The slow pace in processing fishery information particularly on the inland fishery research conducted by the Vietnamese scientists (1985-88) which were provided only recently (1992) to the Cambodian fisheries authorities, and translation of which is still unfinished until this time, led to the accumulation of additional outdated information.

However, the latest research result on fish consumption analysis had been disseminated and used by some organizations and the NGOs for aquaculture development in the rural areas. Some reliable fishery information are also being used by local and foreign scientists for improving fishery development projects.

To summarize, decision-making for the development management of many fishery fields in the Cambodian Government, may not be appropriate due to the non-use of the fishery information.

### NETWORKING

Recently, the Cambodian Government had acceded as a member of the Network of Aquaculture Centres in Asia-Pacific (NACA). It is foreseen that through this cooperation, aquaculture information-sharing with NACA and other organizations in the region, will be facilitated.

FAO, a world collector of fishery information, has contributed the most information to the Cambodian fishery information center and has donated information directly to local and foreign scientists involved in the development of the Cambodian fisheries.

The small-scale aquaculture project in Cambodia of the Asian Institute of Technology (AIT), had organized an aquaculture planning unit for improving the aquaculture information of Cambodia in support of the dissemination efforts of the aquaculturists and extension workers.

PADEK's aquaculture development project in the southeastern part of Cambodia conducts many surveys and experiments on aquaculture. Results of the survey were published for the benefit of the users. Such information is targeted to be shared with users in order to facilitate the development of the fishery information center of the Department of Fisheries of Cambodia.

### PROBLEMS AND CONSTRAINTS

Since the information center of the Department of Fisheries which is the library, is weak and many Cambodian fishery information could not be located, users could not readily access the information they required. Furthermore, since the library is not regularly operational and since there is no proper storing method, it is more difficult for users to get the information they needed.

### RECOMMENDATIONS

The fishery information programs and services of Cambodia need to be improved. The FAO fishery sector program mission to Cambodia in 1993 was concerned with the improvement of the fishery information center of the Department of Fisheries. The mission assisted the government in the preparation of a draft proposal for international assistance.

Options for improvement of the fishery information programs and services in Cambodia were identified as follows:

- a) A fishery library and information center in the Department of Fisheries, should be set up and provided with suitable equipment for photocopying, cataloguing, reading, storing, and retrieval of information
- b) One or two persons should be trained in library science
- c) One person should be trained as information specialist in a recognized institution specializing in aquatic resources and fisheries
- d) The staff, once trained, should contact and visit major libraries in the region to enable them to identify and acquire information related to Cambodian fisheries
- e) Major suppliers of fishery and aquaculture publications should be contacted in order to solicit donations, purchase essential reference books, and subscribe to relevant journals
- f) Documents should be processed using computers
- g) Necessary assistance especially in the preparation of annual reports on fisheries should be extended to the Department of Fisheries
- h) The issuance of a bulletin on Cambodian fisheries should be initiated for internal distribution and for exchange with other libraries and information centers in the region.

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## FISHERY INFORMATION PROGRAMS AND SERVICES OF CHINA

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### INTRODUCTION

China's fishery information management and statistics are being undertaken by the government as well as the non-government sector. In the government, the Division of Fishery Information and Statistics (DFIS) of the Fishery Department, Ministry of Agriculture, is the top managing agency for fishery statistics and information processing. The Division's main responsibilities are to (a) formulate the systems of fishery statistics and information, (b) design the national unified tables and manage methodology for national fishery information and statistics, (c) organize fishery statistical survey programs, (d) organize the implementation of the programs by periodically collecting, processing, analyzing, forecasting, and publishing fishery statistics and information, and (e) provide information inquiry services. In the administrative structure, fishery information and statistics divisions, sections and sub-sections are set up respectively, in the fishery departments of each local government such as provinces, autonomous regions, cities, counties, and townships.

The statisticians and information staff at each level units are responsible for collecting, processing and reporting of the fishery information and statistics to their superior level units.

In addition, the China National Fishery General Corporation, China's biggest fishery enterprise group and several fishery policies and management bureaus, i.e., the East China Sea, the South China Sea, and the Yellow and Baohai Sea, under the leadership of the Ministry of Agriculture, also provide fishery information and statistics through a statistical information network of the Ministry.

In information processing, the Ministry of Agriculture has designed unified and regularized fishery statistical tables which are sent to the fishery departments at each level in the provinces, autonomous regions, cities, counties, and townships. The tables are accomplished regularly by each level of the local government following the state statistic laws, regulations and requirements. These are then returned to the Ministry of Agriculture for processing and publication into information bulletins. Thus, in managing fishery information and statistical data, DFIS plays the role of the national fishery information center.

In the non-government sector, exchange and management of fishery information and statistics are undertaken by the fishery business circles in the regional areas. Information and statistics are exchanged through unofficial network like the fishery associations and their publications. An example is the "Marketing Bulletin for China's Aquatic Products," published by China's Association for Aquatic Product Market, which mainly introduces the fishery market situation in China and abroad. The "Aquatic Business," covering the information on aquatic product market circulation, is published by China's Fishery Magazine Press. In addition, the East China Sea Fishery Research Institute, the Yellow Sea Fishery Research Institute, the South China Sea Fishery Research Institute, the Pearl River Fishery Research Institute, the Yangtze River Fishery Research Institute and Helong River (Black Dragon River) Fishery Research Institute have their own information offices and libraries for collecting and processing information on fishery resource and scientific data in accordance with their research requirements. These research institutes also have their own publications for exchange and circulation. On the other hand, provinces and counties also have their own fishery publications for regional circulation.



### FISHERY INFORMATION

Currently, China's fishery information and statistical data deals mainly with (a) the quantity of aquatic products including catches and culture from both marine and freshwater fisheries, (b) production value, and culture area for marine and inland fisheries, (c) quantity of seedlings of aquatic species, capacities and quantity of fishery processing, (d) number of various types of fishing boats, (e) status report of overseas fishery fleets, (f) non-governmental fishery organizations, (g) fishery households, (h) fishery population and employment, (i) status of fixed fishery investment, (j) fishery disease and losses, (k) fishery production in key fishery cities and counties, (l) personnel status at each level of the fishery administrative agencies, and (m) finance and technology situation of the state-owned aquatic enterprises and marine fishery corporations. These information are compiled and published as China's Fishery Yearbook.

Furthermore, the Ministry selects about one hundred typical counties and several thousands of fishery enterprises and households which are used as fixed units for surveys on fishery cost, taxation, income, and fishery product marketing.

### NETWORKING

In the past years, DFIS had minimum contact with international and regional fishery information agencies. In 1989, a Chinese statistician and a fishery policy expert attended an information congress at the invitation of the Food and Agriculture Organization (FAO). The forum paved the way for an exchange of a great number of fishery materials, views on strengthening cooperation in the field of training and support facilities, and data introducing China's fishery policies. Although the proposed cooperation on strengthening the capability of the country's staff and facilities has not been implemented until now, FAO and China continue to exchange statistical materials every year. However, there are times when transmittal of China's statistical materials are delayed due to different methods of processing the information. China sincerely hopes to strengthen the cooperation with international organizations and other countries especially in fishery information exchange, data compilation, and personnel training.



### PROBLEMS AND CONSTRAINTS

The information and data provided by DFIS plays a significant role in the government programs and activities especially in stipulating policies, planning fishery development programs, and making micro-economic re-adjustments. The information and data are also used as important references for conducting research in fishery economy and resource management.

Since fishery information and data are being updated and expanded regularly, the information practically meets the requirements of fishery enterprises and research agencies. The utilization rate of the information is therefore relatively high. However, during the old era of the economic planning system when the government controlled the systems of statistics and information, more considerations were given on the scale, speed and output of fishery development in order to meet the requirements of the government in making policies and decisions. During this period, the information requirements of the fishery enterprises and fishermen, economic efficiency data, and information feedback, were practically ignored.

Under China's present economic reform system, the statistical standards and methodology continue to face an unavoidable challenge. In fact, the existing fishery statistical system and services can not match with the pace of development of the market economy and rapid development of the fishery industry. Under the new situation, there is a need to make reforms in the systems of compilation and processing of fishery information and statistics in order that DFIS could supply a timely and effective information service, not only for the requirements of the micro-economic management of the government but also for the fishery enterprises, specifically information on economic efficiency, market prices, international fishery situation, allowable fishery production materials, and financial situation.

Although China's fishery production output ranked first place in the world, China is still a developing country and relatively backward in agriculture, transportation, energy and communication. This brings difficulties and has constrained the information center from improving the information and statistics systems, and affected the collection, dissemination and utilization of the fishery information and statistics.

Specifically, under the situation of the national economic reform system, the statistical system can not keep up with the changing economic situation. In the management systems of fishery information, several weak points exist, such as (a) shortage of basic data and systematic information network, (b) unstable statistics agencies and posts, (c) low quality of statisticians, (d) limited knowledge of international fishery information, and (e) shortage of statistical experiences under the market economic system. These factors made it difficult to collect effective and timely information and to carry out feedback mechanism.

Moreover, the inadequate data processing and communication facilities also constrained the effective dissemination of the statistics and information. It was estimated that 1.8 million data are processed by DFIS annually. The shortage of computers at each level of the agencies leads to traditional processing of the data using abacus and pocket calculators. In the absence of Fax machines, data are mostly distributed by mail. Thus the economic efficiency of the information as well as the efficiency of the utilization of the latest information is quite low. This has badly affected the role of DFIS as the national center for information and statistics.

#### RECOMMENDATIONS

In order that China's existing system for fishery statistics and information meets the requirements of the market economic system, the following action plans related to improved collection, dissemination and utilization of fishery information, were identified:

- a) *The existing government fishery statistics and information systems should be improved*

The existing government fishery information and statistics system has some weak points. The system should be improved through reforms within the administrative structure of the agencies at all levels. Statistical agents and posts should be lawfully established at each level of the fishery units. The outdated statistical methodology and principles should be revised in order to establish a state fishery statistics system, which can meet not only the requirements of the government but also those of the fishery enterprises.

- b) *Training of statisticians and information staff should be intensified*

Statisticians in fishery production enterprises and fishermen are trained on the state statistics laws and regulations to enhance their capabilities in providing accurate statistical data to the government. The government at each level has also allotted more inputs to modernize the fishery information and statistics system.

However, in view of the current and future requirements for international information exchange, the statisticians need to be trained on theory and comprehensive processing skills for them to meet the state qualifications and thus are qualified to operate advanced facilities and work with the international network. FAO and other international organizations will be requested to provide personnel training in statistics and information processing.

- c) *Cooperation with international organizations and other countries should be expanded*

China is willing to develop international fishery information cooperation and exchange with international organizations and other countries. From this cooperation, it is hoped that experts from China can learn from other countries' experiences, policies and advanced technology in information management and service. It is hoped that China can be a member of an international fishery information network and in that way, make contributions to the Asia-Pacific region and the world.

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## MANAGEMENT FISHERY INFORMATION SYSTEM OF INDONESIA

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### INTRODUCTION

In line with an effective policy formulation and comprehensive planning, it is necessary to have up-to-date and accurate statistics and reliable information for policy makers and program implementors especially at the Directorate-General of Fisheries (DGF) in Indonesia. The present system of fishery statistics employed by DGF was designed by a Fishery Statistics Expert of the Food and Agriculture Organization (FAO), in 1976. However, some problems have been identified with the present fishery statistics system.

Firstly, the sample fishing villages have not been renewed since their establishment 17 years ago. As a result, the sample is not representative of the present situation. Secondly, the publication of the fishery statistics yearbook at the national level has been delayed by at least two years.

It was for the above reasons that the Management Fishery Information System (MFIS) is being established at DGF in order that fishery information could be readily available and useful to policy makers and top management.

transmission system using MODEM (Modulator-Demodulator) or wireless installations, will be studied, with a view of speedy reporting of data.

Training courses will be organized for the fishery information staff. The courses shall be multi-staged, each stage corresponding to the needs of the computerization program. The training is intended to facilitate the development of a new system of data processing by upgrading the staff's capability and knowledge on the methods of data analysis and presentation. This program will involve (a) training of DGF staff in the Government center, (b) central training of one person from each province, and (c) training by block in some places in the country.

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## FISHERY INFORMATION SERVICES OF MALAYSIA

by

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### INTRODUCTION

Information in this paper is non-statistical and refers to results of research, investigations and surveys, and extension work recorded in documentation form, computer diskettes, tapes, micro films. This paper is an attempt to present the status, channels of dissemination, uses, problems, and constraints of information dissemination in Malaysia.

In Malaysia, information on fisheries can be classified as results of basic research related to biology, aquaculture, environment, water quality, pollution, resources, and management. Information relating to technology and engineering aspects is also available. All information are obtained by way of scientific research conducted by researchers from the various research institutions in the country.

Specifically, fishery research is mainly carried out by (a) the Fisheries Research Institute (FRI) of the Department of Fisheries, based in Penang, with branches at the Marine Fishery Resource Development and Management Department (MFRDMD), the fourth department of the Southeast Asian Fisheries Development Center (SEAFDEC), (b) the Fisheries Research Institute, Bintawa, Kuching, for general research on fisheries, (c) Fisheries Research, Likas, Kota Kinabalu, Sabah, for general research, (d) the National Prawn Fry Research Centre, Pulau Sayak, Kedah, for research on prawn



fry, (e) the National Finfish Research Center, Tanjung Demong, Besut, Terengganu, for research on finfishes, (f) the Brackishwater Fish Culture and Research Centre, Gelang Patah, Johor, for research and production of brackishwater prawn and fish, and (g) the Inland Fisheries Research and Production Centre, Batu Berendam, Malacca, for research and production of freshwater species of fish.

In addition, there are also seven universities/colleges which conduct research in the field of fish biology, namely, (a) the Agriculture University Malaysia (UPM), Serdang, Selangor, for research on fish biology and various aspects of aquaculture, (b) the University Science Malaysia (USM), Penang, for research in marine science and fish biology, (c) University of Malaysia, Kuala Lumpur, for research on fish biology and marine science, (d) the Northern University of Malaysia, Kedah, for research on fish biology, (e) the National University of Malaysia, Bangi, Kuala Lumpur, for research on biology, (f) the Technology University of Malaysia, Sudal, Johor, for research on marine engineering, and (g) the International Islamic University, Petaling Jaya, Kuala Lumpur, for research on marine science and biology.

The above universities and their branch campuses, have a main library and various branch libraries, where books, documents, and research materials are published and documented. Information are available for the general public and the students from these libraries.

The Department of Fisheries (DOF) Malaysia disseminates extension information to its target groups, the fishermen and fish culturists, as well as the entrepreneurs and investors. Extension papers, publications, books, and manuals are prepared by DOF for extension purposes. Some universities, e.g., UPM, also have its Extension and Communication Faculty which produces agricultural extension materials.

## FISHERY INFORMATION

### Users of Fishery Information

Generally, for statistical and non-statistical information, the major user is the general public, classified into general users, non-academic users and academic/research users. The general users, consisting of the general public, fish farmers and fishermen, form the majority of the users of fishery information. For this

group, general extension materials are made available by DOF through extension papers, information papers, bulletins, and pamphlets. These are distributed free of charge to the target groups and the general public.

The non-academic users comprise the general investors and entrepreneurs in marine capture fisheries, aquaculture and related secondary and tertiary fishing industry. For this group, updated information are made available in order for them to make meaningful decisions. These are in the form of up-to-date scientific and economic surveys published in the form of books or magazines. Time factor is very important for them, since outdated information will be of no use to them.

Academicians and researchers also require up-to-date research results or to some extent, even preliminary results, which should be made available at the right time. These are in the form of seminar, workshop, conference papers and final reports. For this group, time factor is also very relevant in order to avoid duplication of efforts.

#### **Methods of Dissemination**

For the general public, catalogues and list of statistical reports on fisheries, extension papers and some general research bulletins are available on sale on-site or by postal mail service through the DOF. Other government agencies such as the Fisheries Development Board (LKIM) and non-government agencies such as the Intergovernmental Organization for Marketing Information and Technical Advisory Services for Fishery Products in the Asia and Pacific Region (INFOFISH), and universities also publish bulletins, and extension and information papers which are also made available for the general public.

The libraries at local universities keep catalogues of books, magazines, research papers, and other materials in bibliographic form. The local university libraries are connected on-line among themselves so that information are readily available all the time. These local libraries have also established arrangements for on-line computer information with other university libraries regionally and even internationally.

Extension materials are disseminated locally through the extension workers of DOF, who are stationed throughout the country close to the target groups, the fishermen and fish farmers. Extension materials are disseminated through extension books, pictures, audiovisual aids, radio, and television broadcasts.

#### REGIONAL NETWORKING

##### ASEAN-Canada Fishery Post-Harvest Technology Project - Phase II

The Canadian Government through the Association of Southeast Asian Nations (ASEAN), set up the ASEAN-Canada Fishery Post-Harvest Technology Project - Phase II at SEAFDEC Marine Fisheries Research Department (SEAFDEC/MFRD) in Singapore. Under this Project, the Regional Centre for Information Preparation and Dissemination (RC-IPD) was set up in Kuala Lumpur, Malaysia. The main task of RC-IPD is to coordinate post-harvest technology information developed at the regional centers in ASEAN and disseminate such information in the form of extension and training materials. The Project intends to enhance the dissemination of extension information on post-harvest technology in the ASEAN region.

##### Southeast Asian Fisheries Information System

Under the umbrella of SEAFDEC, the Southeast Asian Fisheries Information System (SEAFIS) formed a national center for Malaysia known as MALFIS, with the aim of coordinating bibliographical data on Malaysian fishery information. MALFIS compiles, collects, processes, and reports bibliographical information to the SEAFIS center at SEAFDEC Secretariat for processing and dissemination. However, MALFIS finds it difficult to carry out its functions due to lack of staff and inadequate funding in view of the national priority in the distribution of funds. Hence, the compilation of bibliographical data are always delayed. The delay in submission render these bibliographical information obsolete and of little use to those concerned.

## NATIONAL INFORMATION SYSTEM

### National Integrated Database Management System

The Canadian Government through its implementing agency, the Canadian International Development Agency (CIDA), under a bilateral agreement with the Malaysian Government and under the umbrella of ASEAN, embarked on a National Integrated Database Management System (NIDBMS) project in 1992. Under this project, the Canadian Government provides experts to develop a computer networking system for the effective development and management of the fish resource in the exclusive economic zone (EEZ). Basically, the project aims to develop an integrated network for computers linking the main frame computer at its Headquarters in Kuala Lumpur with the 12 states and 96 districts and fishing bases throughout the country. Although the system is mainly for resource development and management, other information packages will also be developed particularly statistical data. The system shall enable the Headquarters to obtain the latest up-to-date information in the shortest time possible. The states, districts and fishing bases will also be able to benefit from the services of the main frame computer by retrieving the latest up-to-date processed national data and information for their own use.

### PROBLEMS, CONSTRAINTS, AND RECOMMENDATIONS

With a huge number of information available nationally and with information coming from various national agencies, it is therefore a tremendous task for the national agency to coordinate the compilation, processing and reporting of the available information. However, the national agency lacks the needed staff and funding to perform this big task. If ever these resources are available, information activities are placed on very low priority resulting in delayed release of the output. Information that are not available instantaneously may no longer be useful to users and hence there is a waste of efforts.

It is a fact that there has been no established standard format for the compilation and reporting of the information. Differences in the format often result in the omission of some important information. Regional organizations are therefore urged to come up with a standard format for easy compilation and access of information.

Language has also contributed to the numerous constraints. Some information are available only in local language, like Bahasa Malaysia. These information could not be easily translated into the common English language. Under this circumstance, some information which are available in local language only are inadvertently left out.

Medium for transmission of these information is important for regional exchange purposes. Computers are presently used in countries in the region. However, each country uses its own software programs, thus, exchange of information can not be easily achieved. A common software program should therefore be developed for use by the countries in the region.

Each participating country, after contributing information for the compilation by a regional organization naturally wants to receive a copy of the processed reports as early as possible. Delay in providing the participating nations with the output would make the information useless. The regional organizations should therefore come up with an efficient method of transmission, processing and compilation so that information could be readily available to the users.

In conclusion, information made available in an appropriate time is useful to the users. On the other hand, delayed information is obsolete and is therefore of no good for the users. National and regional organizations in charge of information services should therefore device a plan for speedy compilation, processing and reporting of information.



## FISHERY INFORMATION

### Information Needs

The most important information needed by the fish farmers of Nepal are (a) proper management techniques for the village ponds which is lacking in most parts of the country, (b) control of water weeds which is a problem in some areas of the country, (c) control of wild fish, some of them carnivorous, which get into the village ponds during the monsoon and compete for space and food with the cultured fish species, (d) control of fish diseases, (e) market price at the local as well as main fish markets throughout the country, (f) improved culture techniques for higher fish yields, (g) fry nursery technology aimed at reducing the mortality rate of fish fry, and (h) predator control.

The information needs of the fish farmers which should be given high priority and immediate attention are (a) timely availability of fish species-wise seeds at the Fisheries Development Research Centres as well as in private hatcheries and nurseries, (b) management practices regarding nursery of hatchlings with special reference to feeding, manuring and control of predators in the nursery ponds, (c) market demand and supply of fingerlings and fish, and middlemen involved in fish marketing, and (d) demand and supply of fingerlings for the fish farmers.

### Information Centers

The Agriculture Communication Division prepares various agriculture programs and broadcasts these for 15 minutes daily through the national radio stations. Fishery programs are also broadcast occasionally and shown on the national television, also occasionally.

The Department of Agriculture Development publishes the bimonthly Agriculture magazine, pamphlets, flipcharts, posters, photo-story, and circulates annual calendar and annual agriculture diary. The Department of Agriculture Development also shows documentary films to the farmers occasionally through the national television and at districts agriculture fair. Other information centers such as the Fisheries Development Division, Agriculture Development Project, Fisheries Development Research Centres, and District Agriculture Development Offices provide useful information to interested farmers. Useful libraries for the



fish farmers are very limited. However, there are few main libraries at the university and office libraries of the Fisheries Development Division which provide library services to the fish farmers.

#### Use and Non-use of Fishery Information

Majority of the fish farmers are illiterate, and hence, booklets, pamphlets, and flipcharts are of little use to them. Due to budgetary constraints, the publication of these materials is limited and do not reach the farmers in the rural areas. Poor communication system of the country is another hindrance. Television has been introduced in the country recently and is limited only to the well-to-do families in towns and cities. This media is therefore, useful only to some innovative and rich fish farmers. Although radio could be a very useful media for the fish farmers, agriculture programs are broadcast in the national language, i.e., Nepali only. This would have been more effective if it is broadcast in other regional languages. In addition, radio units are also limited and are not easily available to the farmers in the remote areas.

#### NETWORKING

The research institutions in the country, namely, the Royal Nepal Academy for Science and Technology, Tribhuvan University, Department of Agriculture Development, National Agriculture Research Centre as well as the other Fisheries Development Research Centres, should establish proper coordination among themselves so that information and other valuable scientific publications can be shared. Coordination should also be developed with these institutions and the regional- and international-level institutions. For this purpose, a contact institution should be identified.

#### RECOMMENDATIONS

In order to improve the existing fishery information programs, an information unit headed by a national coordinator should be established in the Fisheries Development Division. Adequate manpower and budget as well as adequate facilities and equipment for the compilation and dissemination of information, should be provided to this proposed unit.

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**NATIONAL FISHERY INFORMATION PROGRAMS  
AND SERVICES OF THE PHILIPPINES**

by

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**INTRODUCTION**

As the country's major economic sector, fisheries contributes 4.5% to the Philippine Gross National Product. Directly dependent on the fishing industry are more than one million Filipinos deriving their livelihood from fisheries.

Considering the size of the fisheries industry, the value of scientific and technological information to the management and development of Philippine fisheries is evidently essential. In developing countries where resources are usually limited, there is a need to give top priority to information services to avoid wasteful duplication of effort, time and money.

The term "fishery information system" in the Philippines has been related with the Annual Fisheries Statistics of the Bureau of Fisheries and Aquatic Resources (BFAR) and its collection of books, periodicals, journals, and others. Moreover, other agencies concerned with the development and management of the fisheries sector have done their part in maintaining their own fishery information and data.

## FISHERY INFORMATION

### National Agencies

At present, four agencies under the Department of Agriculture (DA) are concerned with fishery information. These are BFAR, the Bureau of Agricultural Statistics (BAS), Bureau of Agricultural Research (BAR), and the Philippine Fisheries Development Authority (PFDA).

BFAR implements different activities which support fishery information services. It continuously collects and generates information on fishery resources management and development. These data are available at BFAR's divisions and centers. Other information activities carried out by BFAR includes the intensification of the fisheries technology transfer through packaging and information dissemination, technical and advisory services in all aspects of fisheries, fishery institutional assistance, creation of a Technical Board to review and publish technical and scientific papers on fisheries, and operation and management of the BFAR Library.

On the other hand, BAS is in charge of the collection, production and dissemination of fishery statistics data, among others. However, due to financial constraints, the scope of BAS' statistical collection is limited. With the recent implementation of the Fisheries Sector Program, collection of fishery statistics by BAS has been improved.

BAR is also involved in providing information services through its Information System Division which currently implements a Research and Monitoring System aimed at providing information and data on fishery researches according to development zones, commodity and technology level.

PFDA is in charge of providing information on fish marketing, post-harvest and infrastructure facilities including municipal and commercial ports, ice plants and cold storages, and processing plants.

### Local and Regional Organizations

The Philippines also benefits from the information programs and services of other local and regional institutions in the country. The Philippine Council for

Aquatic and Marine Research and Development (PCAMRD) has a National Information Program on fisheries and aquatic resources under which its Aquatic Resources Management Unit operates. The program is aimed at extending regional dissemination of information on fisheries and aquatic resources, accelerate technology implementation in the field, and heightening the awareness among Filipinos on the need to protect fishery and aquatic resources.

The University of the Philippines in the Visayas (UPV), on the other hand, operates the Philippine Aquatic Sciences and Fisheries Information System (PASFIS). This system was a result of a national consultative workshop with 34 participating institutions. However, PASFIS is not yet fully operational. It was intended to be operated through a network of coordinating and cooperating institutions with its center to be established at UPV.

The Aquaculture Department of the Southeast Asian Fisheries Development Center (SEAFDEC/AQD) has its own information programs and services. It has developed a system of data gathering, processing and information dissemination, and produces video tapes, regular newsletters, posters and publications such as proceedings, manuals, pamphlets, leaflets, brochures and the like, based on results of its research and development efforts.

Another institutions with its own notable information system is the International Center for Living Aquatic Resources Management (ICLARM). Its Library is known to be the most efficient clearing house for fishery and marine resource information in the Philippines. One of its ongoing programs is the Selective Fisheries Information Service (SFIS), which specializes in finfish aquaculture, resource management, small-scale fisheries, and tropical coastal zone management. ICLARM extends assistance to other institutions interested in developing their own information capabilities.

Moreover, the libraries and information dissemination projects of other academic, research and training institutions, are also operational as well as existing private collections. In sum, the Philippines has a considerable stock of information just waiting to be harnessed and utilized.

### NATIONAL FISHERY INFORMATION SYSTEM

DA, through the Fisheries Sector Program (FSP) with BFAR as the implementing agency, coordinates all the fishery resource management efforts of the government. Fishery resource management consists of (a) policies, rules and regulations directed at the management and control of harvest effort through the control of fishermen, (b) maintenance of fishery habitats necessary for sustained growth of the fishery resources, and (c) equitable allocation of fishing rights among conflicting users.

As the implementing agency, BFAR and its units conduct numerous site surveys, management and research designs and resource studies as well as socio-economic planning. These studies have produced valuable documents in the form of maps, records, designs, and plans.

For the effective use of these data, information or documents, there is a need to improve the present information management system to enable users to know the information available, their contents, and where they can be accessed.

The establishment of the National Fishery Information System (NFIS) is part of the policy reforms underlying the country's FSP. It aims to address the above-mentioned problems and constraints in fishery information.

#### Objectives of NFIS

NFIS is being established with two-fold objectives, namely:

- a) To serve as the center of a well-distributed networked information system in order to facilitate the vertical and horizontal flow of data and information within BFAR and principal agencies, and other information users
- b) To collect, process and provide timely and accurate fishery information and data for the purpose of planning and management, decision making, fishery development, conservation and protection of the resources, and support to research, extension and to the industry. This shall be achieved through networking and sharing of information and data with other agencies involved in fisheries serving as satellite stations of NFIS.



To realize the objectives of NFIS, the following strategies are being carried out:

- a) Integration and coordination of information requirements
- b) Support of the information system and the available computer technology that will allow users easy access to all available fisheries data
- c) Implementation of an information system with a mechanism for synchronization of information and data collection, processing and dissemination, ensuring quality, speed and accuracy of information released
- d) Operation and maintenance of the NFIS center which will serve as the catalyst in the pursuit of effective and efficient integrated information system.

#### Users of NFIS

The users and clients of NFIS may be classified into three important groups, namely:

- a) Researchers in the field of fisheries and related sciences
- b) Fishing entrepreneurs, practitioners, and technicians engaged in developmental and/or operational activities in the various aspects of fisheries and related sciences
- c) Managers, planners and other decision makers engaged in the management and coordination of fisheries and fisheries-related programs and activities.

#### PROBLEMS AND CONSTRAINTS

It is distressing to note that, generally, the present fishery information system in the Philippines is at best fragmented. The fishery information base is inadequate and fragmented as well, in terms of data collection and data banking. The problems concerning the collection, generation and delivery of information and data are characterized by the following:

- a) Dispersion of data and information among many agencies involved in fisheries without any system for access



- b) Lack of integration of and access to research findings
- c) lack of continuity in the methodology of statistical collection due to poor support in terms of funding
- d) lack of any computerized storage and retrieval system of the data generated and collected by BFAR, the principal fishery agency of the Philippines.

In most cases, the factors and or difficulties encountered in satisfying the needs of users which affect the use and non-use of fishery information are as follows:

#### *Degree of technicality*

Since most of the fishery information are highly technical or scientific in nature, only users with fisheries background and with high technical knowledge can understand and are able to make use of the information. It is therefore important to package highly technical or scientific information, such as those embodied in research results, in order to cater to users from different levels including the fisherfolk.

There are also instances where information requested is not within the scope of the existing collection. Such information may be available but are insufficient to satisfy the needs of the clients.

#### *Information Availability*

Fishery information and data are being generated in the different government agencies and other entities involved in fisheries, and most of these agencies are in Metro Manila. Since the country's fishery information base is fragmented, some relevant information may never be used or remain unknown to the users in other parts of the country. It is also very expensive to gather all the available data or information which various clients require.

The priority fishery information needs that are not met or are being met inadequately are summarized below. Although such information may be available, these may be incomplete or limited, or are scattered at different sources.

- a) Information on production which utilizes the outdated sampling frame for aquaculture

- b) Information on fishery catch and effort data particularly on the municipal and commercial fisheries
- c) Fry production which is not yet available, as only reports on special surveys or research studies are available, but these indicate partial information only
- d) Information on production costs and income which is also lacking
- e) Information on marketing-related issues and fish utilization which are not being met
- f) Information on available support services such as infrastructure, credit, processing plants, cooperatives, non-government organizations (NGOs), which are inadequate.

#### RECOMMENDATIONS

The degree of urgency for the establishment of NFIS has been recognized and accepted. The presence of constraints is a certainty but all these can be eliminated through some basic changes or policy reforms. In order to enhance the national and regional efforts to facilitate the availment of information services, the following reforms are recommended:

##### National Level

###### a) *Institutional Reforms*

These are required in order that the present fishery information system would work more efficiently. There is overlapping of mandates of the agencies involved in the coordination of fishery research projects. This should be redefined to eliminate duplication of activities, particularly in the area of information packaging and dissemination.

###### b) *Manpower Development*

Although information specialists are available in the Philippines, they should be trained on the technical aspects of fisheries and on the latest trends in their specialized fields. Since BFAR serves as the caretaker of the NFIS Center, its staff should have the

capabilities to carry out this additional task. The NFIS staff should undergo training on appropriate information technologies. On the other hand, BAS needs to augment its present manpower-enumerators in anticipation of an increasing volume of work.

c) *Upgrading of Equipment and Facilities*

NFIS through BFAR should invest carefully in relevant and practical information facilities. Equipment should be maintained conscientiously and the appropriate location for NFIS should be identified.

d) *The BFAR Library*

More attention should also be given to the BFAR Library. This facility could play a vital role in the fishery information system and should organizationally be integrated into NFIS. It is therefore appropriate to house the NFIS Center and the BFAR Library in one area, since the former will be utilizing the materials of the latter.

**Regional Level**

- a) A regional advisory and technical cooperation body among Asian countries should be created for information technology management
- b) Since the Five-year Fisheries Sector Program, which is presently supporting NFIS, will end in 1995, donor countries and other regional or international organizations should be requested to provide funds for the continued operation of NFIS
- c) The exchange of information and data and experience between and among Asian countries on information systems and technologies should be established
- d) There should be continuous training on statistics and information systems and technologies of information staff from Asian countries, particularly the Philippines, where NFIS is still in its infancy stage.

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## THE INFORMATION PROGRAMME OF NACA

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### INTRODUCTION

The programs of the Network of Aquaculture Centres in Asia-Pacific (NACA), which are meant to facilitate regional collaboration, are designed to complement each other. Training and information activities are meant to strengthen research capabilities and production skills. Research results are fed into training programs and information supports both research and training as well as facilitating contacts among the NACA participating countries. Inter-country exchange of experts and information is also implemented. There are in effect 13 member governments of NACA, namely, Bangladesh, Cambodia, China, Democratic People's Republic of Korea, Hong Kong, India, Malaysia, Myanmar, Nepal, Pakistan, Sri Lanka, Thailand, and Viet Nam. Indonesia pays a voluntary contribution while processing its accession and Iran has begun the process of formalizing its membership. Republic of Korea, Laos, the Philippines, and Singapore, participate in regional projects. Australia and Japan are also involved in various collaborative ways.

Structurally, NACA is a coordinated and interlinked system of aquaculture research institutions working in cooperation for the development of technologies, manpower and information. The structure and the Technical Cooperation among Developing Countries (TCDC) mechanism takes advantage of the strength and distinctive competence of each participating country, agency or institution. Under the NACA project implemented by the Food and Agriculture Organization (FAO) and supported by the United Nations Development Programme (UNDP) from 1980 to 1989, four

national research institutions were identified and strengthened to form the initial nucleus of the network, serving as regional aquaculture lead centers. Besides the four lead centers, five national centers were designed and strengthened. In the network scheme, the national centers adapt the technology developed by the lead centers to suit local conditions and for subsequent transfer to the farmers. In 1987, UNDP provided further support to assist Asian governments to develop seafarming. It mainly involved inter-country transfer of specific seafarming technology through training and demonstration courses, supported by a regional information and expert exchange scheme. When the Seafarming Project terminated in December 1991, NACA which by then has become an autonomous intergovernmental organization absorbed the Project's activities and the seafarming centers became part of the network.

#### INFORMATION PROGRAM

There has been no significant change in the nature of the information program of NACA. What NACA Project and the Seafarming Project established had been sustained throughout the four years that NACA became an autonomous regional body. The program still consists of basically the same components, namely, publications, audiovisual productions, and a computer-based information system.

Publications included working papers, training manuals, the World Food Day technical publication series, the network newsletter and a special publication developed as a prototype (in two volumes) under the Seafarming Project, called the Regional Seafarming Resources Atlas. Audiovisual productions were those mainly developed by the regional lead centers, while the computer-based aquaculture information system (AQUIS) is a numerical information system designed to generate essential farm performance data needed to develop and refine farm management methods. It has since become dysfunctional for various reasons. There are however, plans to revitalize AQUIS.

The three key elements in NACA's program that relate to a sustainable regional information development and exchange system are (a) the scheme of having national coordinators, (b) publication of reports of regional and national studies and writing and dissemination of reviews on specific topics on aquaculture and the environment, and (c) the planned development of a regional database on sustainable aquaculture farm performance and the environment which is



one of the projected outputs of an ADB-assisted regional technical assistance, called Aquaculture Sustainability and the Environment, which is to be achieved shortly.

### National Coordinators

Participating governments have designated national coordinators for specific NACA regional activities, including Seafarming Development, Seaweed Development, Epizootic Ulcerative Syndrome (EUS) research, Fish Health Management, environment, and farm performance. The coordinators are the focal points of the studies or projects in their respective countries and coordinate information gathering and other in-country activities required under the project. After the project, it is assured that the results and recommendations are followed up in policy formulation or implementation. In the overall NACA mechanism, the national coordinators remain as the focal points of activities under their respective areas. This feature in NACA's networking mechanism has provided governments the opportunity for direct participation in the regional activities. In specific projects, it has facilitated an information exchange and ensured a continuity in the implementation of follow-up activities.

### Reports and Reviews

This includes published reports of the regional and national-level studies, workshops, and meetings of NACA or of which it is one of the implementors, and specialist reviews on certain areas concerning technology or policy. A notable example is the Report on the Fish Disease and Fish Health Management Study and Workshop conducted by the Asian Development Bank (ADB) and NACA, which has been widely hailed as a landmark publication in the field. A regional review in collaboration with AAHRI, of the results of studies on EUS in fish and recommendations to control the problem is another example. Reports of both the Governing Council Meetings and the Technical Advisory Meetings especially the latter, contain updated information on in-country aquaculture development activities that include production data, status of the projects and policy updates. In line with the expressed priority needs of the member-governments for aquaculture development, specialist guidelines and reviews have been recently recommended. These include (a) guidelines on the impact and control of exotic fish introductions, (b) fish quarantine systems, (c) management of aquaculture effluent, and



(d) environmental criteria for inland aquaculture. NACA seeks collaboration with interested and appropriate organizations in the development of these reviews.

#### **Aquaculture Farm Performance Database**

This will be established in conjunction with the Regional Study and Workshop on Aquaculture Sustainability and the Environment. The project is aimed at improving aquaculture production and investment returns while seeking measures to ensure long-term sustainability of aquaculture development. It will establish a benchmark database on current aquaculture practices in the region (initially on carps and shrimp farming systems which is the scope of the present project) and formulate guidelines and strategies for improving aquaculture productivity and ensure environmental sustainability. It will collate and exchange information on management practices and identify areas and opportunities for applied research to improve aquaculture technology and farm performance consonant with resource sustainability.

#### **FUTURE DIRECTIONS**

With expansion, the problems now facing the aquaculture industry in Asia have arisen in part because the thrust of aquaculture development has concentrated on the development of technology with little consideration of the wider issues relating to natural resource management, human resources and economic development. The poor economic performance of some farms, resulting from bad investment decisions and poor farm design, incorrect site selection, disease and lack of infrastructure support, has led to a significant loss of investment by both public and private sector, premature withdrawal of support, lack of confidence in aquaculture and abandonment of farms, which in some cases has led to major degradation of natural resources. In line with the need for a holistic approach to aquaculture development, NACA in 1991 developed the program of the Environment and Aquaculture Development. Endorsed by the participating governments, the program has defined NACA's regional aquaculture development thrust in accord with the emphasis on promoting sustainable development of aquaculture within the broader context of environment, resource management, and socio-economic development. The concept and activities for this program were inspired by several studies and workshops organized by NACA which highlighted the need for a balanced approach to aquaculture development. A number of projects have been developed under this holistic program. NACA's information program is likewise being geared towards the same thrust.

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## SEAFDEC INFORMATION PROGRAMS

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### INTRODUCTION

The Southeast Asian Fisheries Development Center (SEAFDEC) is an autonomous intergovernmental body which was established for the purpose of promoting fisheries development in the Southeast Asian region. Although established twenty-six years ago, SEAFDEC is still growing. At present, the SEAFDEC Member Countries are Japan, Malaysia, the Philippines, Singapore, and Thailand. Membership is open to other Southeast Asian countries, and Brunei Darussalam and Viet Nam have tendered their applications. The policy-making body of SEAFDEC is the Council of Directors, while the coordinating body is the Secretariat, located in Thailand. SEAFDEC has four departments, each with specific functions, namely, the Training Department (SEAFDEC/TD) in Thailand which undertakes training and research on marine capture fisheries, the Marine Fisheries Research Department (SEAFDEC/MFRD) in Singapore conducts training and research on fishery post-harvest technology, the Aquaculture Department (SEAFDEC/AQD) in the Philippines for aquaculture research and development in the region, and the Marine Fishery Resources Development and Management Department (SEAFDEC/MFRDMD) in Malaysia for training and research on resources development and management. The departments and the Secretariat exchange and disseminate information in fisheries and aquaculture among themselves, and with other member and non-member governments and organizations through their respective information programs and systems.

In 1989, the Seminar on Fishery and Aquaculture Information Systems in Southeast Asia was organized also with IDRC support. The objectives of the Seminar were to review the status of fishery and aquaculture information systems in the region, and to determine future activities in order to strengthen collaboration amongst information sources in Southeast Asia. The Seminar also aimed to identify appropriate training programs to enhance the development of fishery information systems in the region as well as to improve information management. The Seminar was meant to serve as a forum for the operation of the SEAFDEC regional information programs, e.g., the SEAFIS project. One of the important recommendations of the Seminar was the establishment of a coordinating committee to develop the SEAFIS project, later called the "system." However, such a committee has not been formed. The Seminar identified problems and constraints which hinder the smooth flow of information among the fishery information systems in the region, such as lack of trained personnel, difficulty in obtaining foreign journals, financial constraints, and the need to improve existing facilities, especially computer hardware and software.

#### INFORMATION PROGRAMS

SEAFDEC information programs comprise the general information service including publications, information system and audio-visual which are carried out by the SEAFDEC Departments as well as SEAFIS which is implemented by the SEAFDEC Secretariat in Thailand, and the Brackishwater Aquaculture Information System (BRAIS) by SEAFDEC/AQD in the Philippines.

#### Publications

Each Department of SEAFDEC and the Secretariat carry out publications activities as part of their information programs. SEAFDEC/TD for example, has been issuing a number of technical documents and reports since 1975. From 1989 to 1993, the following were published: 15 Research Papers, 21 Text and Reference Books, 26 Circulars, 6 Reports and Special Publications, and 17 Lecture Notes.

The Secretariat on the other hand, published the following materials from 1989 to 1993: 11 Special (Administrative) Publications (including SEAFIS publications), 9 Statistical Bulletins, 14 Reports of Meetings, 19 Newsletters, 4 Circulars.

### Audio-visual Activities

Another information-related function of SEAFDEC/TD is the production of audio-visual materials which is presently being undertaken by its Training Aids Section. Since its establishment in 1986, the Section has a moderate collection of about 172 video cassettes and 41 slides. These materials, either produced by the section or acquired from other sources including SEAFDEC/AQD, are mainly for training and information purposes and are released for use by the national training institutes in the SEAFDEC Member Countries.

### SOUTHEAST ASIAN FISHERIES INFORMATION SYSTEM

From 1984, the SEAFDEC Secretariat implemented SEAFIS with funding support from IDRC until 1989. The project aimed to provide a centralized facility and location for the fishery information and related disciplines. During its first phase, SEAFIS concentrated on the development of national networking agencies to facilitate its future activities as a regional focal point for fishery information and related disciplines and technology. The project was designed to collect, store, analyze, and disseminate such information.

The SEAFIS network originally comprised the Thai Fisheries Information System (THAIFIS) with its focal point at the National Inland Fisheries Institute (NIFI) of the Department of Fisheries, Thailand; the Indonesian Fisheries Information System (INFIS) at the Directorate-General of Fisheries, Jakarta, Indonesia; the Philippine Aquatic Sciences and Fisheries Information System (PASFIS) at the University of the Philippines in the Visayas in Iloilo, Philippines; and the Malaysian Fisheries Information System (MALFIS) in collaboration with the Fisheries Management Information System (FMIS) of the Fisheries Department, Kuala Lumpur, Malaysia.

From 1989, SEAFIS has continued operating but on a low scale with limited funding and personnel. It now concentrates mainly on bibliographic publication utilizing Mini-Micro CDS/ISIS as its database program.

SEAFIS has produced publications such as the annual Regional Bibliography on Fisheries and Aquaculture in Southeast Asia. This bibliography is largely a compilation

of English fishery literatures provided to SEAFIS by THAIFIS, MALFIS, INFIS, SEAFDEC/AQD, and SEAFDEC/MFRD. From 1989 to 1993, four separate volumes of this series have been produced covering the period from 1986-1989. This series is mainly distributed to concerned groups of persons, fishery libraries and institutions, within and outside Thailand.

SEAFIS also assists THAIFIS in the publication of the Thai Fisheries Bibliography which is meant to promote the flow of fishery information in Thailand. From 1989 to 1993, two volumes of this series covering the periods 1976-1980 and 1986-1990 have been published by SEAFDEC/TD, through this arrangement. Each volume contains bibliographic records of literature published during a five-year period in English and Thai literatures, e.g., books, journal articles, theses, conference proceedings, technical papers, extension papers, statistics, and research papers. Sources include libraries, information centers and universities in Thailand, the Department of Fisheries agencies, and other institutes. This Thai-stressed series is made available to the libraries, institutes and organizations concerned with Thai fisheries as well as to interested individuals.

SEAFIS also assists THAIFIS in the publication of the THAIFIS Acquisitions List, compiled bimonthly by THAIFIS. From 1989 to 1993, thirteen issues of this series have been published. It is a list of fisheries bibliographic records which is compiled from the acquisitions lists of other libraries in the THAIFIS network. The THAIFIS Acquisitions List is compiled from both Thai and English literatures and distributed to fisheries officers, scientists, researchers, and institutes or organizations concerned with Thai fisheries.

#### PROBLEMS AND CONSTRAINTS

These problems were encountered in the implementation of SEAFIS:

- a) Although SEAFIS has exchange arrangements with its network in the region, contributions from the networking agencies are not received regularly, while some agencies have not been active in their participation in the system. This has caused delay in the publication of the SEAFIS bibliographies.
- b) In many cases, details of bibliographic citations received from the SEAFIS networks are not complete.



- c) The published Thai and Regional Bibliographies are not up-to-date because the information supplied is also outdated by two to three years. In addition, these series of bibliographies are exclusive of abstracts. The data can not be retrieved through computer, thus, making the information useless to some groups of users.
- d) SEAFIS has inadequate staff, and therefore unable to carry out its activities on a normal scale.
- e) SEAFIS equipment and facilities, e.g., computers, need to be upgraded.
- f) SEAFIS's activities are given low priority because the components of SEAFDEC's information programs are fragmented, i.e., the information, publications, audio-visual, and the library services are under different divisions in SEAFDEC/TD.

#### RECOMMENDATIONS

The following recommendations are aimed at improving and expanding the capabilities of SEAFIS:

- a) A coordinating committee or a system coordinator, as recommended during the 1989 Seminar, should be designated in order to formulate plans and to take charge of the SEAFIS activities. This committee shall comprise the participating countries of SEAFIS. In addition, a strong information staff with an experienced leader should be organized.
- b) The Thai Government, through the Department of Fisheries (as a national body) will be urged to allocate adequate resources for the development of THAIFIS in order for this to function as a true national center for fishery and aquaculture information, while working effectively with SEAFIS.
- c) All information or related services at SEAFDEC/TD should be merged into one division as the centralization of work would result in a more effective output.
- d) The SEAFIS facility should be continuously evaluated and upgraded.



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**THE BRAIS PROJECT:  
Sustaining an Information System**

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**INTRODUCTION**

The Brackishwater Aquaculture Information System (BRAIS) is being implemented by Aquaculture Department of the Southeast Asian Fisheries Development Center (SEAFDEC/AQD), with financial support from the International Development Research Centre (IDRC) of Canada from March 1984 until April 1989. The objective of BRAIS was to provide for the training of personnel and the organization of a specialized information analysis center for brackishwater aquaculture.

For the implementation of its activities, BRAIS collaborated with aquaculture centers in the region, namely, the Brackishwater Aquaculture Development Center, Jepara, Indonesia; the Fisheries Research Institute, Penang, Malaysia; and the Fishery Science Society of Thailand, Bangkok, Thailand. The Philippine center for BRAIS is at SEAFDEC/AQD in Tigbauan, Iloilo, Philippines.

The services provided by BRAIS are (a) access to SEAFDEC/AQD Library collection, (b) document delivery and photocopying, (c) question-and-answer including written replies, (d) database search, and (e) referral services. Through networking, BRAIS was able to provide training of its project staff from Indonesia, Malaysia, the Philippines, and Thailand, in information and communications.

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\* until 28 February 1994

### STATUS OF BRAIS

From 1984 to 1989, BRAIS published various materials such as (a) Brackishwater Aquaculture Abstracts (4 volumes), (b) BRAIS Newsletter (4 volumes), (c) Species Abstracts and Bibliographies on Prawn (1), Rabbitfish (1), Sea Bass (1), Milkfish (1), Mussel (1), Grouper (1), and Mud Crab (2), (d) Directories (Institutions and Scientists), and (e) State-of-the-Art Reviews (shrimp, rabbitfish). BRAIS has established a mailing list covering 430 institutions and answered to more than 650 written-in queries.

Results of the utilization assessment survey which was conducted in 1988 indicated that among the publications, the species abstracts and bibliographies were most used. On the other hand, among the services offered, the query-and-answer and the mailing list were recommended to be enhanced and sustained.

Through BRAIS, a publication exchange with about 600 institutions worldwide was established, BRAIS input centers included. From 1989 to the present, SEAFDEC/AQD still continues to receive documents and publications worthy of inclusion into the BRAIS databases. With a very limited budget after the termination of IDRC's support in 1989, information analysis and inputting into the BRAIS databases continued while indexing efforts were sustained at a low scale. Four databases were developed and enhanced, namely, (a) Filipiniana database which consists of citations on Philippine fisheries and aquaculture and serves as the source for the Philippine contribution into the Southeast Asian Fisheries Information System (SEAFIS) regional bibliography publications, (b) SPEC (species) database which consists of citations on selected species, (c) Serial holdings which covers all types of serials received including journals, magazines, newsletters, series, and (d) Book database or a collection of citations of monographs, general references, technical books, conference proceedings, and pamphlets.

As a happy consequence of the BRAIS project, the Library at SEAFDEC/AQD now has a steady growth of collection on relevant species covered by BRAIS and an increasing collection on species recommended by the Seminar on Aquaculture Development in Southeast Asia (ADSEA), i.e., snapper, ornamental fishes, which await to be published as abstracts or bibliography updates.

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**INFORMATION SERVICES:  
The SEAFDEC/AQD Experience**

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**INTRODUCTION**

Since late 1989, when the Aquaculture Department of the Southeast Asian Fisheries Development Center (SEAFDEC/AQD) streamlined its operation and the Information Division was merged with the Training Division, the information programs and services have been carried out by the newly established Training and Information Division (TID). Sourcing, processing and dissemination of aquaculture information continued in order to sustain efforts at transferring technologies to the fish farmers and at exchanging information on aquaculture R & D among SEAFDEC Member Countries and with other organizations in the region and beyond.

Each of the three sections under TID conducts information activities and services. In addition to its training function, the Techno-Transfer Section conducts outreach seminars and on-site training, and participates in agro-industrial fairs and exhibits in the country. The Section also participates in radio broadcast programs by facilitating the availability of resource persons for various topics related to aquaculture and conducts briefing of visitors and distribution of information materials to guests, visitors and interested parties.

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\* until 28 February 1994

The Audiovisual-Print (AV-Print) Section packages information drawn from published research results and produces print and non-print materials for industry development and technology dissemination. The Section produces extension manuals, aquaculture technology modules, quarterly newsletters of research reports and activities of SEAFDEC/AQD, bimonthly news service for fish farmers, posters, proceedings, brochures, monographs, collected reprints, and press releases. Distribution of these materials covers a wide global reach with emphasis in the Southeast Asian region. Video programs produced by the AV-Print Section include documentaries on various aquaculture technologies or practices as well as on SEAFDEC/AQD research and training activities.

The Library Section, which implements the Brackishwater Aquaculture Information System (BRAIS) project, contributes regularly to the Southeast Asian Fisheries Information System (SEAFIS) regional bibliography. The Library locates, organizes and disseminates information materials for its clientele within SEAFDEC/AQD and the public. The Section facilitates a Gifts and Exchange Program with 630 national and international institutions using the BRAIS and SEAFDEC/AQD publications. The query-and-answer activity of the Library Section is enhanced by the acquisition of a CD-ROM facility and the Aquatic Sciences and Fisheries Abstracts (ASFA) database.

Four databases are being maintained for easier access to the various sources of information in the Library especially on species of current research interest. Information materials gathered through the Gifts and Exchange Program are inputted into these databases.

Linkages with other information systems and services in the region are maintained through the Gifts and Exchange Program, Referral Services, and Query-and-Answer Service. As recommended in the 1989 assessment of BRAIS publications and services, document delivery, query-and-answer and referral services were sustained by the Library Section of SEAFDEC/AQD to answer the information needs at the national, regional, and international levels.

Information users accommodated by the Library include researchers and scientists, trainees, other personnel of SEAFDEC/AQD and other institutions, both local and foreign, as well as entrepreneurs, fish farmers, teachers, students, information specialists, and librarians. Information users

through various media (letters, faxes, telexes, phone-calls) are also classified in the same manner. Fish farmers also receive information through outreach seminars and lectures, and the in-house bimonthly publications.

### INFORMATION DISSEMINATION

Information provision is easily done if the query is subject- or title-specific. Otherwise, the query is forwarded to subject specialists at SEAFDEC/AQD's Research Division for interpretation or direct response. With the recent acquisition of the CD-ROM facility, retrieval of information has become speedier. For requested titles which are not available at the Library of SEAFDEC/AQD, an alternative document is either sent or suggested, depending on the distance or accessibility of the user. Most often, an abstract or table of contents of an alternative document is sent with a referral address of another institution which may have the requested document.

The availability of BRAIS publications such as abstracts and bibliographies has facilitated easier retrieval of information. An abstract publication on grouper, for example, can be immediately dispatched to the user seeking list of materials on this species. However, the Grouper Abstracts (BRAIS, July 1987) needs updating.

Clarity of subject and voluminous request for photocopies are two of the most challenging tasks in information provision. These require more time, effort and money. SEAFDEC/AQD plans to intensify its document delivery service with appropriate charging, on cost-sharing or exchange basis.

Another challenge is the information processing system of the SEAFDEC/AQD Library itself, which is gradually adopting to a computer-based system. The backlog of unprocessed materials is a stumbling block to efficient retrieval of needed or appropriate information. The Library Section has computerized its monographic collection from the latest acquisition and backwards. This also requires additional manpower to handle the computerization processes.

Finally, the greatest challenge for information provision is the sourcing of information itself, especially in the form of research progress reports, technology updates and manuals of national, regional, and international

institutions at the least cost and effort. Researchers and scientists would want to know more about the work of other institutions, while fish farmers need immediate information on how-to's and how-much.

#### SUSTAINING INFORMATION SERVICES

Information services at SEAFDEC/AQD will continue at focusing its activities on (a) document sourcing and computerized processing, (b) packaging of information on significant pamphlets and leaflets, and video coursewares, (c) exchanging information and networking with national, regional, and international institutions, (d) query and document delivery services, and (e) participation in agro-industrial fairs and exhibits, and radio broadcast programs.

Publication of the newsletters (SEAFDEC Asian Aquaculture and Aqua Farm News) will continue to report on the research updates and appropriate farm-level technologies. Publication of abstracts and state-of-the-art reports will be pursued to provide updates to the previous publications.



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**NON-STATISTICAL INFORMATION SOURCES  
FOR FISHERIES IN ASIA**

by  
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**INTRODUCTION**

The importance of fisheries in Asia has led to a wide variety of information sources becoming available. Donors, especially the International Development Research Centre (IDRC) of Canada, actively promoted the establishment of fishery information services.

The status of the information sources in the region was reviewed in 1989, when mainly Southeast Asian services were discussed (SEAFDEC 1989). At that time, emphasis was placed on the need for training mainly of library staff in management, computerization, indexing, abstracting and information packaging.

More collaboration and integration between the various services and user-pays mechanisms were proposed. SEAFIS was also proposed as the sub-regional coordinator (Table 1), backed up by a coordinating committee with secretariat in SEAFDEC to undertake formulation of policy and action programs for sub-regional information service development (SEAFDEC 1989).

Since that meeting, training sessions have been held in various locations and SEAFIS continues but no coordinating body has been set up. Indeed information sources and programs available in the Asian region in general, act fairly independently and overlap considerably.

### INFORMATION SOURCES

At present, there are about 11 international, nine regional and seven national information programs and services for fisheries in Asia (Table 1). Amongst the international level sources are (a) two major bibliographic databases, the Aquatic Sciences and Fisheries Abstracts (ASFA) and the International Information System for the Agricultural Sciences and Technology (AGRIS), (b) two project-information databases, the Current Agricultural Research Information System (CARIS) and the Fishery Project Information System (FIPIS), (c) one database on fish marketing (GLOBEFISH), (d) one which gives background information on key demographic indicators related to national fisheries, the Fishery Policy and Planning Database (FIPDAT), (e) two "specialty" services on diseases and FAO documentation, respectively, and (f) two other "specialty" services on tropical fisheries, the Selective Fisheries Information System (SFIS) and on brackishwater aquaculture, the Brackishwater Aquaculture Information System (BRAIS), for which IDRC funding had ceased and which continue at a low level of operation. The Marine Environmental Data Information (MEDI) deserves special mention as a directory of sources of environmental data, although there are apparently not much data of its use within Asia.

Regionally, the services are more specialized topically, i.e., on agricultural aspects, the Agricultural Information Network for Southeast Asia (AGINFONET); on post-harvest, the ASEAN Food Handling Bureau (AFHB); on environment, the Environmental System Information Center (ENSIC); on marketing, the Intergovernmental Organization for Marketing Information and Technical Advisory Services for Fishery Products in the Asia and Pacific Region (INFOFISH); and on seaweeds and invertebrates, the Seaweed and Invertebrates Information Center (SICEN). While geographically, we have for Southeast Asia, the Southeast Asian Fisheries Information System (SEAFIS) and for the Pacific Islands, the Pacific Islands Marine Resources Information System (PIMRIS) and the Pacific Regional Aquaculture Information Service (PRAIS).

There are formal national services in most Southeast Asian countries but few elsewhere (Sri Lanka and China). National bibliographies are maintained by most Southeast Asian countries and by Australia (by the Commonwealth Government and the Australian Society for Fish Biology) and India (by the Central Inland Fisheries Research Institute), as well as sub-regionally, by SEAFIS, ENSIC and AGINFONET.

In addition to the formal services listed in Table 1, many international and regional institutions, networks and societies cater for the needs of Asian fisheries. Twenty-six of them are listed in Table 2 and there are doubtlessly more in each category. Most supply literature, often free, and/or have mechanisms for exchange of information. As well, there are numerous networks and societies at the national level which contribute to information exchange (Table 3).

The list of sources would be incomplete without mention of the numerous national agencies called upon to provide information for their constituency. A sample representing some of these informal sources which completed the questionnaires about their activities, is given in Table 4. Most of the agencies in Table 4 are from two countries only (Indonesia and the Philippines). A complete listing for all Asian countries would be very large. For example, most educational and training centers would have libraries for the needs of teachers, researchers and students. In Indonesia alone there are at least 18 such centers apart from agencies listed in Table 4. Elsewhere in Asia, the number of teaching institutions expected to include library and information services for their constituency are: Australia - 14, Bangladesh - 3; Brunei Darussalam - 1, China - 16, Hong Kong - 2, India - 30, Japan - 64, Malaysia - 9, Pakistan - 5, Philippines - 16, Republic of Korea - 3, Singapore - 1, Sri Lanka - 6, Taiwan - 7, Thailand - 10, Myanmar - 3, and Viet Nam - 1. There are at least 17 more teaching institutions in the South Pacific Islands. Details of these institutions are in FAO and ICLARM (1993).

Note that for most of the countries, the above lists do not include the various line agencies of the national governments which also perform information functions. A few are given in Table 4 for Indonesia and the Philippines. There are some overlaps in Tables 1 to 4 as the total number of information sources mentioned is about 210. Regionwide then, there must be at least 250 information sources for fisheries.

#### FORMAL INFORMATION PROGRAMS AND SERVICES

The international services (Table 1) mostly consist of independent databases, each aimed at different but overlapping user groups or with differing purpose. In the case of BRAIS and the Selective Fisheries Information Service (SFIS), ASPA is also used. Definitions of user

groups and objectives of the various services were hard to find but they are apparent from the product descriptions.

At the regional level also, most services are based on "exclusive" databases based on at least moderate-sized libraries. Again there are overlaps. On the other hand, at the national level there is some use of the international and regional services, augmented by small libraries and collections except China.

### Overlaps and Gaps

At the international level, the two bibliographic databases AGRIS and ASFA certainly overlap but the extent has not been reported. AGRIS has some 140 inputting centers worldwide and by far the largest collection, but only a small part deals with fisheries. ASFA is closer to the needs of most countries in fishery matters but has only a dozen or so inputting centers globally. This is being improved somewhat at present, e.g., the International Center for Living Aquatic Resources Management (ICLARM) is beginning to input its own material as a new member of the ASFA network. There has been discussion at the Food and Agriculture Organization (FAO) on rationalizing the role of the two databases (AGRIS and ASFA) and the outcome is not yet known.

There has always been a perceived lack of coverage of "grey" literature. Grey literature is seen as the large quantity of material which is currently preventing information specialists from supplying the real information which people want.

John Woolston, as part of a consultancy for FAO on ASFA in 1991, examined the performance of ASFA against some FAO bibliographies and ICLARM's *Naga* mini-database. In both cases, the overlap in coverage was close to 50%. He concluded that ASFA would need to double in size to about 65,000 items/year to cover "all" the literature (J. Woolston, pers. comm.). The missing literature is, by definition, mostly grey.

However, ASFA (on compact disc) covers all aspects of aquatic sciences globally. Fisheries, including aquaculture, represent about one quarter only and one might expect that temperate fisheries which constitutes the majority, are covered much better than tropical fisheries, such that most of the grey literature is in the tropics.

One could therefore argue that the *Naga* database, which is focused on tropical fisheries, needs only to be doubled in size from 1,000 to 2,000 items/year to provide near complete coverage of that field.

The two project databases, CARIS and FIPIS must also overlap. FIPIS only provides data on fisheries projects for which there is foreign assistance. These data are relatively easy to obtain through donors. However, it has been pointed out that this is not so useful either because unassisted projects are not available to the user, such that the extent of research and development in the sector cannot be determined. FIPIS needs expanding to cover all ongoing projects in the sector. CARIS deals largely with agricultural project information, although with 900 fisheries entries at present, it must cover a significant part of the field.

The other international services, BRAIS and SFIS, which are projects that have actually formally ceased, continue to collect and disseminate information through their own resources. They overlap, since brackishwater aquaculture (BRAIS) is a subset of tropical fisheries (SFIS). The two were set up in view of their parent organizations' (SEAFDEC/AQD and ICLARM, respectively) differing mandates and collections.

At the regional level, there are a number of specialty bibliographic databases which presumably have sources of grey literature that distinguish them from ASFA (or other primary databases). Certainly, most of them use ASFA while INFOFISH uses GLOBEFISH.

The sub-regional, "general" bibliographic databases and services overlap in content. SEAFIS is intended to be a sub-regional inputting center to ASFA of bibliographic information from the Southeast Asian national systems (INFIS, MALFIS, THAIFIS). AGINFONET presumably contains material also in SEAFIS while PIMRIS must overlap with PRAIS. While all must overlap to some extent because they deal basically with the same (Indo-Pacific) flora and fauna. As for SFIS and BRAIS, different orientation of the parent organization accounts for the presence of overlapping databases.

The various national programs rely on small collections and access to the in-country sources and/or ASFA. Figure 1 shows the relationships between the various international and regional or national information systems and services. There is much overlap, real or potential, in the databases.



Nearly all the information services provide references and articles from their shelves or on loan. A few of them repackage information. Until now, none scan the literature to provide very specific data. ICLARM, FAO and collaborating institutions are developing a database called FishBase that provides a wide range of information to different people. For university teachers and students in ichthyology, FishBase contains a checklist of the fishes in their country together with biological information on these species. For taxonomists, it contains the latest revisions of all genera and higher taxa of recent fishes and for research directors and funding agencies, it shows existing knowledge for each species and research gaps. For conservationists, it lists all threatened species for a given country as contained in the IUCN Red Book. For zoologists, it contains information on reproduction, morphology, brain size, eye pigments and for ecologists, it lists preferred habitats, environmental tolerance, prey and predators, food consumption. For aquaculturists, it provides information on gene traits and on culture experiments and for the fishing industry, it contains proximate analyses and recommendations for processing. For sport fishers, it lists the occurrence of game fishes by country. Researchers on indigenous knowledge will find more than 24,000 common names of fishes together with the language and culture in which they are used and with comments on their etymology. Librarians can provide their customers with up-to-date species synopses as print-outs from FishBase. ICLARM and some collaborators have also begun work on a similar database for coral reefs, called ReefBase.

#### INFORMAL NATIONAL INFORMATION SERVICES

The above formal information services were not surveyed regarding their own sources or problems. However, a number of informal services mainly libraries of research institutions or universities in Indonesia and the Philippines were asked to complete the questionnaires about their work.

Seventeen completed questionnaires, representing eight institutions in Indonesia, six in the Philippines and one each in Malaysia, Singapore and Thailand were examined (Table 4). In many cases, the only sources used by these informal services were at the national level, a linkage with one or more other institutions, principally the Indonesian Fisheries Information System (INFIS) in Indonesia. ASFA was



"CDS/ISIS, by its adherence to international standards, its flexibility and its broad user base, can act as a world bibliographies pipeline. If its users, who have received the software free, in turn offer their records freely to one another, bibliography, which has slipped out of the hands of librarians into greedy commercial hands, will again become free" (McFadden 1993).

The existing major bibliographic source, ASFA, is bounded by economics. Its orientation is to cater for users who can pay, thus, it points west. Since the missing quantity of information from ASFA to cater for the region's fisheries is not great, a synthesis with the various databases (mainly CDS/ISIS) around the region is not an insuperable nor expensive task.

The intention here is not to do away with the existing information services, only to provide them with better tools. Of course, many of the various services are the entities collecting and providing bibliographic control over the documents, they are the points of access to the documents. The synthetic database should tell users where to look for the documents.

Another tool to improve access would be a regional Union Catalog. ICLARM is working on the development of such a Catalog with the help from libraries concerned, as a by-product of examining the degree of overlap of serial holdings around the region (Temprosa and Maclean 1994). A Union Catalog would help information workers - both within and beyond Asia - to pinpoint needed serial titles and issues and also help rationalize holdings around the region.

Some form of networking would be useful to facilitate maintenance of the catalog as well as of the proposed 'synthetic' bibliographic database. In order to benefit from international progress and to forge links with western information programs and services, membership of the International Association of Marine Science Libraries and Information Centers (IAMSLIC), which also deals with freshwater despite its name, is useful. IAMSLIC offers a twinning arrangement through which a current member institution would "adopt" an Asian counterpart and pay for the latter's membership. What is suggested is not an unorganized sharing of databases as McFadden proposed, but a coordinated ongoing effort which would involve filtering for duplicate entries and improving compatibility of records into a single database which would need to be merged with ASFA.

available in a third of the institutions and the other major sources were publications - of FAO (in 50%), SEAFDEC (40%), and ICLARM (30%). The list, undoubtedly incomplete, is in Table 5. The major perceived problem is "lack of information," mostly through gaps in what is available. Also because the information on hand is out of date, irrelevant or not in an appropriate form. The language barrier was felt strongly in the Indonesian and Thailand institutions. Details of this are shown in Table 6.

### RATIONALIZATION

Few of the many issues related to the region's fishery information services include geography, access, timeliness, and relevance.

#### Geography

Earlier, Indo-Pacific was used as a substitute for Asian. Use of the former term enables us to think of a bounded area supported by a definable set of literature. The area is bounded by Hawaii to the east, northern Australia to the south and southern China to the north, excluding Korea and Japan. The west actually includes some of eastern Africa but more practically, western India can be used as the western boundary. What is being dealt mainly here are the two FAO fishing areas (areas 57 and 71), which are also those used by ASFA. The number of fishery information sources is closer to 200 than 250 using this "definition" of Indo-Pacific.

Much of the information generated is applicable over a very broad area and this implies that a single comprehensive information source would suffice. In fact, it could only be an improvement because one would not need to approach several non-comprehensive services. The excluded countries to the north - most of China, the Koreas, Japan and possibly Taiwan - are more closely related faunistically and otherwise than the other countries, and could form a separate information grouping in that fishing zone.

#### Access

Nearly all the national services and some of the regional and international services are based on the free CDS/ISIS software of UNESCO. As one expert recently stated:

"CDS/ISIS, by its adherence to international standards, its flexibility and its broad user base, can act as a world bibliographies pipeline. If its users, who have received the software free, in turn offer their records freely to one another, bibliography, which has slipped out of the hands of librarians into greedy commercial hands, will again become free" (McFadden 1993).

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### Timeliness

One should mention the concept of timeliness, since ASFA is very slow at present. Presumably, this will be improved in the future and a synthetic database as discussed above should help. Nevertheless, the end result is a record of past research in most cases.

A great leap forward could be made by including in any improved database the project records held in (an expanded) FIPIS and CARIS (aquatic resources projects only). The records concerning projects in progress would be cross-referenced to any document produced to date by the projects.

A major rationale for this idea is that literature databases are supposed to help prevent duplication of research efforts. The present ones thus fail because they do not include recent or present research. It is difficult to imagine that CARIS and FIPIS will ever be as accessible as ASFA, which itself is poorly distributed.

Figure 2 shows the steps needed to rationalize Asian fishery information: first a merger of all the Asian project and bibliographic databases to form an "Asian Database" which would overlap with the existing ASFA. A second step would follow, in which the Asian Database and all other relevant project information globally is merged with ASFA. This would presumably require some re-allocation of inputting responsibilities in the ASFA network and would take some time to accomplish. Meanwhile and until ASFA can provide cheap access, the Asian database should be available free of charge, separately.

### Relevance

It was noted that relevance and not the mysterious grey literature, is the major problem in the region. The above discussion was largely on technical documents and mainly for researchers, the common denominator of nearly all the information services.

The problem starts with text books. Fisheries text books, designed explicitly for use in the tropics are virtually non-existent. If something so basic is lacking, one can imagine the state of information with regard to other research-derived products such as extension literature, guidelines for managers, and sustainable



aquaculture technologies. This is a matter beyond the present scope but it will continue to plague information workers and their clients for a long time to come.

The degree of relevance of information provided by ICLARM's SPIS from 1988 to 1991 was assessed by a questionnaire. On quality, 86% (N=115) found the information "very useful," the remainder found it only "slightly useful." On quantity, 65% found it "all that was needed." Only 44% (N=92) of the users needing the information for a specific project found it "improved their project quality," while for most others (50%), it "provided background data." One can not expect a 100% success rate given the broad spectrum of enquiries received. However, better access to scientific expertise would have helped. ICLARM's scientific staff are too busy to attend to all the numerous enquiries they receive. Our goal is to have permanent subject specialists working with the library staff to form a solid information center for enquiries.

The language problem fits here also. More translations of important or potentially important books, articles, comics, videos are clearly needed in some Asian countries. Computer software is already for machine translation in some languages. ICLARM, for example, is beginning to use an English and French translation program which looks like saving enormous translation time, the only drawback is its limited technical dictionary to which we are adding. This will only be a matter of time before Asian and European languages are easily translated in this way.

Looking to the future, the term "fisheries research" will become less of a discrete subject of study and more part of resource system research. Sustainable fishing practices require looking at the ecosystem in which they operate. The ecosystem plus the human users comprise the resource system. An important area will be gauging the effects of the environmental (including climate) change on the resources and their users. Similarly in aquaculture, sustainable technologies will be needed.

In this regard, the breadth of ASFA is farsighted and praiseworthy. It confirms the central role of ASFA in aquatic resource research as well as the urgent need for ASFA to pick up the missing elements - some literature from other bibliographic databases (international, regional or national) and project-related information.



- d) The new synthetic database should be merged with ASFA, but could be available (free) separately
- e) FIPIS should be enlarged to include all fisheries-related projects and its data be merged into ASFA
- f) The existing information services and programs should be maintained, as they form a network of sources of the documents
- g) The loose existing network of services and programs could be formalized to facilitate coordination of record inputting, to facilitate finalization and maintenance of a regional Union Catalog, to facilitate resource sharing, and to share knowledge, problems and technologies
- h) The members of the proposed network should join IAMSLIC and form an Asian Branch (PIMRIS may elect to retain its separate Pacific Island membership)
- i) The information services and programs should all make use of FishBase and ReefBase for their clients.

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Table 1. Formal sources for Asian fisheries information

Service/Center	Facilities (relative size)*	Products/Services	Fees	Users
<u>International</u>				
AGRIS - International Information System for the Agricultural Sciences and Technology, FAO, Rome (from 1970)	Major computerized library (++++)	Ongoing bibliography including many fisheries items	High fee for the main product, Agriindex	Researchers, planners, etc.
ASFA - Aquatic Sciences and Fisheries Abstracts, FAO, Rome (from 1971)	Commercial publisher, network of inputting centers (++++)	Ongoing general bibliography	High	Researchers mainly
BRAIS - Brackishwater Aquaculture Information System, SEA/DEC Aquaculture Department, Iloilo, Philippines (1984-1990)	Large computerized library, technical expertise (++)	Bibliographies, literature searches, repackaging into (state-of-the-art reviews). Services continued at minimal level after project funding	Rephotography at cost	Researchers, policymakers, extension workers, students, fish farmers
CARIS - Current Agricultural Research Information System, FAO, Rome	International network of 134 centers, database (++)	Agriculture (including fisheries) research projects in developing countries	-	Research planners, managers
FIPIS - Fishery Project Information System, FAO, Rome (from 1989)	-	Computer-based info on fisheries projects funded by official bilateral and multilateral agencies.	-	Planner, managers
FIPPOAT - Fishery Policy and Planning Database, FAO, Rome (from 1991)	Software package (+)	Key information on structure and socioeconomic of country fisheries sectors	-	Planners, policymakers, managers
Global Fish Disease Information Exchange and Diagnosis Service	-	-	-	-
GLOBEFISH, FAO Rome (from 1984)	Database accessible by satellite	Fish marketing information, commodity reviews	Moderate	Mainly industrial fishing industry, entrepreneurs
MEDI - Marine Environmental Data Information, IOC, Paris (since 1975)	Referral system	Directory system for oceanographic datasets, including pollution, biology and fisheries. CI 26 countries in the 1993 directory, Asian data are available from Australia, Canada, China, India, Japan, Korea, USA	-	Researchers

REPDOC - Fisheries Library, FAO, Rome (from 1992)	Large computerized library (++++)	Country subset of FAO documents	Various. Available at FAO country offices
SFIS - Selective Fisheries Information Service, ICLARM, Phils. (1984-1992)	Large Computerized library, databases (+++)	Newsletter, Q-A service, literature searches, in tropical fisheries, farming systems	Mainly researchers
<b>Regional</b>			
AGINFONET - Agricultural Information Network for Southeast Asia (from 1987)	Library, network of inputting centers; about 7% of entries are on fisheries (++++)	Literature searches related to Southeast Asian fisheries	Researchers, policymakers, managers, extension workers
AFHB - ASEAN Food Handling Bureau, Malaysia (from 1979)	Computerized "library" collection	Technical Information Service; Newsletter, Current Awareness in post-harvest field	Researchers
ENSIC - Environmental Systems Information Center, Asian Institute of Technology, Thailand (from 1978)	Large computerized library, bibliography (++++)	Network (ENSICNET) of China, Indonesia, Nepal, Pakistan, Philippines and Vietnam providing ongoing bibliography. ENSIC collects, repackages and disseminates information	Mainly Asian researchers in environmental management, pollution control, water supply, sanitation
INFOFISH, Malaysia		Information on fish products and fishing technology	Mainly industrial-scale fishers, marketers
PIMRIS - Pacific Islands Marine Resources Information System. Library, University of the South Pacific, Fiji (since 1989)	Computerized database, national, regional networking libraries (++)	Q-A service; current awareness; literature searches on all materials related to living (and non-living) resources in the tropical Pacific	Various
PIN - Pacific Islands Network, consortium of US agencies to coordinate assistance to US-affiliated states (from 1988)	On-island network of extension agents and subject specialists	Technical info and expertise in all aspects of oceans and coastal resources planning and management	Researchers, etc in Northern Marianas, Federated States of Micronesia, Marshall Islands, Belau, Guam, American Samoa
PRAS - Pacific Regional Aquaculture Information Service, Hamilton Library, University of Hawaii (from 1988)	Large computerized library	Literature searches, articles	Fee-based Researchers

SEAFIS - Southeast Asian Fisheries Information System, SEAFDEC Secretariat, Thailand (from 1984)	Network of national/regional information centers/libraries (+)	Regional bibliographies	?	Researchers, managers
SICEN - Seaweed and invertebrates information center, Marine Science Institute, University of the Philippines (since 1990)	Computerized library and herbarium	Publications; O-A service; repackaging info; bibliography; literature searches on all aspects of seaweeds and invertebrates; technical assistance	?	Researchers, educators, students, planners, policymakers, farmers, industrialists
<b>National</b>				
INFIS - Indonesian Fisheries Information System, Directorate General of Fisheries Indonesia (from 1984)	Network of libraries (+)	Collects, repackages and translates material; bibliographies, abstracts	-	Researchers, managers, extension workers
NFIS - National Fisheries Information System, Philippine Bureau of Fisheries and Aquatic Resources (from 1994?)	To be a network of regional units, computerized	Information on resources technology, socioeconomic and legal aspects, production data, literature	?	Researchers, planners, managers, extension workers
MAARIS, Marine Affairs and Aquatic Resources Information System, Sri Lanka (from 1989)	Computerized library, database (+)	Literature searches, articles, videos	?	Researchers, managers, extension workers
MALFIS - Malaysian Fisheries Information System, Department of Fisheries, Malaysia (from 1988)	Network of information agencies/libraries (+)	Bibliographies (also statistics)	?	Mainly researchers
PCAMRD - Philippine Council for Aquaculture and Marine Research and Development, Los Baños (from 1988)	RIUD, Research Information and Utilization Division, library, and databank (+)	Information on national fisheries and aquatic resources (publications, audiovisuals, packaged technologies)	?	Researchers, policymakers, extension workers
SDIC - Sciencetech Documentation and Information Center of the Chinese Academy of Agricultural Sciences	Large library w/ over 200 scientists/technicians (++++)	Literature searches, translations, publications, training	-	Various
THAFIS - Thai Fisheries Information System, National Inland Fisheries Institute, Thailand (from 1984)	Library, network of library-contributors (+)	Bibliographies, information on fisheries resources	?	Researchers, managers

\*Relative size of collection/database \* 1 - 5,000; \*\* 5,000-15,000; \*\*\* 15,000 - 50,000; \*\*\*\* > 50,000



Table 2. International/Regional institutions which provide information on Asian fisheries

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Aquaculture Genetics Network of Asia
ASEAN Aquaculture Development and Coordinating Programme
Asian Fisheries Social Science Research Network (AFSSRN)
Asian Fisheries Society
Bay of Bengal Programme
Coastal Resource Research Network (Dalhousie University, Canada)
FAO Regional Office for Asia and Pacific (RAPA)
Group of Experts on Marine Information Management (GEMIM-IOC)
Indian Ocean Fishery Commission (IOFC)
IOFC Committee for the Development and Management of Fisheries in the Bay of Bengal
Indian Ocean Marine Affairs Cooperation (IOMAC) (?)
Indian Ocean Tuna Commission
Indo-Pacific Fishery Commission (IPFC)
IPFC Standing Committee on Resource Research and Development
IPFC Committee for the Development and Management of Fisheries in the South China Sea
Indo-Pacific Tuna Development and Management Programme (IPTP-FAO/UNDP)
Intergovernmental Oceanographic Commission - Sub-Commission for the Western Pacific (WESTPAC)
International Association of Marine Science Libraries and Information Centers
International Center for Living Aquatic Resources Management (ICLARM)
Network of Aquaculture Centers of Asia-Pacific (NACA)
Network of Tropical Aquaculture Scientists (NTAS-ICLARM)
Network of Tropical Fisheries Scientists (NTFS-ICLARM)
Southeast Asian Fisheries Development Center (SEAFDEC)
Southeast Asian Marine Science Association
Southeast Asian Programme in Ocean Law, Policy and Management (SEAPOL)
South Pacific Commission
South Pacific Forum Fisheries Agency (FFA)
UNEP Regional Seas Programme
Western Pacific Fisheries Consultative Committee

Table 3. Some National Fisheries-Related Networks and Societies in Asia (Source: Carigma 1987)

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<b>Australia</b>	<ul style="list-style-type: none"> <li>Australian Marine Science Association</li> <li>Australian Society for Fish Biology</li> <li>Australian Society for Limnology</li> <li>Australian Society of Phycology and Aquatic Botany</li> <li>Commercial Mariculture Council of Queensland</li> <li>Coral Reef Society</li> <li>Malacological Society of Australia</li> </ul>
<b>China</b>	<ul style="list-style-type: none"> <li>China Society of Fisheries</li> </ul>
<b>Hongkong</b>	<ul style="list-style-type: none"> <li>Marine Biological Association of Hongkong</li> </ul>
<b>India</b>	<ul style="list-style-type: none"> <li>Academy of Ichthyology</li> <li>Alumni Association of the Mangalore College of Fisheries</li> <li>Anglers Association of India</li> <li>Association of Indian Fisheries Industries</li> <li>Forum of Fishery Professionals</li> <li>Indian Association of Parasitologists</li> <li>Indian Association of Systematic Zoologists</li> <li>Indian Association of Water Pollution Control</li> <li>Indian Fisheries Association</li> <li>Indian Society of Ichthyologists</li> <li>Indian Society of Limnology</li> <li>Industrial Fisheries Association</li> <li>Inland Fisheries Society of India</li> <li>Marine Biological Association of India</li> <li>Sea Food Exporters Association of India</li> <li>Society of Fisheries Technologists (India)</li> </ul>
<b>Indonesia</b>	<ul style="list-style-type: none"> <li>Fisheries Graduates Society of Indonesia</li> <li>Indonesian Association of Oceanologists</li> </ul>
<b>Japan</b>	<ul style="list-style-type: none"> <li>Japan Society of Fish Pathology</li> <li>Japanese Society of Scientific Fisheries</li> <li>National Federation of Fisheries Cooperative Associations</li> <li>Plankton Society of Japan</li> </ul>
<b>Malaysia</b>	<ul style="list-style-type: none"> <li>Malaysian Society of Marine Sciences</li> </ul>
<b>Philippines</b>	<ul style="list-style-type: none"> <li>Philippine Fisheries Research Society</li> </ul>
<b>Taiwan</b>	<ul style="list-style-type: none"> <li>Taiwan Fisheries Society</li> </ul>

Table 4. Non-formal Information Sources

Service/Center	Facilities	Products/Services	Fees	Users
Fishing Technology Development Center, Semarang, Indonesia	Small library, 1 professional staff	Consultation, data, publications, articles mainly on catches, stock assessment and technology	Free	Mainly researchers and students (300)
Library, Brackishwater Aquaculture Development Center, Jepara, Indonesia	1 professional staff	Articles, publications, reference lists in aquaculture	At cost	Various
Nasional Seafarming Development Center, Lampung, Indonesia	1 professional staff, small collection	Articles on aquaculture	Free	Mainly students (1200), and researchers (450)
Library, Central Research Institute for Fisheries, Jakarta, Indonesia	Small library, 1 professional staff	Consultations, articles, reference lists	At cost	Various
Directorate General of Fisheries, Jakarta, Indonesia	4 professional staff	Articles, publications, reference lists, etc.	At cost	Various
Library, College of Fisheries, Education and Training Institute, Jakarta, Indonesia	Large library, 1 professional staff	Reference lists	Free	Educators, students, researchers
Library, Research Institute for Marine Fisheries, Jakarta, Indonesia	5 professional staff	Articles, publications, reference lists	At cost	Various
Provincial Fisheries Service of West Java, Bandung, Indonesia	2 professional staff, mainly extension material	Reference lists, articles, publications	Free	Various
Library, UPV, Miag-ao, Iloilo, Phils.	Small library collection, 1 professional staff	Consultations, articles, publications, reference lists	At cost	Mainly educators (50), students (200), researchers (100)
PIOS, Manila, Philippines	No collection, 7 staff	Economic indicators, policies and planning literature	At cost	Policy-makers, researchers, students
Library, Department of Agriculture, Manila, Philippines	Small fisheries collection	Copies of articles	Free	Mainly students, researchers
BFAR extension, Manila, Phils.	20 professional staff	Consultation, articles, technical assistance, training, demonstrations	Free	Various (broad) include fishers (700,000) and consumers
Library, BFAR, Manila, Phils.	4 professional staff	Broad services	At cost	Various
UPLB Library, Los Baños, Laguna, Phils.	3 professional staff, small fisheries collection	Philippine Agricultural Information Service	At cost	Educators, students, researchers
Fisheries Management Information Systems, Department of Fisheries, Malaysia	3 professional staff, no library	Infrastructure information, fisheries statistics	At cost	Various
Marine Aquaculture Section, Department of Primary Industries, Singapore	Scientists provide information on request, no library, no staff	Copies of articles	Free	Scientists (>100), students (>100)
SEAFDEC Training Department, Thailand	Small library, 3 professional staff	Publications, biological data, indicators, extension, infrastructure information	At cost	Educators, researchers, fishers

Table 5. Sources of information of the 17 information services in Table 4.

Source	No. reporting
National data	15
FAO publications	8
SEAFDEC publications	7
ICLARM publications	6
SEAFIS	3
Infofish	3
AGRIS	2
ASEAN Fish Handling Bureau	2
University of Rhode Island publications	1
World Bank publications	1
AADCP newsletter	1
IFPREMER newsletter	1

Table 6. Problems encountered by the 17 information services in Table 4.

Problem	No. reporting
Gaps in available material	11
Language barrier	7
Lack of relevance of material	5
Lack of latest information	5
Need for more appropriate material	5
Users unaware of service	4
Accessibility (remoteness of clients)	4
No coordination with other institutions	3
Lack of qualified personnel	3
Need to market services	2
Lack of operating funds	2
Users do not have much time	1

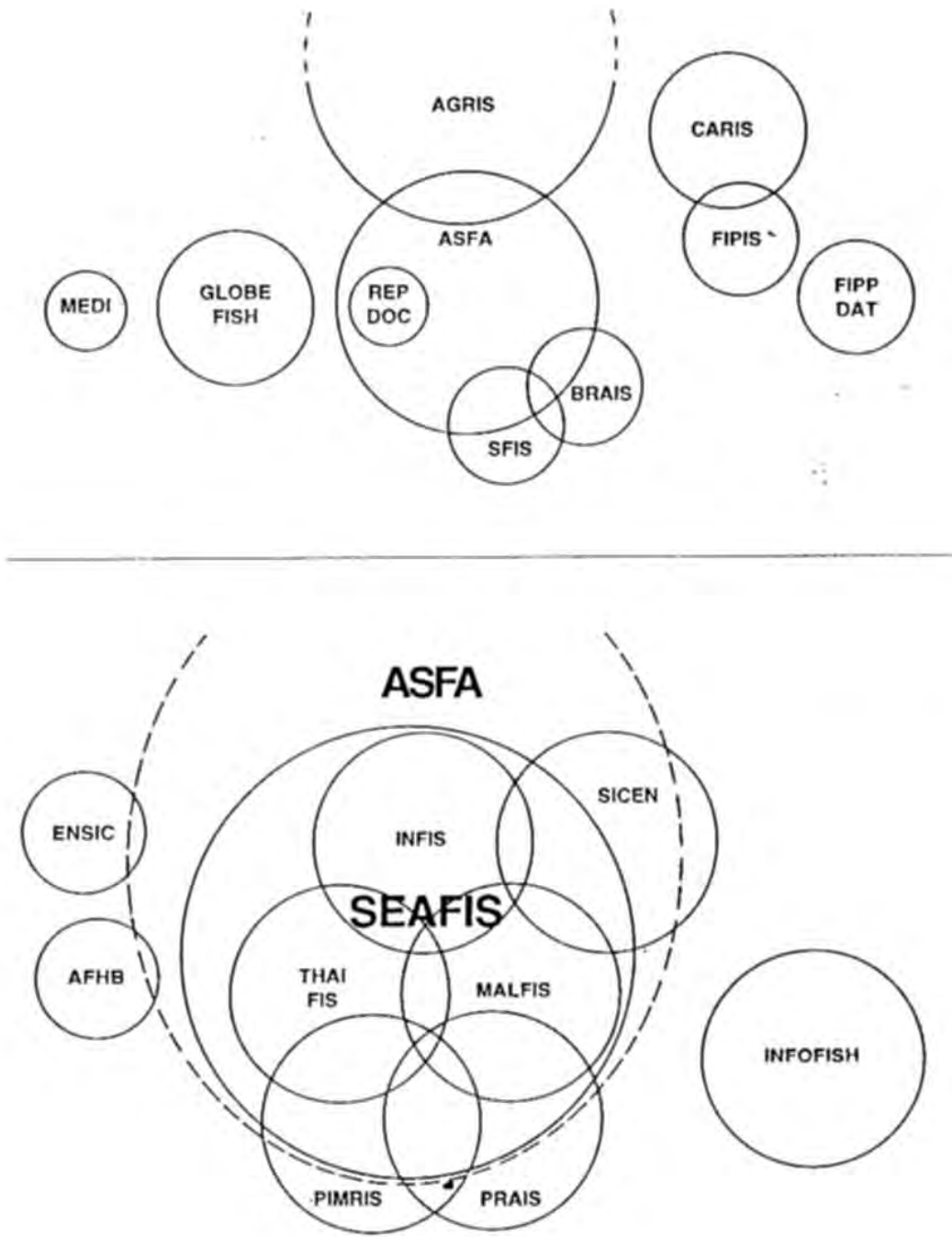


Fig. 1. Relationship between the international (upper) and regional/national (lower) fisheries related information series.



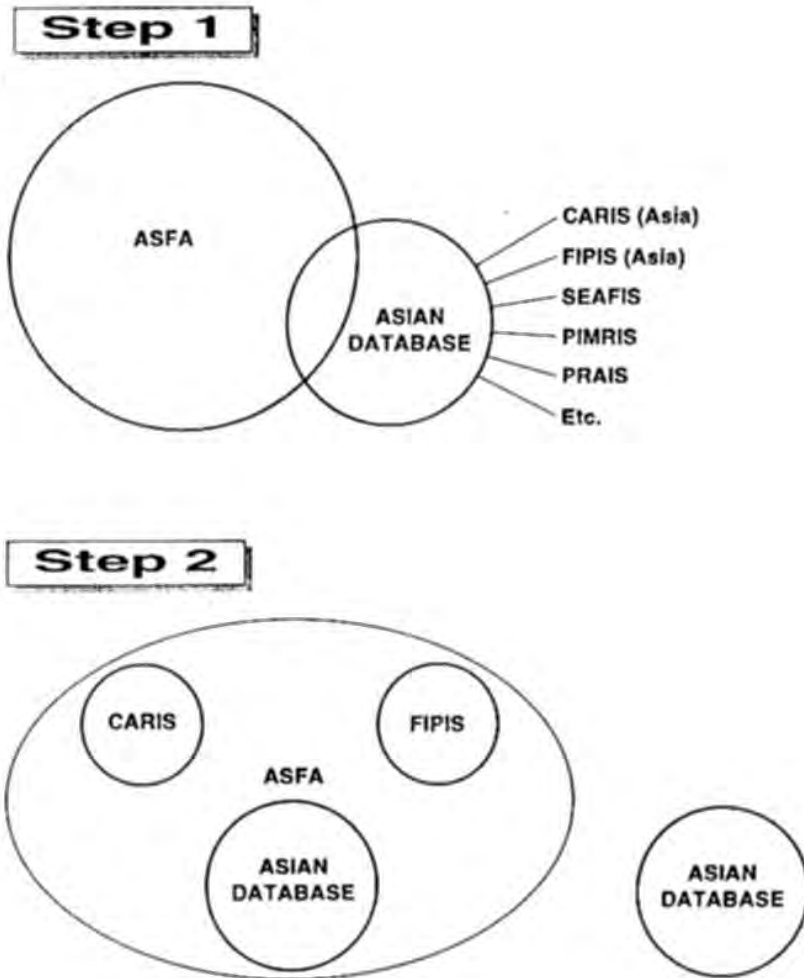


Fig. 2. Proposed solution to scattered, overlapping project and bibliographic information: STEP 1 is the merging of existing (CDS/ISIS) databases, which would overlap with ASFA to some extent. STEP 2 is the merger of the two databases with continued separate access to the Asian database as needed.

Proceedings of the Regional Workshop  
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**UNION CATALOG OF FISHERY SERIAL HOLDINGS  
IN ASIA**

by  
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**INTRODUCTION**

This paper is a contribution of the International Center for Living Aquatic Resources Management (ICLARM) to the Study of Fisheries Information Needs for Developing Countries. ICLARM has identified a long-felt need for a database of serial holdings of aquatic and fishery science libraries and information centers in the Asian region, especially those with information services. This study began in September 1993 involving forty seven (47) libraries and institutions in thirteen countries which provided a copy of their serial holdings list to the study. The countries involved in the study were Bangladesh (1 library), Brunei Darussalam (1), China (6), India (7), Indonesia (6), Japan (1), Malaysia (5), Philippines (8), Singapore (2), Sri Lanka (2), Taiwan (1), Thailand (5), and Viet Nam (2).

**OBJECTIVES OF THE STUDY**

As part of the Study on Fishery Information Needs for Developing Countries, ICLARM conducted a comprehensive study of non-statistical information programs and services. In the process, it was important to compare serial holdings from the major sources within the region in order to identify gaps in the collections. Thus the production of a Union Catalog was considered in order to facilitate easy and quick access to serial sources available in the Asian region and promote resource sharing and active interlibrary loans.

## METHODOLOGY

The survey made use of different means of fast communication facilities such as the commercial courier service, fax, cable and telex because of time constraint. The serial holdings list were catalogued by the Project Librarian and titles were classified according to *Anglo-American Cataloguing Rules* and basic guidelines established by the ICLARM Library. Several bibliographic tools were used to identify the serials correctly, such as:

- a) *Agricultural Journal Titles and Abbreviations*. 2nd ed. 1983. Phoenix, Ariz.: Oryx Press. 136 p.
- b) *AGROVOC: a Multilingual Thesaurus of Agricultural Terminology*. 1982. Rome: Food and Agriculture Organization of the United Nations. 530 p.
- c) *An Annotated Guide to Philippine Serials*. 1976. Diliman, Quezon City: University of the Philippines Library. 120 p.
- d) *Aquatic Sciences and Fisheries Thesaurus*. 1986. ASFIS Ref. Ser. No. 6, Rev. 1. Rome: Food and Agriculture Organization of the United Nations. 418 p.
- e) *Geographic Authority List*. 1985. ASFIS Ref. Ser. No. 7, Rev. 1. Rome: Food and Agriculture Organization of the United Nations. 91 p.
- f) *International Directory of Serial Publications in Aquatic Sciences and Fisheries*. ASFIS Ref. Ser. No. 12. 1993. Rome: Food and Agriculture Organization of the United Nations. 320 p.
- g) *International Serials Data System (ISDS) - SEA Bulletin*. 1982-1985. Bangkok: ISDS Regional Centre for Southeast Asia. 4v.
- h) *International Union List of Agricultural Serials*. 1990. Wallingford, U.K.: C.A.B. International. 757 p.
- i) *Irregular Serials and Annuals: an international Directory*. 10th ed. 1985. N.Y.: R.R. Bowker Co. 1765 p.
- j) *Library of Congress Subject Headings*. 14th ed. 1991. Washington, D.C.: Library of Congress. 3v.
- k) *List of Journals Indexed in AGRICOLA*. 1991. Beltsville, Md.: National Agricultural Library. 206 p.

### THE UNION CATALOG

Of the forty seven libraries and institutions requested for their serial holdings, 31 have submitted their list. Another five libraries responded but did not submit the requested list because (a) back issues of titles are not retained but donated to related agencies after they have extracted the articles, while the journals are only kept for one year, (b) concerned offices have not yet compiled and set up any system for information programs and services in any serial holdings or diskettes, (c) titles do not refer to any publications, (d) not in a position to provide information requested, and (e) it is not possible for the libraries to give the list of serial holdings because of overlapping in the subject matter and the massive amount of information such that libraries do not have the list at hand.

As of early January 1994, the serial database contains a total of 3876 titles from 23 libraries out of which there are 1870 unique titles with an overlap of 52 per cent. There are still 6751 titles which need to be encoded aside from those which are to be submitted by eleven more libraries. Once the inputting of all titles is finished, analyses of the data will be started.

### PROBLEMS AND CONSTRAINTS

- a) Several libraries have sent only the list of titles received. Data such as ISSN, publisher's name, place of publication, frequency have to be searched and could be time consuming.
- b) Some data of locally published serials are not found in any bibliographic tools for proper identification.
- c) Difficulty was also encountered in cataloguing some locally published serials in a country's own language.

### PLANS AND PROGRAMS

Eventually, a Union Catalog can be made from the ICLARM's serial database. This could be made available on diskette and hard copy before the end of 1994. The database, projected to be around 10 M bytes, has been conceived to be distributed on 4 to 5 3.25" HD diskettes which will include the royalty-free DataEase run time

module. An installation routine will be developed for hard disk set up and easy-to-follow menu will be provided for data retrieval. More importantly, it will contain modules to selectively export data to dBase, FoxBase, Lotus 123 and CDS/ISIS (i.e., ISO 2709) formats.

While ICLARM can manage to maintain this database, regional organizations such as the Southeast Asian Fisheries Development Center (SEAFDEC), the Food and Agriculture Organization/Regional Office for Asia and the Pacific (FAO/RAPA), the Network of Aquaculture Centres in Asia-Pacific (NACA) or other interested organizations should continue this work for the Asian region. Moreover, some kind of networking or formal regional association of aquatic and fishery science libraries and information centers should be established. Thus, ICLARM can transfer the responsibility to the Regional Coordinating Library or Institution to monitor and update the database.

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**IDENTIFICATION OF PRESENT AND FUTURE  
INFORMATION TECHNOLOGY TOOLS FOR  
INTEGRATED FISHERY RESOURCE MANAGEMENT**

by  
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**INTRODUCTION**

This report identifies, as the most significant obstacle in the development and implementation of an Integrated Fishery Resource Management (IFRM), the fact that no sufficient common standards and organizational structures have been designed within the fishery community in the region. Consequently, an initial prototype of a Reference Model for IFRM is developed and discussed in the report.

An inventory was made of the many identified present and planned valuable constituents of the information technology (IT) tools for IFRM. This report also includes recommendations on how to incrementally develop an IFRM from the current situation in order to realize a sustainable exploitation of the aquatic resources. The potential extent of the recommended actions is obviously very large due to the fact that no easy and simple solution is available to the problems at hand. However, if actions are properly planned and managed along with the recommended line of incremental development, most probably benefits can be attained by the fishery community well in excess of the implied costs. The training and detailed tools needed for such development require elaboration beyond the limitations of this report. However, all the necessary methodologies and tools for such development are made available, some in public domain while some could be available at reasonable prices. Many generic solutions for the aforementioned development are likely to be available and are transferrable from other professional communities which are equally dependent on information technology for their realization of an Integrated Information Management.



This report is based on the results of a study which is part of the worldwide "Strategy on International Fisheries Research." This undertaking implies as a prerequisite, the existence of a commonly shared, formal, conceptual framework, within which all efforts, activities, documents, applications can be understood as a meaningful constituent of one coherent whole. But such a framework has not yet been established within the fishery community in the region. Initially therefore, a proposal for a framework has been developed. This framework serves subsequently as the background reference against which all present, planned and future tools for an integrated management of the fishery resources could be identified, defined, assessed and commented upon.

The framework has been made in accordance with the Integrated Computer Aided Manufacturing Definition (IDEF) Methodology which is widely used concerning an integrated management of information within the other areas of a complex professional human activity. Many approaches and views in the report are based on the developments and experiences from informatical integration in other areas of professional activity. This is due to the fact that the problems encountered in the fishery community, from the informatical point of view, are very similar to those encountered by other communities and are equally dependent on efficient IT tools. For this reason, it is likely to expect many informatical solutions developed for other purposes, to be easily transferrable to the fishery community.

#### OBJECTIVES OF THE STUDY

The main objectives of the study were to identify key methodologies and tools applicable to IFRM, to inventory and annotate the appropriateness and limitations of tools used at present by selected information centers within the fishery community in Southeast Asia, and to make recommendations on new or further developed tools and training in order to achieve a state of sustainable exploitation of the aquatic resources.

#### METHODOLOGY

A prototype of a reference model for IFRM has been designed and done initially by means of a formal model of the hierarchy of interrelated functions (types of work

processes) required for IFRM. The model will subsequently serve as a reference background after which the completeness and appropriateness of the currently performed functions are clarified. Also, the interactions between functions are modelled as an initial identification of the data (models) to be exchanged.

Current functional areas of activity and applied IT related tools and deliverables, as they were identified at the information centers visited and from elsewhere, have been inventoried and annotated. The annotations comprise several identified causes of significant deficiencies in the current endeavors to rationalize an IFRM. Recommendations on how, further successively, to develop and implement an efficient IFRM, were also made.

A series of various statements and comments on the general issue of development and implementation of IFRM has finally been added in order to highlight and clarify certain aspects of an IFRM which, according to experience, might be less obvious as from a non-informatical point of view. Many such less obvious aspects are likely to be caused by substantial deviations between a fully implemented IFRM and current working methods, perceptions of work, and patterns of cooperation within the fishery community.

#### PROTOTYPE MODEL FOR IFRM

Neither an exhaustive definition of the term "Integrated Fishery Resource Management (IFRM)" nor a reference model by which to clarify all its implications has been available as part of the basis of this report. Such clarification is needed, however, for the purpose of a comprehensible identification of key data and IT tools for the realization of IFRM. This requirement does also apply to an appropriate assessment of current and future practice, and IT tools applied. Therefore, a prototype of a reference model for an IFRM has been designed.

As a basis for this report, an IFRM is assumed to comply with the fact that (a) the concerned fishery resources is managed by means of a set of commonly controlled and coordinated functions, i.e., functional units, each fitted for a particular type of work which collectively cover all relevant disciplines necessary for proper fishery management, (b) each function is supposed to be based on a clear understanding of own and other work as part of an integrated whole, (c) all sorts of information,

generated for the purpose of a particular function, should be easily accessible and transferrable to other functions where it might be needed, and (d) all information, shared by more functions, should comply with an agreed common understanding of the subject matter.

The prototype has been made in accordance with the IDEF Methodology which is used worldwide for informatical integration within other professional communities and for international standardization of such subject matter. The designed reference model is intended as a vehicle of common understanding and communication by which successively, issues are captured and clarified, such as (a) complete structure of successively decomposed functions or work processes by which to perform all undertakings required for the realization of an IFRM, (b) all relations between functions as successively developed identifications of the information, to be communicated and eventually to be exchanged via data models, and (c) all IT tools, data models and other IT related deliverables needed for the performance of the identified functions.

As such, the reference model of an IFRM can be developed as a powerful tool for comprehensible mapping and assessment both of current practice within the fishery community, and of measures to be taken for an incremental development of a fully implemented IFRM.

#### INVENTORY OF IT TOOLS

The main objective of the study which was conducted in November 1993 and which concentrated in Thailand, Malaysia, and the Philippines, was to identify existing IT tools and other elements from which an IFRM could be developed and implemented. Furthermore, the study also aimed to assess appropriateness and limitations of currently used IT tools. This was done as a background of the development of a prototype of a reference model for an IFRM.

An inventory of the IT tools and other deliverables was made which was identified as potential constituents of a future set of systems for the realization of an IFRM. Functional areas of activity and IT related tools and other deliverables were inventoried directly on the basis of material and information received during the study. Further to this, a number of valuable potential contributions to a future set of integrated IT systems were indirectly identified. Such contributions appear in the annotations to the inventory.

The inventory comprised items which are considered potentially or parts of, constituents of a reference model and IT tools for an IFRM. Very few, if any, of the identified items are in a form complying directly with the various types of constituents of the prototype. However, still many of these were considered deliverables having a substantial degree of compliance with the prototype.

The main types of such deliverables were identified as operationally implemented application systems, prototypes of the application systems, planned application systems, methodologies and models for fishery science and research, formal data models and function models, databases, principles and systems of classification, bibliographies, books, documents, reports, articles, addressing theory, investigations, statistics, methodologies, phenomena, entities, processes, models or other issues pertaining to the subject matter, agreed structures and modes of integrated or interfaced collaboration concerning the subject matter, and formats for exchange of data.

All identified functions and IT tools can, without any big problem, be related directly to the function model and as such can be conceived as parts of the prototype reference model. It should be noted that for the sake of good order, the inventory in no way whatsoever, can be considered exhaustive for no validation could be made so far with the information centers visited and with the persons involved. This is due to the short time available during the study and the short notice with which the study was made. Some mistakes and lacunas will probably be due to the same reasons.

#### COMMON MANAGEMENT STRUCTURE

Each of the many functional units of the Reference Model for an IFRM is assumed to be a unit which autonomously performs its allocated part of the work when required input, tools and control information, is available. This is but a fundamental condition to all kinds of coordinated efforts. All such units are however, in reality, parts of independent international and national organizations within the fishery community. It is therefore required that the fishery community establish and comply with a common management structure for the necessary overall coordination and control of the functions required for IFRM.



## OPEN SYSTEM ARCHITECTURE

All Hardware/Software systems dealt with in the report are in principle, supposed to be physically separated and independently implemented systems. This is in order to allow many existing types and qualities of systems, all constantly under modification and further development, to work together. However, if such systems are supposed to be able to communicate efficiently and unambiguously with each other, they must necessarily all be tied together and comply with one conceptual whole, as the prototype Reference Model for IFRM.

## PROBLEMS AND CONSTRAINTS

### Informatical Consistency

The subject of this report implies that the working procedures and concepts of many types of professionals have to be modelled precisely and consistently as from an informatical point of view. This is an important prerequisite, both for the development of efficient application systems and for unambiguous communication between different professional disciplines.

Such informatical consistency can be achieved only through a strict discipline in the definition and modelling of all comprised procedures and concepts. Consequently, a common vocabulary is required for a series of key concept within the fishery community. This is in order to avoid subversive confusion to be induced in the communication from the colloquial, habitual or even ambiguous interpretations of the various terms used elsewhere.

## RECOMMENDATIONS

Many details of the current practice and currently applied IT tools are considered valuable components for the realization of an IFRM. At the same time, several details may be considered problems and inconveniences compared with the prototype reference model for an IFRM.

Therefore, a carefully considered order of priority is recommended for a further incremental development of an IFRM. The following priority list of recommended actions reflects both the significant informatical aspects of the subject matter as well as an attempt to transform as many existing solutions as possible, directly and efficiently, into constituents of a fully implemented IFRM:

- a) Within the fishery community, to initiate the development of a "Systems Architecture for an IFRM" in order to provide a common reference for an incremental development and implementation of an IFRM. This activity implies that key personnel from all involved organizations successively, need to be trained and acquainted with the applied modelling methodology.
- b) All organizational bodies and structures within the fishery community, to identify and agree among themselves, one agency which should undertake the common coordination and control of the activities required for the development and implementation of an IFRM.
- c) All functional areas of activity should be urged through suitable incentives, to clarify, adopt, and adapt their role within the IFRM. This means that functions, communications with others and tools used should be clarified and documented according to a common standardized methodology. Also, conceptual data models of the subject matter addressed within each function should be developed and documented in accordance with a common methodology and made available for use in other functions.
- d) From the data models of the particular functions, to extract and compile a common data model for communication within the fishery community. If integrated with key classification systems, this data model will prove to be a significant tool for storage and retrieval of information on various media.
- e) All types of information processing, including manual procedures, should then incrementally, be made consistent with the developed common data models. Attention is drawn to the fact that such consistency is a fundamental requirement for unambiguous and efficient communication. The conceptual consistency should be achieved for IT systems based on "flat files" as well as for systems with databases. And many cheap standard database systems with query language facilities, are available in support of this activity.
- f) Suitable fishing waters should then be selected, in order of priority, for incremental development of sustainable exploitation of fishery resources on the basis of the developed reference model for IFRM.



It is obvious that the potential extent of the recommended actions is large. Equally obvious is the fact that this incremental integration of IT in the work of the fishery community, if properly planned and managed along the line of development, can produce benefits in excess of the implied costs. A fully implemented IFRM, by which to achieve sustainable exploitations of the fishery resources, can probably not be realized without such integration of IT.

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**PROTOTYPE OF A REFERENCE MODEL FOR AN  
INTEGRATED FISHERY RESOURCE MANAGEMENT**

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**INTRODUCTION**

It is true with the fishery community, as it is with the other professional communities dealing with complex subject matters, that over all integration of the common efforts can be achieved only on the basis of a commonly shared and agreed framework. Such common framework must provide a background pattern against which all efforts, phenomena, regulations, models, entities, documents, tools can be conceived as meaningful pieces of an emerging, if not yet fully clarified jigsaw-puzzle.

This report comprises an initial prototype of such framework. It is designated as a "Reference Model for an Integrated Fishery Resource Management (IFRM)," because it is intended subsequently to be used as the reference against which to assess current practice and applied information technology (IT) tools within the fishery community. At present, the model comprises a functional model which is a powerful tool by which to develop a clear overview of all functions, work processes and interactions needed for an IFRM. Subsequently, the model will turn out to be a suitable background against which to identify and assess current functional areas of activity and applied IT related tools and deliverables. The model will also provide a clear background for recommendations of future actions and developments.

Each function in the model will potentially serve as a well defined functional background against which an associated data model can be developed. In addition, all exchanges of the data between different functions can be precisely identified as the informatical intersection between the involved data models. The model at hand will thus be understood as an important prerequisite for a precise identification of those exchanges of information needed for the full implementation of an IFRM.

#### SCOPE OF REFERENCE MODEL

If developed further, the reference model can be extended into a complete "Systems Architecture," a coherent set of deliverables which together constitutes what is needed for the full realization of an "integrated information management" within a particular professional community. The reference model, in an anticipated eventuality, shall comprise the following types of deliverables: (a) common vocabulary applying to IFRM, defining all key terms and their associated concepts, (b) fully elaborated function model for IFRM, defining all comprised functions, their common control structure, their mutual lines of communication, and their applied tools, (c) complete set of shared data models for IFRM, defining the sets of significant entities addressed by the particular functions, (d) an inventory of reference documents properly classified in relation to relevant parts of the entire systems architecture, (e) an inventory of IFRM related application systems properly classified in relation to the relevant parts of the entire systems architecture, and (f) an inventory of IT integration standards applicable to IFRM and properly classified in relation to the relevant parts of the entire systems architecture.

It will appear that each of these types of deliverables addresses some particular aspect of IFRM and ignoring the others. However, taken collectively such set of deliverables will comprise all aspects necessary for a complete understanding and a full development and implementation of an IFRM.

#### IDEF METHODOLOGY

All function models and data models developed for the purpose of the Reference Model for an IFRM are made in accordance with the Integrated Computer-aided Manufacturing Definition (IDEF) Methodology, which was developed for and published by the U.S. Air Force as part of the ICAM Project.

The IDEF Methodology serves as a tool for the precise understanding, capturing, analyzing, and documentation of complex systems, their environment and their constituents. Further to this, the IDEF Methodology also serves as a vehicle for precise communication regarding these matters.

The main techniques used in the IDEF Methodology are diagramming and graphical representations supplemented by vocabularies and other textual contributions. The IDEF Methodology is described in detail in reference manuals and various textbooks to which reference is made.

The main parts of an IDEF modelling are the functional decomposition of the system, documented in functional IDEFO diagrams and an associated vocabulary; and a data model displaying all objects dealt with in the system, documented in IDEF1x data model diagrams, lists, and an associated vocabulary.

The IDEF Methodology is widely used within the worldwide development of "Computer Integrated Manufacturing (CIM)" and within ISO standardization of associated subject matter. More specifically, all computer-made IDEF diagrams in the model have been made by the DESIGN/IDEF tool - a software tool developed by Meta Software Corporation, Cambridge, Ma., U.S.A.

#### FUNCTION MODELLING OF IFRM

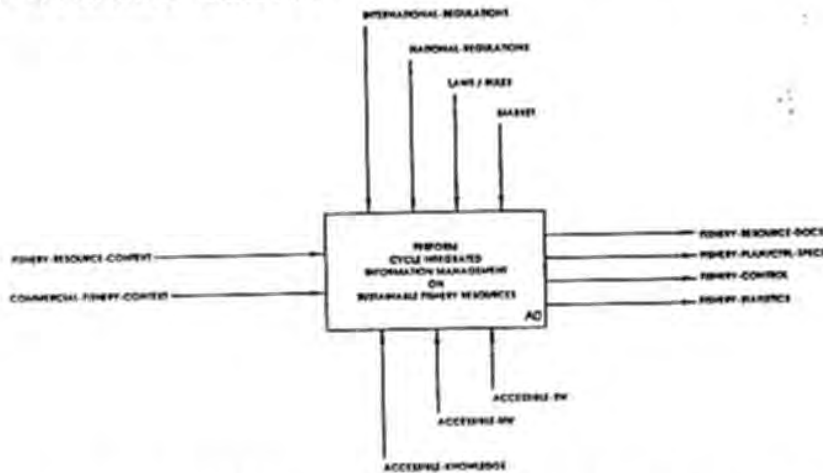
This section comprises a series of functional model diagrams, designated as "IDEFO diagrams," displaying an initial top-down decomposition of functions or work processes pertaining to IFRM. The diagrams are required, when fully elaborated, on each level of abstraction, to include all kinds of activities necessary for the proper realization of IFRM. This basic requirement makes a careful elaboration of each diagram a necessity. In return for this effort, each completed diagram will constitute a precise picture of the comprised functions and their interaction and the value of such agreed understanding of the subject matter will easily be appreciated when considered more closely.

Due to the limited space on the diagrams, all detailed texts and abbreviations are to be considered labels only. Therefore, all functions and arrows indicating exchange of information between the functions have been fully defined on the following pages. It is always recommended to have a copy of the relevant diagram available when reading the definitions.

It will be evident that the value of the diagrams, as the documented common understanding of the subject matter, depends crucially on the common will and discipline to keep strictly to the stated terminology and definitions of the underlying concepts.

### IDEF FUNCTIONS

The basic symbol of IDEFO function diagrams is a box with attached arrows:



Each box is considered a "black box" representing a function or a work process which qualitatively is characterized by the text in the box. The procedural details of a function are considered unknown (as yet at the modelled level of abstraction).

Arrows entering the box from the left represent information needed as Input for the performance of the function in the box.

Arrows entering the box from above represent information needed for Control of the performance of the function in the box.

Arrows leaving the box to the right represent information produced as Output from the function performed in the box.

Arrows entering the box from below represent tools, knowledge, needed as Mechanisms for the performance of the function in the box.

The four types of arrows are collectively designated ICOMs referring to the initials of their four roles: Input, Control, Output, and Mechanism.

## PROTOTYPE FUNCTION MODEL FOR IFRM

The following pages comprise diagrams, representing a prototype of a function model for IFRM. Next to the diagrams follow pages comprising at present, only the most significant definitions and comments pertaining to the diagrams. Definitions are not stated for expressions considered self-explanatory.

### Diagram A-O Perform Cycle Integrated Info Management on Sustainable Fishery Resources

#### Function AO:

"Perform cycle integrated information management on sustainable fishery resources" is considered a phrase which embrace the entire over all function addressed by the study on fishery information needs conducted by the Strategy for International Fisheries Research (SIFR).

#### Input:

##### FISHERY-RESOURCE-CONTEXT

All kinds of information needed concerning the nature-given context of aquatic resources.

##### COMMERCIAL-FISHERY-CONTEXT

All kinds of information needed concerning the impact of commercial and rural fisheries on the context of aquatic resources.

#### Control:

##### INTERNATIONAL-REGULATIONS

##### NATIONAL-REGULATIONS

##### LAWS/RULES

Every kind of significant document addressing some aspect pertaining to integrated planning and control of efforts associated with IFRM.

##### FISHERY-CONTROL

Efforts for enforcement of fishery control as part of IFRM

##### FISHERY STATISTICS

#### Mechanism:

##### ACCESSIBLE-KNOWLEDGE

All kinds of accessible professional knowledge required for development and implementation of IFRM.

##### ACCESSIBLE-HW

All kinds of accessible hardware applicable to the development and implementation of IFRM.



**ACCESSIBLE-SW**

All kinds of accessible commercial and public domain software applicable to the development and implementation of IFRM.

**Comment:**

Diagram A-0 represents the formal delimitation of IFRM from the rest of the world

**Diagram A 1-2**

**Perform Cycle Integrated Info Management  
on Sustainable Fishery Resources**

**Function A1:**

"Manage the Cycle Integrated Information Management (CIIM) on sustainable fishery resources" - an over all common management function which must be exercised id IFRM is to be realized.

**Function A2:**

"Develop, maintain, support fishery CIIM systems architecture" - and informatical support function for A1, A3, and A4.

**Function A3:**

"Survey and control commercial fishery."

**Function A4:**

"Investigate and forecast fishery resource context."

**Comments:**

It will appear that diagram A0 clearly displays the main functions needed for the full development and implementation of IFRM. Also, the required interactions of the functions and the necessary structure for common coordination and control are clearly displayed in the diagram. The importance of common systems architecture and an IT support function is displayed in particular by function A2 and its channels of communication ICOMs with the other functions.

**Diagram A3**

**Survey and Control Commercial Fishery**

**Function A31:**

"Manage survey and control of commercial fishery" - the function by which to manage and coordinate all functions concerning data collection, license administration and modelling related to the commercial fishery.

**Function A32:**

"Collect data on fishing efforts."

**Function A33:**

"Collect data on fish landings."

**Function A34:**

"Collects data on fish processing."

**Function A35:**

"Issue licences and enforce restrictions."

**Function A36:**

"Process survey and control area."

**Comments:**

It will appear that all the functions implies the existence of appropriate common data models concerning various aspects of the commercial fishery. Most of the labelled ICOMs in this diagram are self-explanatory, many ICOMs need further elaboration.

**Diagram A4****Investigate and Forecast Fishery Resource Context****Function A41:**

"Manage investigations of fishery context and forecasting of resources" - the function by which to manage and coordinate all functions concerning the biological and oceanographic investigations and forecasting of the fishery resources.

**Function A42:**

"Investigate oceanography and species recruitment."

**Function A43:**

"Investigate live resources and their distribution and interaction."

**Function A44:**

"Investigate species mortality by fishery."

**Function A45:**

"Make fishery model forecasts and analyze consequences."

**Comments:**

It will appear that all functions implies the existence of appropriate common data models concerning various biological and oceanographic aspects of the aquatic resources. Most of the labeled ICOMs in this diagram are self-explanatory. However, there are still many ICOMs that need further elaboration.

### DATA MODELLING FOR IFRM

No data models, according to the IDEF1x Methodology, has been developed as yet, as part of the reference model. But a series of data models, from which communication within the fishery community obviously would benefit very much, can immediately be identified from the function model and from the inventory. Examples of subjects of such data models are the following:

- Fishery statistics
- Fishery policy and regulations
- Fishery survey and control
- Fishing fleets and their allocation
- Fish utilization and marketing
- Fishery research structures
- Fishery research programs
- Fishing gear and technologies
- Aquaculture technology
- Coastal management
- Fish processing and quality control
- Socio-economic aspects of fisheries
- National economic aspects of fisheries
- Fisheries training and extension
- Biological information on aquatic animal species
- Distributions of aquatic animal species
- Multispecies fish stock monitoring and assessment
- Dynamic interaction between fish species and fishing efforts
- Oceanographic phenomena applying to fisheries
- Coral and artificial reef area ecosystems
- Habitats and environments
- GIS technology application on fisheries
- Fisheries reference documents

Many of these data models have substantial overlaps where consistency must be established for the purpose of efficient transfer of information between different areas of activity. Taken collectively, when completed and properly structured and validated, this list of data models will successively map the significant universe of entities addressed by the fishery community.

### CONSTITUENTS OF REFERENCE MODEL AND IT TOOLS FOR IFRM

This is an inventory conducted in Malaysia, the Philippines and Thailand, in November 1993, and comprises items which are considered potentially or to be parts of,

constituents of a reference model and IT tools for an IFRM. Very few, if any, of the identified items were in a form complying directly with the various types of constituents of the prototype. However, many of the items could be considered as deliverables, having a substantial degree of compliance with the prototype.

The inventory was conducted in collaboration with various information centers, namely, the Food and Agriculture Organization/Regional Office for Asia and the Pacific (FAO/RAPA), and the Southeast Asian Fisheries Development Center (SEAFDEC), in Thailand; the Department of Fisheries (DOF) in Malaysia; the Bureau of Fisheries and Aquatic Resources (BFAR), the Bureau of Agricultural Research (BAR), the Bureau of Agricultural Statistics (BAS), the University of the Philippines - Marine Science Institute (UP-MSI), all in the Philippines; and the Aquaculture Department of SEAFDEC (SEAFDEC/AQD) and the International Center for Living Aquatic Resources Management (ICLARM), also in the Philippines.

All identified functional areas of activity and IT tools and other deliverables were inventoried directly for each information center visited. Indirectly identified deliverables appears from the general or the specific annotations.

#### FAO/RAPA

##### *Functional areas of activity pertaining to fisheries*

- a) statistical processing and analysis
- b) fishery information
- c) fishery exploitation and utilization of marine fisheries
- d) fishery policy
- e) promotion of technical cooperation between countries of the region, including the use of regional institutes and exchange of information on activities
- f) organization of technical meetings
- g) fish utilization and marketing service (Fisheries Department)
- h) publication of fishery statistics
- i) publication of bibliographies on fishery information
- j) publication of GLOBEFISH European Fish Price Report
- k) publication of GLOBEFISH Highlights
- l) publication of studies of the GLOBEFISH Research programme

##### *Identified IT related tools and deliverables*

- a) ASFIS - Aquatic Sciences and fisheries Information system (developed by FAO Rome)

- b) Aquatic Sciences and fisheries Thesaurus - Descriptors used in ASFIS
- c) ASFA - Aquatic Sciences and Fisheries Abstracts Database (developed by FAO Rome)
- d) GLOBEFISH - database with worldwide fishery information for use in strategic medium and long-range planning (developed by FAO Rome)
- e) AGROSTAT PC - software providing time series statistics for agriculture, fisheries

*Specific annotations*

- a) Many essential processes, data models and IT tools applicable to IFRM seems, explicitly or implicitly, to exist within the FAO organization.

**SEAFDEC**

*Functional areas of activity*

**Training Department (Samut Prakan, Thailand)**

- a) fishing gear technology
- b) oceanographic studies
- c) artificial reef studies
- d) statistics and socioeconomics

**Marine Fisheries Research Department (Singapore)**

- a) fish processing and quality control
- b) development of training courses

**Aquaculture Department (Iloilo, Philippines)**

- a) Aquatic Sciences and Fisheries Abstracts
- b) Broodstock and hatchery development
- c) feed development
- d) fish health
- e) searanching and seafarming technology
- f) environmental impact of aquaculture
- g) development of training courses
- h) publication of extension materials

**Marine Fishery Resources Development and Management Department (Kuala Terengganu, Malaysia)**

- a) biological research
- b) ecological research
- c) research on population of fish stocks

- d) stock monitoring
- e) management and exploitation of shared stocks
- f) methodology of fishery resource assessment

*Identified IT related tools and deliverables*

- a) Southeast Asian Fisheries Information System
- b) Brackishwater Aquaculture Information System
- c) Regional Bibliography on Fisheries and Aquaculture in Southeast Asia
- d) Spreadsheets widely applied for statistics and research
- e) CDS/ISIS
- f) relational database systems applied for survey data
- g) manuals of fishery and aquaculture

*Specific annotations*

- a) The identified areas of activity and IT tools seem to have numerous overlaps with other identified functions and systems.

**DOF - Malaysia**

*Functional areas of activity*

**Fisheries Management and Development Division**

- a) Management, monitoring and rational exploitation of resources in the Exclusive Economic Zone (EEZ)
- b) administering and enforcing the Fisheries Act 1985 and EEZ Act 1984 for the proper management and conservation of the inshore and deep-sea resources
- c) controlling and determining the use of suitable fishing gear
- d) rehabilitating inshore fishery resources by artificial reef construction
- e) ensuring the proper management of the inshore and deep-sea resources
- f) coordinating the monitoring, controlling and surveillance activities in the territorial waters and EEZ
- g) regulating import and export of live fish by issuing permits
- h) regulating, managing and conserving aquaculture areas to ensure its rational development
- i) monitoring the progress of development projects

**Planning and Research Division**

- a) formulate policy, strategy and development plan for the fisheries sector
- b) collect, manage and analyze fishery data pertaining to, among others: landings, fishermen, cost and earnings, and socioeconomic aspects



- c) carry out stock assessment and monitoring of the inshore and deep-sea fishery resources
- d) undertake specific research activities on aquatic resource rehabilitation, marine park, turtle rehabilitation
- e) research in aquaculture, in specific areas such as artificial propagation of prawn and fish fry for pond culture, formulation of fish feeds, and the improvement of pond culture techniques.

#### **Extension and Training Division**

- a) training for fishermen
- b) training for aquaculturists
- c) staff training
- d) field extension
- e) publication

#### **Technology and Logistics Division**

- a) carry out physical implementation of DOF's development projects
- b) coordinate the physical implementation of foreign aid projects in the field of boat construction, aquaculture, and fish handling facilities
- c) Maintain the boatyard of DOF's fleet of vessels for research, training, and enforcement activities
- d) carry out technology adaption and development within fishing, fish handling, and aquaculture engineering
- e) provide engineering advisory service

#### **Administration and Finance Division**

- a) preparation of annual budget
- b) management and control of approved annual allocations
- c) management, control and maintenance of DOF's assets, quotation and tender matters, payment of salary
- d) carry out services for the benefit of personnel

#### *Identified IT related tools and deliverables*

- a) application software for fishery statistics
- b) individually tailored research software for PCs
- c) spreadsheets widely applied for statistics and research
- d) relational database systems applied for survey data
- e) software system for commercial fishery information
- f) standard classification of Malaysian fishes and other aquatic animals

*Specific annotations*

- a) Many essential processes, data models and IT tools applicable to IFRM seems, explicitly or implicitly, to exist within the DOF organization

**INFOFISH, Malaysia***Functional areas of activity*

- a) publication of marketing information
- b) trade promotion services
- c) identification of marketing opportunities and sources of supply
- d) publication of trade news
- e) special coverage on tuna and shrimp markets and supply
- f) GLOBEFISH Highlights (trends, analyses and forecasts)
- g) publication of INFOFISH International (information on topics such as: markets and marketing, handling, processing, quality control, technological advances)
- h) publication of special studies
- i) technical advisory services
- j) handling, processing and marketing of fishery products
- k) Technical Information Center
- l) library of fishery documentation
- m) consultancy on tailoring products to market requirements
- n) consultancy on profitable use of discard or under-utilized species
- o) consultancy on post-harvest aspects of fisheries
- p) organizing conferences, workshops, seminars and training
- q) network of marketing correspondents
- r) maintaining close links with FAO worldwide fish marketing information network (comprising INFOPECSA, INFOPECHE and INFOSAMAK)

*Identified IT related tools and deliverables*

- a) databases with interests and specializations of fish product importers, producers and exporters
- b) database with manufacturers and suppliers of equipment for aquaculture, fish handling and processing
- c) database with Asia-Pacific institutions specializing in aquaculture, fish technology, inspection, and quality control
- d) rosters of technical experts and consulting firms specializing in the fishery industry
- e) spreadsheets, WordPerfect and other standard software for PCs which are widely used
- f) classification according to FAO systems
- g) Micro CDS/ISIS - a menu-driven generalized information storage and retrieval system designed for the computerized management of text databases (developed by UNESCO)

- e) CITES
- f) manpower
- g) extension training
- h) credit

**Subsystem 5: Market info/infrastructure**

- a) exports
- b) prices
- c) infrastructures
- d) facilities

**Subsystem 6: BFAR Library**

- a) technical books/materials
- b) directories
- c) literature
- d) photos
- e) slides
- f) maps
- g) videos

Draft of NFIS organizational structure

Draft of NFIS physical network structure

NFIS Hardware/Software strategy

**Classification according to FAO system**

CDS/ISIS

*Specific annotations*

- a) NFIS seems to have numerous overlaps with other identified systems as regards data models and functional specifications

**BAR, Philippines**

*Functional areas of activity*

- a) development of Agricultural Research Monitoring System
- b) coordination and monitoring of agricultural research
- c) distributed Network Information Systems Architecture (through NFIS)
- d) sponsoring and coordination of training programs on research methodologies, advanced programming

*Identified IT related tools and deliverables*

- a) Research Program System - a data entry and retrieval system concerning submitted research proposals and their current status (evaluation, recommendation and comments)
- b) Manpower Development Data System - with summaries of researcher/extension workers profile, field of specialization, and trainings attended and needs
- c) Monitoring and Evaluation System - recording of monitoring and evaluation systems
- d) Outreach Plan System - similar to Research Program System for projects implemented under National Fisheries Outreach Program
- e) Fishery Library System - comprising abstracts on research results, mature technologies and other references
- f) Database of Research Highlights of the National Fisheries Research Program (based on Micro CDS/ISIS developed by UNESCO)
- g) Research and Technology Subsystems (part of NFIS)
- h) SAS software
- i) spreadsheets
- j) relational database systems

*Specific annotations*

- a) Both the identified functional areas of activity and IT tools seem to have numerous overlaps with other identified functions and systems as regards data models and functional specifications.

**BAS, Philippines***Functional areas of activity*

- a) collection of statistical data on fisheries (quantities and value) from 935 localities; manual collection in forms and centralized input
- b) communication and exchange of data with FAO, INFOFISH, SEAFDEC

*Identified IT related tools and deliverables*

- a) centralized processing of fishery statistics
- b) widespread use of spreadsheets for data processing and exchange (in floppy diskettes)
- c) classification according to FAO ASFIS (modified to Philippine fish species)

**UP-MSI***Functional areas of activity*

- a) information center on seaweed and invertebrates
- b) publication and dissemination of guidelines on seaweed farming
- c) publication of newsletter
- d) Fisheries Sector Program
- e) coastal management plan
- f) application of GIS system
- g) semicircular circulation patterns in bays and gulfs

*Specific annotations*

- a) Some areas of activity seems to have substantial overlaps with functions identified within other visited information centers.
- b) An external data model of the characteristics of San Miguel Bay, would be useful for the purpose of transfer of data to other areas of application.

**ICLARM***Functional areas of activity*

- a) Asian Fisheries Social Science Research Network
- b) Network of Tropical Aquaculture Scientists (NTAS)
- c) Network of Tropical Fisheries Scientists (NTFS)
- d) publishing of research reports
- e) publishing of bibliographies
- f) Selective Fisheries Information System (SFIS)
- g) research relevant to improving the quality and availability of aquatic resource information
- h) development of training courses
- i) ecological and bio-economic modelling
- j) methodologies for multispecies fish stock assessment
- k) tropical fish stock assessment
- l) biological data on important fish species
- m) satellite images of phytoplankton distribution
- n) modelling of prey selection
- o) "North Sea Model" (one species at a time)
- p) Multispecies Virtual Population Analysis (MSVPA)
- q) Length-Based Multispecies Virtual Population Analysis (LB-MSVPA)
- r) multispecies fish stock assessment for lakes
- s) modelling of the dynamic interaction between fish species and fishing efforts from fishing fleets
- t) modelling of fishing fleets and their allocation Capture Fisheries Management Program (CFMP)

- u) Coastal Resource Systems Program (CRSP)  
"Dynamics of Multispecies Systems"
- u) village-based aquaculture methods
- w) coral reef area ecosystem modelling
- x) Coastal Area Management Program
- y) farming of giant clams
- z) studies of San Miguel Gulf dynamics

*Identified IT related tools and deliverables*

- a) FISHBASE - operational encyclopedic database with pictures and key biological information (ecology, population dynamics, reproduction, identification, taxonomy, aquaculture, and diseases) on more than 8,000 species of aquatic animals collected globally from more than 6,000 references; all species from North America and Europe are included. It is developed in collaboration with FAO and CEC.
- b) ECOPATH II - operational application system for straight-forward construction and parametrization of steady-state tropic models of aquatic ecosystems. Fifty quantified descriptions of ecosystems are published on the basis of ECOPATH II.

**GENERAL ANNOTATIONS**

The following annotations reflect the general observations made during the visit to the concerned information centers and partly from materials received during the visit. Several of the annotations emphasize conditions considered to be significant obstacles for implementation of an effective IFRM. Consequently, measures for urgent removal of such obstacles, are regarded as the most decisive.

- a) Shared conceptual modelling of common functions and objects, addressed within various areas of application, is a prerequisite for efficient informatical integration. This is the reason why standardized methodologies for such purpose have been developed within other professional communities especially within high-technology industrial communities.

Such methodologies are consequently at the core of ongoing international informatical integration within other professional communities and within ISO standardization of associated subject matter.

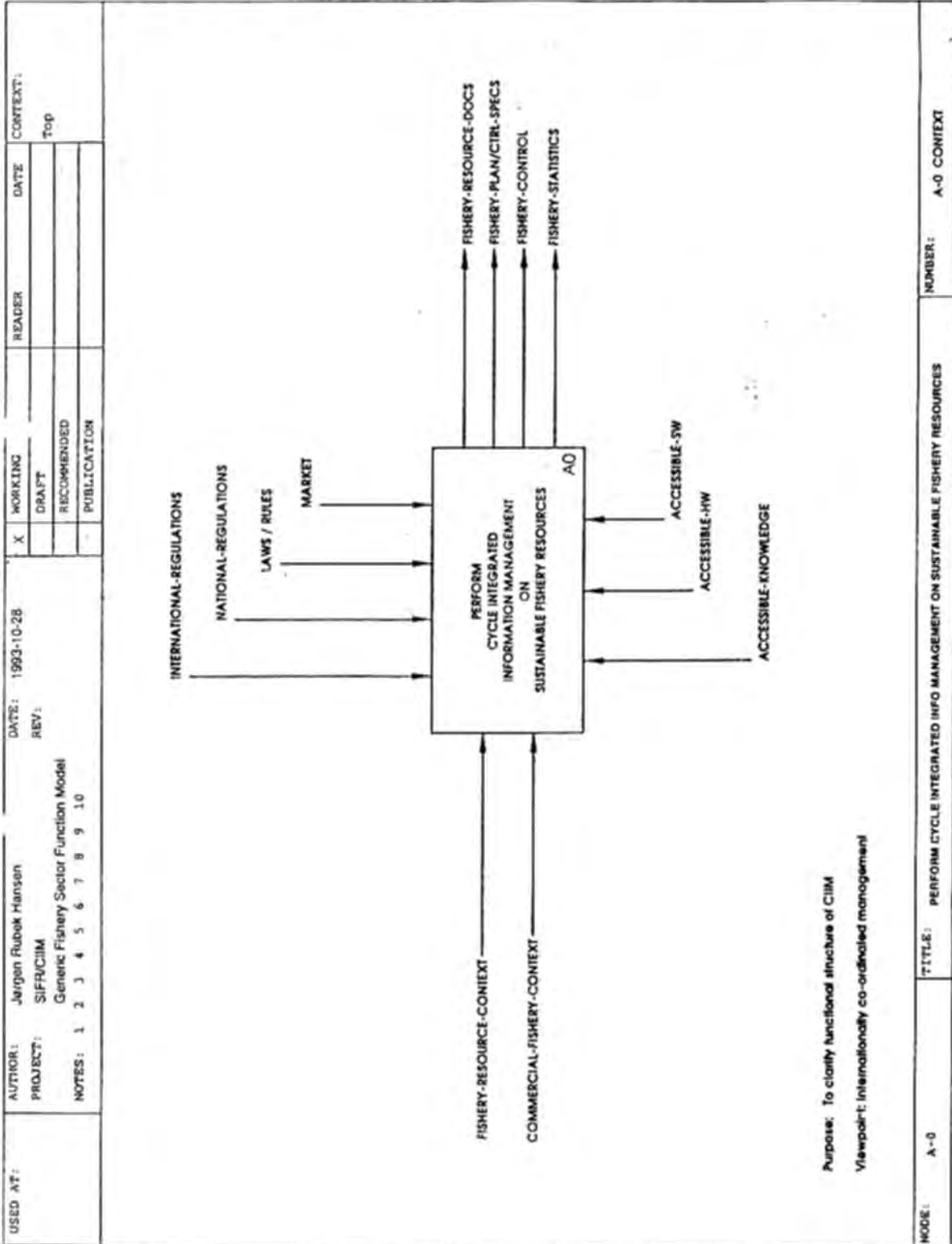


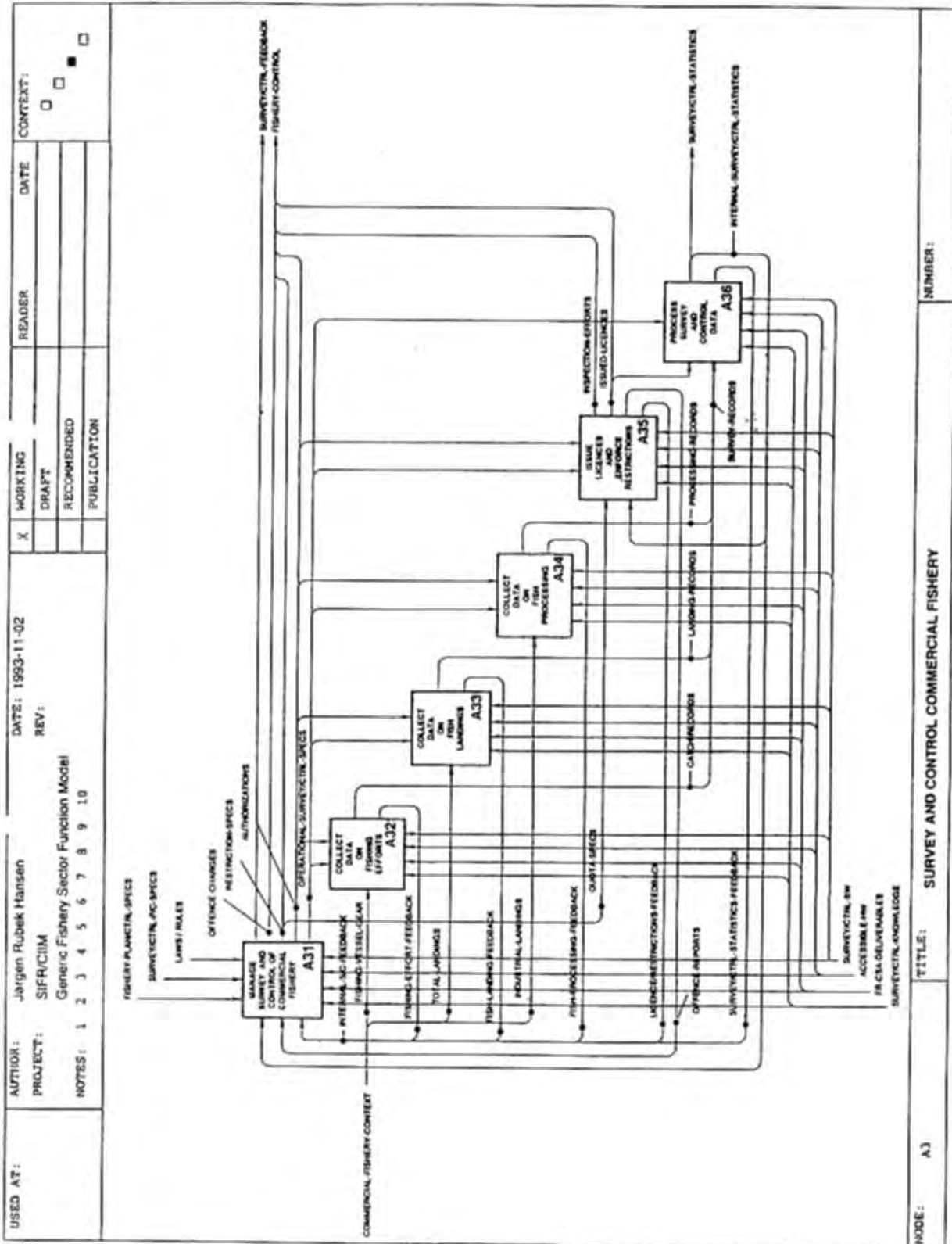
No such common modelling has apparently been organized as yet within the fishery community. Exceptions are general compliance with commonly applied classification systems and national and local efforts to develop and keep to common standards. This matter of fact, if correctly observed, is probably one of the major present obstacles for development and implementation of IFRM.

- b) Realization of IFRM implies necessarily, a clearly defined organizational structure of functional responsibilities for the over all common coordination and control. Such organizational responsibilities are apparently defined only for minor areas of activity within the fishery community. Also, this matter of fact, is likely to be a major obstacle for the development and implementation of IFRM, whether this be on international, national or regional level.
- c) The identified functional areas of activity seems qualitatively, to a great extent, to cover most types of functions necessary for the realization of IFRM.
- d) It is likely to suppose that many very valuable models of various subject matters have been developed within several of the identified functional areas of activity. In addition, many areas seem to address models with significant overlaps in subject matter and logical structures. None of these models, however, seems to have been documented according to a standardized methodology in order to make them known, externally understandable, and directly communicable to other functional areas of activity. This means that probably, such models may be restricted very often to use only within limited areas of application due to simple lack of communicability. Also, unexploited opportunities for useful transfer of knowledge and results between different areas of activity and unnecessary development of similar models in parallel elsewhere, are likely to be consequences of this lack of a standardized methodology for modelling.
- e) Communication of professional achievements within the fishery community seems predominantly to be through textual publications. These are recorded and published periodically in bibliographies, from where they subsequently can be retrieved directly or by means of classification by key words. It is likely to expect that, this technique could be improved significantly,

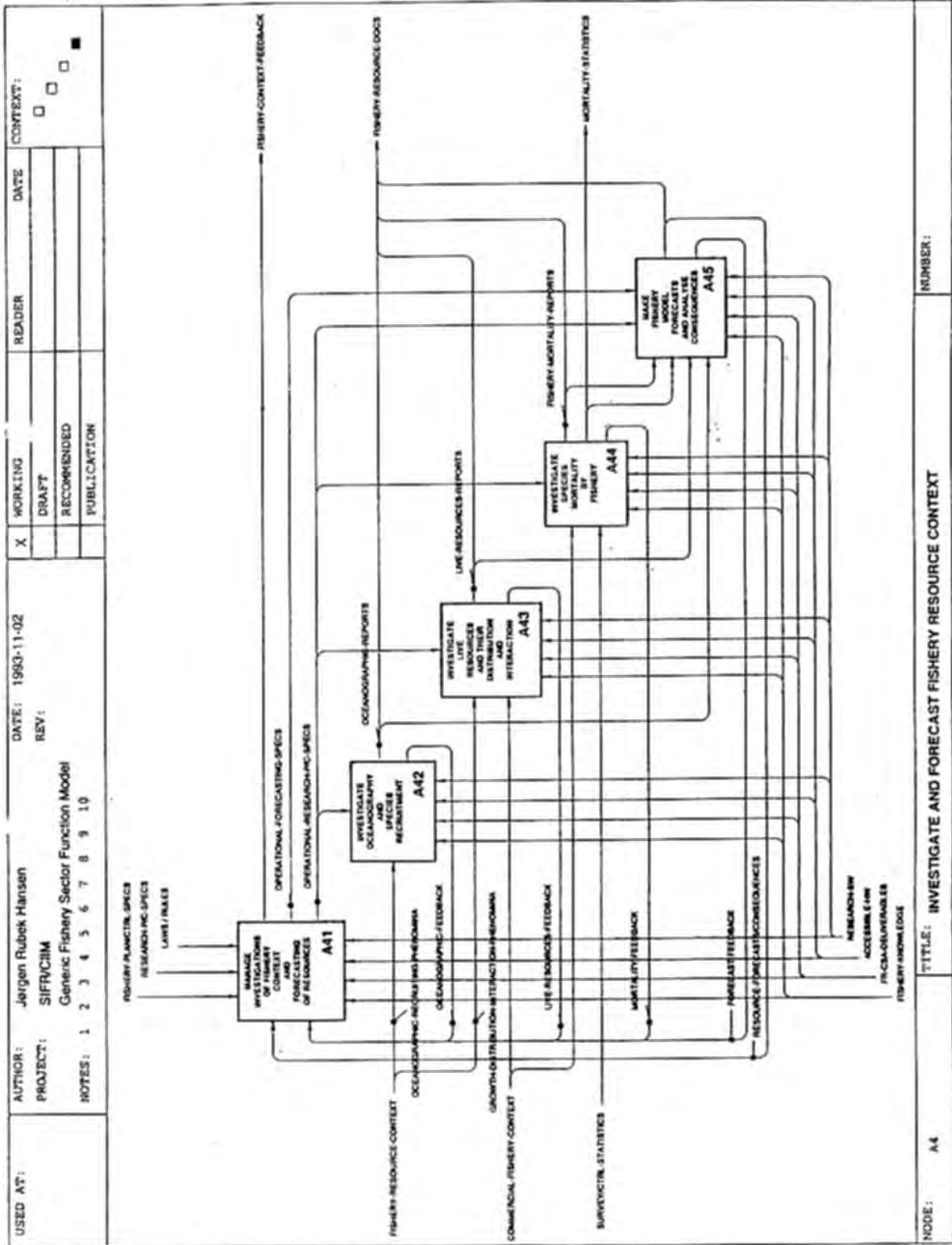
if documents in general as part of a concerted effort, were required to relate directly to a common model of functional areas of activity within the fishery community and to the associated classified data model views. Such technique, together with standardized methodologies for modelling, would probably also enhance the accessibility and transferability of the models and sometimes, the voluminous quantities of data acquired, processed and analyzed for the purpose of a specific publication.

- f) Only few functional areas of activity seems to have formally defined and precisely identified users of their output. This may lead to less appropriate design of the produced output and lack of useful opportunities for feedback.
- g) Fishery statistics seem in general, to be disseminated to end users only in voluminous textual and unified forms. Availability of statistical information through relational databases would preferably offer flexible and very valuable opportunities to certain types of users.





MODE: A3 NUMBER:



NODE: A4 TITLE: INVESTIGATE AND FORECAST FISHERY RESOURCE CONTEXT NUMBER:

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## INVENTORY OF STANDARD SOFTWARE APPLICABLE TO IFRM

by  
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### INTRODUCTION

A sufficient clarification of the extent, structure, and various implications of the complex concept of an Integrated Fishery Resource Management (IFRM), is an absolute pre-requisite for a meaningful identification of present and future information technology (IT) tools applicable to this end. As no detailed definition of IFRM seems to be available, a reference model for IFRM has been prototyped as the basis of the performed identification of the present and future IT tools applicable for this purpose.

The essential part of the prototype is a function model, by which all functions or types of work, required for IFRM are mapped top-down together with their patterns of controlled interaction, i.e., ordinary channels of communication. On the basis of this work, inventories have been produced concerning functions performed and IT tools applied within the fishery organizations in Southeast Asia which were visited in November 1993.

The extent to which the functions required for the realization of IFRM are performed, appears clearly from the inventory and so does the many applied and valuable IT tools. However, if the reference model is compared more closely with the functions and IT tools, it will appear that several important components are still missing which are absolutely necessary if IFRM is to be realized. Among the missing components are (a) defined and organized complete management structure, (b) established common definition of the involved functions and their interactions, and



(c) systems in general, defined according to a common methodology, either internally or externally. This means that most systems depend very much on the individuals. It does not also mean that external understanding of the systems and their potential usefulness is more difficult than necessary.

The general lack of common definitions of functionalities, structures, interactions associated with IFRM makes it difficult in particular to recommend IT tools for this purpose. However, a series of available standard softwares will obviously apply very well for the implementation of IFRM especially if this is made within the framework of a commonly developed systems architecture, in line with similar international developments within the other sectors.

It was not possible to identify software which immediately can be recommended as potentially applicable to IFRM. However, many of the identified softwares presently applied for managing fishery resources within the organizations visited, with relatively few modifications, could be strong candidates as substantial constituents of a full scale implementation of IFRM.

Moreover, a series of commercially available, relatively cheap, standard softwares will also apply effectively as tools for many of the functions which can be identified within the concept of IFRM. Such softwares are supposed, most probably, to be for implementation on PCs with DOS and MS-Windows.

The following requirements are to be regarded as absolute minima, if satisfactory performance is to be expected:

CPU	: 80286, 80386 or 80486 (but 80386 or higher is recommended)
Memory	: 2MB (but 4MB or more is recommended)
HD	: 40MB (but more is recommended)
Screen	: Colored
Other dev.	: Mouse

Certain softwares require more than this.

## EXAMPLES OF STANDARD SOFTWARES

### Relational Database Management Systems (RDBMS)

Oracle, Ingres, Informix, Sybase, and Progress  
all for bigger and more complicated database applications

dBase IV  
widely used, Windows version expected in 1994

MS Access  
widely used and with advanced tools for easy and more complicated applications

DB2, RDB, and Gupta  
all in client/server systems and also on dedicated servers

All these RDBMS systems have SQL and ODBC (Open Database Connectivity) facilities for exchange of data with other systems, e.g., spreadsheets.

### Application Development Tools

MS Access  
interactive, graphical, very easy and advanced tool for database applications, can generate dBase IV applications as well

Oracle Browser  
tools comparable to MS Access tools - expected in 1994

Progress 4GL  
comparable to tools above

MS Visual C  
for easy "traditional" programming of applications

MS visual C++  
for object oriented programming

### Communication Systems

MS Mail and Lotus cc:Mail  
both systems are for electronic mail

Kermit and Betty

both systems are for terminal emulation

Excursion

for emulation of graphical applications

WP Office

for networking of PCs.

**Spreadsheet Systems**MS Excel and Lotus 1-2-3

both are advanced spreadsheet systems with facilities for report generation and graphical presentations.

both systems can communicate with databases via ODBC and with text processing systems via DDE (Dynamic Data Exchange)

**Word Processing Systems**MS Word and WordPerfect

both systems are advanced WP systems for both DOS and Windows, both systems offer DDE facilities

**CAD and Drawing Systems**AutoCAD

widely applied system for CAD drawings, the system offer DXF facilities for exchange of data with other systems

Corel DRAW

excellent for drawing and generation of high quality graphics

Many formats are applied for the exchange of data within the CAD, and drawing application area.

**GIS Systems**ESS Maps and Mapinfo

both systems are applicable for similar PCs

Smallworld

require more powerful PCs

## Statistical Systems

### Systat and Statgraphics

both systems are widely applicable and with facilities for graphical presentations. both systems can exchange data with spreadsheets and certain database systems

## Graphical Presentation Systems

### SAS Products

for high quality graphical presentation, can communicate with various databases

### MS Open EIS

for high quality graphical presentation in combination with MS Excel, can communicate with various databases

## Desk Top Publishing Systems

### Aldus Page Maker

for professional illustrations of reports, papers, brochures, drawings can be imported from e.g., Corel DRAW

## Project Control Systems

### MS Project

widely used general project control system for minor products, precedence diagrams, can be produced, data exchange with e.g., spreadsheets according to DDE

## Administrative Standard Systems

Many standard systems are available for simple bookkeeping and financial control, but systems need in general, to some extent, to be fitted to local practice. However, most systems ought to be based on standard database systems which can communicate with other database systems and spreadsheets

## Function and Data Modelling Systems

### ERwin/ERX

powerful interactive tool for IDEF1x data modelling and for generation of detailed SQL database designs, all widely applied types. High quality diagrams and reports can be communicated via DDE to WORD, Excel and WordPerfect, and essential tool for development of client/server solutions. Reverse engineering of existing database designs can be performed

### Design/IDEF

powerful interactive tool for IDEFO function and IDEF1x data modelling and associated reporting. High quality presentation of diagrams. Model data can be exported in generic database formats

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**PROPOSED ACTION PLANS  
FOR FISHERY INFORMATION PROGRAMS  
IN ASIA**

**Summary**

The participants of the Workshop were grouped into three sub-regional groups in order to facilitate the formulation of action plans which would best solve the issues and constraints which they identified as regards fishery information in their respective countries.

The sub-regional groups were: Indo-Chinese countries, comprising Cambodia Laos, and Viet Nam; South Asian countries, comprising Bangladesh, India, Pakistan, Sri Lanka, Maldives, and Nepal; and Southeast Asian countries, comprising Brunei Darussalam, Indonesia, Malaysia, Philippines, and Thailand.

The fourth group, comprising Australia, China, Japan, and Taiwan served as the resource and reference group.

During the Workshop, the three sub-regional groups identified the following action plans, which the Workshop unanimously adopted on 22 January 1994:



**Action Plan for Indo-China**  
**(Cambodia, Laos, Viet Nam)**

1. To formulate a national policy for strengthening the information systems in support of national research and development
2. To establish national information centers and sub-centers located in different regions of the country to form the fishery information network
3. To strengthen the information network by setting up suitable libraries in the centers and sub-centers with appropriate facilities for development, processing, and dissemination of information, and training of staff for them to function effectively
4. To build up the targeted national fishery information to meet the users' needs by conducting a fishery census, proper statistics activity and required research for appropriate decision-making on development 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 centers and services such as FAO, ICLARM, SEAFDEC, AIT, INFOFISH
7. To require immediate international assistance for the first and second items in this proposed action plan, and long-term assistance for the third item and especially 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 the above action plans.

## Action Plan for South Asia

(Bangladesh, India, Pakistan, Sri Lanka, Maldives, Nepal)

### *Action Plan of the South Asian sub-group on "fishery information, constraints encountered, and suggestions for their solutions"*

The South Asian sub-group sat together and enumerated the constraints encountered on fishery information in the participating countries and came up with priorities on certain constraints peculiar to some of them and some common to all of them. The priorities fixed up by them are enumerated below along with suggestions for their solutions:

#### Mechanisms for Collection and Dissemination of Information

1. Poor national and regional information on resources and services. A Fishery Resources Survey System (FRSS) should be re-organized through 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.

#### Trained Expertise

2. Absence of adequate skilled and trained manpower, and infrastructure for the fishery information system, is a great hindrance in the participating countries except India. The national institutes may be extended the necessary assistance by international and regional bodies.

#### Compilation, Processing and Reporting of Data

3. Absence of a central information unit in some participating countries is a hindrance for framing fishery information. This will enable countries to compile, process and report data from different agencies involved in data collection.

#### Cooperation and Collaboration with International Agencies

4. 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, while existing offices should be strengthened.

#### Strengthening of Information Service

5. Existing library facilities in connection with fishery information in some countries is not adequate. These should be strengthened.

#### Necessity of Information Tools

6. Inadequate transport and other equipment and facilities needed in data collection are also great hindrances in fishery information. These facilities should be developed.

#### Finances

7. Absence of adequate funds necessary in undertaking programs in connection with fishery information is a common constraint. Adequate funds should be made available to overcome this problem.

#### Necessity of Liaison with International Regional Bodies

8. Inadequate liaison with international and regional fisheries bodies is also a hindrance in the formulation of proper fishery information system. The liaison should be strengthened by organizing seminars/workshops in the participating countries and supplying them with all publications.

#### Coordination of Fisheries Information

9. Lack of coordination among participating countries is also another constraint. Member countries should have national coordinators who should meet regularly in order to exchange fishery information.
10. Donor agencies like FAO, BOBP and SEAFDEC, assisting the Southeast Asian countries, will be approached to assist the South Asian countries in strengthening their information systems.

**Action Plan for Southeast Asia**  
**(Brunei Darussalam, Indonesia, Malaysia,**  
**Philippines, Thailand)**

**1. Introduction**

1.1 The participants from Southeast Asia representing Brunei Darussalam, Indonesia, Malaysia, Philippines, Thailand, identified common issues and constraints and formulated a common approach or action plan.

**2. Priority Actions Identified**

2.1 Various issues and constraints common to the group were identified. The more important and critical issues and constraints to be addressed are:

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

**3. Regional Program**

3.1 The issues and constraints identified are further related to the programs as follows:

- a) Implementing and strengthening the national fishery information resources and services
- b) Analysis and dissemination of fishery resource management information

c) Fisheries technology transfer and extension.

#### 4. Objective of Program

4.1 The group identified the objectives for each program. The main objectives to be addressed were also identified.

4.2 Re-activation of National Fisheries Information Centers

The issue requires the re-activation of existing national fishery information systems (MALFIS, THAIFIS, INFIS, NFIS) and the establishment of new national fishery information system in Brunei Darussalam. This involves proper training of personnel and the commitment of the national leadership to support the centers.

4.3 Analysis and Dissemination

There is a national need to analyze and disseminate fishery information for resource management purposes, for both the policy makers and researchers. These should be effectively disseminated in a uniform format for timely utilization of the information.

4.4 Technology Transfer and Extension

The group felt the need to have the national fishery information obtained, properly analyzed and packaged ready for extension. The ready packaged information should be timely transferred to the relevant target groups within the national framework.

4.5 Regional Transfer and Exchange

There is a need for an effective regional transfer and exchange. The existing system of information transfer and exchange, i.e., SEAFIS could be re-activated and enhanced for the timely transfer of information.

#### Actions to be Taken at the National Level

a) To establish or strengthen a focal point for the national fishery information system with a definite national policy

- b) To encourage the exchange of fishery information among the national agencies through a national fishery
- c) To improve national efforts for an effective national fishery system through adequate financial and manpower support, facilities and regular training of staff
- d) To establish an effective system for compilation, dissemination and information exchange/distribution.

#### Actions to be taken at the Regional Level

- a) To establish an effective regional center for fishery information
- b) To provide training on information technology and management for information staff
- c) To strengthen information exchanges within the region and with outside the region
- d) To develop appropriate information input tools and methods
- e) To conduct a regular review on the progress, problems and constraints on information programs in the region.

#### Action to be taken at International Level

- a) To assist participating countries in developing and/or strengthening their national information input capability.

#### 5. National and Regional Needs

- 5.1 The group felt that there is a need for strong national fishery information program to provide leadership and coordination and to develop and implement training program in the areas of information management, development communication and information repackaging both at national and sub-national levels.
- 5.2 Nationally, the group felt that there is a need for the existing national information to be re-activated. Information staff at the national level should be re-activated and retrained while at the grass-roots level, intensive training of staff should be regularly given.



- 5.3 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, i.e., SEAFDEC, FAO/RAPA could take the leading role.
- 5.4 Appropriate software should be developed and an effective networking linkage should be evolved to resolve the problem of time lapse of information.
6. **Follow-up Procedures**
  - 6.1 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 agency in conjunction with appropriate international agencies, e.g., SIFR, for funding and expertise support.

Recommendations on  
Fishery Information

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### RECOMMENDATIONS ON FISHERY INFORMATION

1. In order to strengthen the fishery information systems in Asia to serve more effectively the needs of users within and outside the region, the Workshop recommended the following actions for consideration by the participating governments and international organizations/agencies concerned:
  - 1.1 Actions recommended to be taken at the national level:
    - a) To establish or strengthen the national fishery information system with a definite national program
    - b) To encourage exchange of fishery information among the national agencies through a national fishery network
    - c) To improve national efforts for an effective national fishery system through adequate financial and manpower support, facilities and regular training of staff
    - d) To establish an effective system of compilation, dissemination and information exchange and distribution.
  - 1.2 Actions recommended to be taken at the regional level:
    - a) To establish or strengthen the effective sub-regional and regional fishery information systems in close collaboration with the national fishery information programs of the participating countries
    - b) To coordinate and provide training on information technology and management for national information staff
    - c) To develop appropriate information tools and methods

- d) To promote and facilitate regional cooperation and collaboration in exchange and management of fishery information
  - e) To conduct a regular review on the progress, problems and constraints on information programs in the region.
- 1.3 Actions recommended to be taken at international level:
- a) To support and supplement national efforts in developing and/or strengthening their national information capability
  - b) To promote and facilitate international cooperation and collaboration in exchange and management of fishery information.
2. The project proposals for the sub-regional and regional fishery information programs should be developed on the basis of the options and action plan prepared by the three sub-regional working groups, and be submitted for consideration and support by the participating governments in the region.
3. In order to facilitate the preparation of project proposals on the development of effective fishery information programs for possible funding by donor countries or agencies, technical assistance from international organizations/programs such as, *inter alia*, FAO, SEAFDEC, INFOFISH, NACA, BOBP and the Mekong Secretariat, was recommended. FAO/RAPA was requested to coordinate these efforts.
4. The Workshop further recommended that the project proposals on fishery information in the region be submitted to the donors for their consideration through SIFR.
5. The Report of the Workshop should be disseminated and distributed to the participating governments for their support and that a follow-up Workshop/ Seminar be convened by the organizations concerned to discuss the implementation of the proposed action plans.

FISHERY STATISTICS

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## OUTLOOK OF FISHERY STATISTICS IN SOUTHEAST ASIAN COUNTRIES

by

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### INTRODUCTION

The Southeast Asian Fisheries Development Center (SEAFDEC) organized the first regional workshop on fishery statistics in 1976 in order to unify the statistical standards of collection, compilation, and processing of fishery data to facilitate regional comparison, and to initiate the publication of the "Fishery Statistical Bulletin for the South China Sea Area." The first issue of the Bulletin, published in 1978, covered the 1977 fishery statistical data.

In order to improve the national fishery statistics and the Bulletin, several workshops were consequently organized by SEAFDEC, some of which were conducted in collaboration with FAO. Until now, however, there are still many indifferences and constraints related to the collection and compilation of fishery statistics, both technical and administrative, which need to be overcome. This paper points out some problems which need further discussion and deliberation.

Also included in this paper is a table on fishery statistics available in each country, based on the reports on national fishery statistics and country papers received from the participating countries in the region.

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\* until 15 February 1994



### CURRENT STATUS

In most countries, a central statistical office or agency is responsible for conducting fishery census. In general, a fishery census has been undertaken at intervals of ten years, as is done with the population census. So far, Malaysia is the only country in the region that has not conducted a fishery census. Its fishery data are collected from the results of the population census.

In almost all countries, a national fishery department is responsible for the collection of the annual fishery statistics. However, in the Philippines, this task was transferred from the Bureau of Fisheries and Aquatic Resources to the Bureau of Agricultural Statistics in early 1989.

Since 1965, the staff involved in fishery statistics have been strengthened in many countries through the creation of fishery statistical sections within the national fisheries departments.

#### National Level

Considering the size of the countries and their fishery industry, the number of statistical staff assigned to the central fishery statistical office seems to be adequate, as in the case of Thailand, Peninsular Malaysia and Indonesia. However, country reports of the Philippines and East Malaysia indicated a shortage of staff.

#### Local Level

The number of field staff assigned in the collection of fishery statistics seems to be adequate in Thailand, Malaysia and Indonesia, where staff and enumerators are full-time government officials. Consequently, ongoing statistical surveys conducted by their staff seem to be doing effectively. On the contrary, in the Philippines, all field enumerators are casual employees. Thus, problems of efficiency often entailed.

In the past few years, the use of microcomputers for data processing has been introduced in almost all countries. In Peninsular Malaysia, a computerized on-line system has been adopted country-wide. As a result, fishery data could

be made available in a short time. Data input and processing are done at all levels using floppy diskettes for data storage. The monthly estimates are immediately forwarded to the central office.

Among ASEAN countries, Thailand was the first country to computerize the data processing of fishery statistics at the central office in Bangkok. In 1989, Indonesia has introduced a microcomputer system at the central office. The system has been useful in making a cross-tabulation of catch by type of gear and species. There is now a plan to install a microcomputer at the provincial level system in Peninsular Malaysia. On the other hand, the Philippines has started recently to use computers in data collection, compilation and processing.

#### FISHERY CENSUS

Fishery census is being undertaken in many countries in the region, like Indonesia, Japan, the Philippines, and Thailand in order to show the economic structure of a fishery at a specific time. Specifically, the objectives of the fishery census are:

- a) To clarify the economic structure of the fishery industry, a dual economic structure in marine fishery. Small-scale fishery establishments and industrial fisheries have separate statistical formats. For small-scale fisheries, various socio-economic information in both working and living status are needed for fishery resource management.
- b) To provide inventory data, such as number of fishing households, fishing boats, fishermen, fishing units, ice factories, cold-storage facilities.
- c) To provide an accurate sampling frame for designing various statistical surveys.

Since 1965, fishery censuses have been conducted in most Southeast Asian countries. FAO, which took the initiative in implementing agricultural censuses in the region, did not assist fully in the conduct of fishery censuses owing chiefly to the absence of FAO technical expertise assigned in the region. As a result, the outcome of fishery censuses in many countries in the region may not be satisfactory and this is due to the following specific reasons:

- a) In many instances, the fishery censuses undertaken in the region have been limited to a fishery inventory survey only. The economic structure of the marine fishery could not be clarified, except in Thailand where a marine fishery census was conducted in 1985 by the National Statistics Office.
- b) Malaysia obtained some inventory data through the population census. However, the coverage of the fishery establishments may not be sufficient, as the definition of major occupations in the population census is confined to the major income source during the last week prior to the conduct of the census. As a result, many part-time fishermen in Malaysia could not be identified.

Recently, many coastal countries such as the Philippines and Malaysia have implemented their "Coastal Fishery Management Program." In order to limit or reduce the entry of coastal fisheries into the overall socio-economic data, for example, the number of fishermen, size of fishing boats, type of fishing gear and their working status, are required. This can only be obtained through the conduct of a fishery census. Therefore, participating countries are encouraged to conduct fishery census periodically.

Fishery census may be undertaken as part of an agricultural census. This would lead to some advantages, which include the fact that, it is easier to obtain the necessary budget for the fishery census, since it will be much less, compared to the agricultural census. The identification of fishing establishments can be done at the same time as in the agricultural census. Moreover, the large number of the small-scale fishermen engaged in inland fisheries could be easily identified.

#### FISHERY STATISTICS

Generally, fishery statistics are collected annually and compiled into national yearbook of fishery statistics in order to show the yearly changes that take place in a fishery over a given period of time. Annual fishery statistics generally refer to catch statistics, however, aquaculture and fishery economic statistics are now considered part of fishery statistics.

### Catch Statistics

All countries in the region provide catch statistics both in quantity and value. Catch statistics are divided into marine and inland fishery. Recently, however, some countries ceased to compile the data on catch value while some ceased to publish catch by fishing gear due to shortage of funds. Many data are estimates only of the total catch by species at the national levels and this has caused difficulty, on the part of SEAFDEC, in compiling the Fishery Statistical Bulletin for the South China Sea Area. The multi-species and multi-gear nature of tropical fishery, make the data on catch by fishing gear very essential. For instance, many tuna species are caught not only by tuna purse seine but also by trawling and gill net.

Over the last decade, many joint fishery ventures have been established. The establishment of the 200 mile Exclusive Economic Zone (EEZ) has caused many trawlers to lose their traditional fishing grounds, while some countries, i.e., Indonesia and Malaysia were able to expand their fishing grounds. Since many countries could not fully utilize their fishing grounds due to technical and economic reasons, many joint fishery ventures were established for mutual benefit of the affected countries.

In the case of joint fishery ventures, catch data by vessels should be counted in the flag country in order to avoid duplication of data or in some cases, possible omission of some data. However, for "double national" registration of vessels, their catch data might be doubly counted. In this regard, it would be necessary to study the situation carefully and that countries concerned should settle this particular problem of data reporting in order to avoid duplication.

### Aquaculture Statistics

Aquaculture, classified as either freshwater culture or mariculture, have been well developed in many countries in the region. Thus, it is necessary that this sector provides separate data in the form of aquaculture statistics. At this point in time, however, survey items and species of aquaculture has not yet been standardized. The distinction between capture fishery and aquaculture, in some countries, is not yet very clear.

Although the distinction between freshwater and coastal culture, which includes both brackishwater culture and mariculture, has already been defined, the distinction between the latter sectors has not been made clear.

#### **Economic Statistics**

A fishery economic survey is not being conducted in many countries in the region, except in Japan and Thailand. The National Statistics Office of Thailand has recently undertaken an economic survey on shrimp culture, but this is not done on a regular basis. As this data is important in coastal resource management, all countries in the region should strive to undertake an economic survey regularly. Two types of economic statistical surveys may be conducted, namely, a cost and earning survey for enterprise fisheries in order to analyze catch efficiency and profitability, and an income and expenditure survey to clarify the living status of small-scale fishermen.

#### **Fishery Products Statistics**

In the last decade, many varieties of fishery products have been processed in the region and exported to foreign markets, i.e., U.S.A. and Japan. Furthermore, many fish processing facilities with high technical standards have been developed in the region. It is therefore, noteworthy to include the data on the number of fish processing plants, cold storage, and amount of production in each category in the national statistical yearbook of countries in the region.

#### **STANDARDS FOR NATIONAL FISHERY STATISTICS**

National fishery statistical standards have been fairly well developed in many countries in the region. However, some improvements are still needed in many countries.

SEAFDEC has provided several classifications for fishery statistics, such as the classification of fishing vessels, fish species, fishing gear. This was made in order to unify the reporting of fishery statistics in the region. However, some countries compile fishery statistics which are not broken down according to these classifications. Therefore, their data has little relevance and of less use



especially in the compilation by SEAFDEC of the Bulletin. It should be noted that great accuracy of catch estimates, such as total catch can be obtained if these classifications and standards are applied.

### **Marine Capture Fishery**

Size classification of fishery establishments in terms of gross tonnage of fishing boats in use is indispensable for clarifying the economic structure of marine fishery. This classification has not yet been applied in Malaysia and the Philippines. Although this classification was established during the 1985 marine fishery census conducted by Thailand, results have not yet been adopted in its annual fishery statistics report.

Fishing gear classifications currently used by many countries should be updated to take into account recent developments. For example, a new type of purse seiner, troll line have been developed and are being used now for the exploitation of oceanic pelagic fishery resources such as tunas and skipjacks.

On the other hand, species classifications, currently used by many countries should be reviewed. For instance, tuna and tuna-like groups may be reclassified. It may also be necessary to examine carefully whether species identification is properly done at the time of data collection.

### **Inland Capture Fishery**

Inland capture fishery has some importance in China, Indonesia, the Philippines and Thailand. The classifications currently being used by these countries should be reviewed in order to assure that collection and processing of data by these countries, is more or less uniform.

### **Aquaculture**

Different types of aquaculture, which vary from country to country have been developed in the region. In many countries, statistics on aquaculture have been rather poorly dealt with. In fact, poor reporting of aquaculture statistics make it difficult for many countries to assess



the overall status of aquaculture in the region. The species classification applicable to each type of aquaculture production and other relevant data, have not been established in some countries in the region.

#### NATIONAL YEARBOOK OF FISHERY STATISTICS

Countries in the region compile a national yearbook of fishery statistics for various users, namely, fishery administrators, fishery planners, fishery economists, fishery biologists and many others. Therefore, the timing of the yearbook's issue, the contents of its statistical tables, the form in which the yearbook is compiled, are very important.

However, there are issues which need to be clarified and solved in order for the national yearbooks to become an efficient and effective tool for decision-making as far as fishery planning is concerned. Firstly, the time lag in the production of the yearbooks by many countries should be shortened. Outdated data make the information in the yearbooks redundant at publication date. Secondly, although the yearbooks of every country give fishery production statistics, inventory statistics, such as fishing establishments, boats, fishermen and fishing units, are generally not included in the yearbook. Thirdly, some countries like Malaysia and the Philippines prepare tables showing catch and fishing effort statistics by area of capture. Although these information are needed for stock assessment, they take up about half of the yearbook. These data should therefore be tabled separately. Fourthly, not all yearbooks give annual time series data. It should be noted that reports should include not only the latest figures but also the past trend, as these are of great importance to some users. Finally, a yearbook is used mainly for making economic analyses of fisheries, which normally follow a fixed order, that is, number of fishing establishments, fishing boats, fishermen, fishing units and catch in quantity and in value. Many countries do not follow this fixed order.

To sum up the observations, from 1976 to the present, classifications and standards for national fishery statistics are still not unified as yet. Therefore, it may be appropriate to organize a training course on fishery statistics. The training could include hands-on sessions concentrating on how to design and compile useful statistics. The training course could also include the process of collecting and compiling fishery economic statistics.

Table 1. Fishery Statistics Available in Some Asian Countries

## 1. Socio-economic Structure of Fisheries

Type of Statistics	Indonesia	Japan	Malaysia	Philippines	Taiwan	Thailand
1) No. of Fishing Establishments by Strata	○	○	△	○	○	○
2) No. of Fishermen	○	○	○		○	○
by race			○			
by fishing gear			○		○	
by sex and age		○			○	○
by working status	○	○	○		○	○
3) No. of Fishing Boats	○	○	○		○	○
by tonnage class	○	○		○	○	○
by length of boat						○
by horse power of engine					○	
by ownership						○
by make of engine						
by fishing gear by size		○		○	○	○
4) No. of Licensed Boats		△	○		△	
by fishing gear			○			○
by fishing gear and by tonnage			○			
5) No. of Fishing Units Operation	○	○	○		○	○
6) Fishing Operation						○
No. of licensed fishing gears			○			
No. of fishing gears operated			○			
No. of fishing trips, days and hauls by type of gears			○			○

Type of Statistics	Indonesia	Japan	Malaysia	Philippines	Taiwan	Thailand
7) Fishing Effort Statistics, in terms of trips, fishing days, hauls, hours		△	○		○	○
(1) Trawl						○
(2) Purse seine		△	○		○	○
(3) Tuna long line		△			○	
(4) Squid Jigger		△			○	
(5) King mackerel drift gill net						○
(6) Mackerel encircling gill net						
(7) Push net						

## 2. Catch Statistics

Type of Statistics	Indonesia	Japan	Malaysia	Philippines	Taiwan	Thailand
<u>Marine Fishery</u>						
1. Annual Trend of Catch and Value	○	○	○	○	○	○
2. Total Catch by Type of Fishery	○	○	○		○	
3) Catch by Major Species	○	○	○	○	○	○
4) Catch by Fishing Gear and Species	*	○	○	○	○	○
5) Catch by Fishing Gear and by Fishing Areas		○	○	○	○	○
<u>Inland Fishery</u>						
1. No. of Fishing Households	○	○				
2. No. of Fishermen	○	○				
3) Catch by water body and Species	○	○	○	○		○

Type of Statistics	Indonesia	Japan	Malaysia	Philippines	Taiwan	Thailand
<u>Inland Fishery</u> (continued)						
4) Catch by Fishing Gear and Species				○		

## 3. Aquaculture Statistics

Type of Statistics	Indonesia	Japan	Malaysia	Philippines	Taiwan	Thailand
1) Yield of Mariculture by Species		○	○	○	○	○
2) Yield of Brackishwater Culture by Species	○		○	○	○	○
3) Yield of Freshwater Culture by Species	○	○	○	○	○	○
4) No. of Fry Produced			○		○	

## 4. Fisheries Economics

Type of Statistics	Indonesia	Japan	Malaysia	Philippines	Taiwan	Thailand
1) Cost and Earning of Commercial Fisheries		○	○	●	○	●
2) Income and Expenditure of Small-Scale Fisheries		○		●	○	●

## 5. Fish Price and Processing

Type of Statistics	Indonesia	Japan	Malaysia	Philippines	Taiwan	Thailand
1) Quantity and Price of Fresh Fish at Wholesale Market by Species		○	○	○		○
2) Quantity and Average Price of Fresh Fish at Consumer Market			○			

Type of Statistics	Indonesia	Japan	Malaysia	Philippines	Taiwan	Thailand
3) Disposition of Fish Landed	○	○	○		○	○
4) Yield of Processed Fishery Products	○	○	○		○	
5) No. of Ice Plants, Cold Storages and Factories by Category		○	○		○	○

## 6. Fish Trade (Import and Export) and Fish Consumption

Type of Statistics	Indonesia	Japan	Malaysia	Philippines	Taiwan	Thailand
1) Imported Fish and Fishery Products, Q. & V. by Species	○	○	○	○	○	○
2) Imported Fish by Origin by Species	○	○	○	○	○	○
3) Exported Fish, Q. & V. by Species	○	○	○	○	○	○
4) Exported Fish by Destination by Species	○	○	○	○	○	○
5) Food Balance Sheet on Fishery Products		○				○
6) Average per Capita Consumption of Fish and Fishery Products		○	○	○	○	○

- Notes: ○ = Available  
 △ = Available but limited use for resources analysis  
 \* = Catch by Fishing Gear only  
 ● = Available but occasionally

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## FISHERY STATISTICS OF BANGLADESH

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### INTRODUCTION

Fish and fisheries play an important role in the economy of Bangladesh, in terms of nutrition, income generation, foreign exchange earnings and employment generation. Fish contributes 71% of the total animal protein intake of the people of Bangladesh, indicating its importance in the nutrition of every Bangladeshi. In recent years, fish production was not able to cope up with the increasing demand as a consequence of population increase. In view of the importance of the sector, the Government of Bangladesh has given importance on fishery development in its national development plans. Unless statistics are available, it would not be possible to understand the diverse fish production system and related fishing activities, which are essential elements for a viable fishery planning. Keeping this in mind, the Department of Fisheries (DOF) has instituted a system for the collection of fishery statistics and the dissemination of the information to concerned organizations, policy planners, administrators, scientists, and the general public.



Fishery statistics, the most important aspect in a good management system, is very relevant for countries like Bangladesh which is deficit in fish production. Production ensures availability of fish for consumption and trade, domestic as well as international. Fish consumption and trade can be managed better if fishery statistics is made available. The periodic changes in the selected fishery parameters provide the plan of action to be taken to remedy the situation. Therefore, up-to-date statistics is of vital importance for the management of the fishery resources.

#### DATA COLLECTION AND COMPILATION

The country's fishery statistics took shape in July 1982-83, through the establishment of a Fishery Resources Survey System (FRSS) at the DOF. Through FRSS, two types of surveys and data collection programs are being conducted, namely, inventory and survey of different types of water bodies and their areas, including fishermen, fishing crafts and gear used; and estimation of fish catch by species, gear and season (month), and types of water bodies. Separate sampling techniques have been developed to estimate the total catch from ten categories of fisheries, such as riverine fishery (river, canal, estuary), "beel" and "baor" fishery (depressions), flood land fishery (seasonally flooded area, paddy fields), Kaptai Lake fishery, "Baor" fishery (Oxbow Lake), pond fishery, shrimp fishery, artisanal marine fishery, industrial marine fishery, and Sundorban (forest) Area fishery.

Every catch assessment survey is designed as a sample survey using one-, two-, or three-stage sampling for the estimation of the total catch on the basis of data from sample units collected by the Fishery Survey Officer under the authority of District Fishery Officer in the 64 districts.

For the fish sampling units, such as villages and rivers, and for estimating the total catch by districts, a frame survey is conducted in advance prior to the initiation of catch assessment survey. This is done in order to provide a complete list of the fish sampling units together with their basic information such as number of fishing efforts.

Sample data of the catch assessment survey are thoroughly checked and edited in the field and sent to the Headquarters once a month or once in six months, or annually. The field data are then processed using computers. In addition, data on total number of fishing units operated and the producers' price of the catch, are also collected and compiled from field survey results.

The Bangladesh Bureau of Statistics is responsible for conducting fishery census every year. In addition, the Bangladesh Fisheries Development Cooperation (BFDC) collects landing data of the Kaptai Lake on a daily basis. Also, the Marine Fishery Unit of DOF is authorized to deal with licensing and monitoring of the operations of fishing vessels including Factory Ships under the provisions of the Marine Fisheries Rules 1983. The Control Unit of DOF is assigned to enlist the Fish Processing Plants in the country. The Mercantile Marine Department of the Ministry of Shipping is responsible for registering mechanized boats, operating in the coastal areas of Bangladesh. In addition, the country's Boat Pilot Project of the Bangladesh Inland Water Transport Authority and the National Oceanographic and Marine Institute (NOAMI) estimate the total number of country-crafts operating in Bangladesh. Lately, the Ministry of Industries has been authorized to accord permission for the acquisition of trawlers in consultation with the Ministry of Fisheries and Livestock. Most recently, the government is planning to set up a Prawn Development Board which would be responsible for the prawn hatchery and other activities related to prawn culture. DOF is providing information of fish seed production farms in Bangladesh, while the Bangladesh Space Research and Remote Sensing Organization (SPARSO) is providing information on the total area of different types of water bodies.

### **Fishery Census**

Fishery census is done by the Bangladesh Bureau of Statistics (BBS), and covers the following items, as reflected in the statistical year book:

- a) Number and area of fisheries (current)
- b) Number and area of fisheries by region (previous year)
- c) Inland and marine catch by species
- d) Quantity of fresh fish caught by source

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- e) Number of fishermen and fishing units
- f) Fish output from Kaptai Lake
- g) Area and production from shrimp farms, by region
- h) Quantity, value and export price of prawns and shrimps exported from Bangladesh
- i) Quantity and value of fish products exported from Bangladesh
- j) Annual total catch and area of productivity
- k) Annual total catch from inland waters, by district
- l) Annual total catch from principal rivers
- m) Annual total catch from principal rivers, by district, by species
- n) Annual catch from all rivers, by district, by species
- o) Annual catch from riverine fisheries, by river, by district
- p) Annual catch from beel fisheries
- q) Kaptai Lake catch
- r) Annual total catch from flood lands
- s) Total area and total catch from ponds, by district

#### DATA PROCESSING

Through computer facilities, extensive data sets can be handled for storage, review, analysis, and final presentation of output in a systematic way. In processing and analyzing fishery data, the use of computers should be ensured.

For analysis and processing of data from the ten sectors of fisheries, FRSS makes use of four IBM compatible computers (PCs) which replaced the outmoded Apple III microcomputers. DBase IV software has been set up in the PCs for the estimation of riverine, pond, flood land, and subsistence catch data. So far, the ten fishery sectors have been covered by computerization. However, at present there is no proper set up of the computer personnel, as they are the same personnel working as officers of the different disciplines at DOF.

## FISHERY STATISTICS

The objective of FRSS is to carry out field survey to provide reliable data on various inland and marine fisheries for the purpose of resource management and development. The resource survey system has been designed to estimate the total catches of each sector of fisheries (rivers, beels, Kaptai Lake, ponds, flood land, baors, Sundorban, shrimp farms, marine industrial fisheries, and marine artisanal fisheries. The Annual Fish Catch Statistics Reports are produced annually by FRSS.

The staff of FRSS consists of one Principal Scientific Officer, three Senior Scientific Officers, five Scientific Officers, sixty-four Fishery Survey Officers, and thirty-two other support staff including computer operators and a Cartographer. In addition, a few staff of the ongoing projects of DOF, such as the Third Fisheries Project and the Second Aquaculture Project, also collect fishery statistics in their respected areas.

The Statistical Year Book of Bangladesh, 1992 current edition, is the thirteenth in a series. The Fish Catch Statistics of Bangladesh 1988-89 has been published, while the 1989-90 and 1990-91 editions have been submitted to the concerned Ministry for approval. Reports for 1991-92 and 1992-93 are being processed. There is time lapse in the publication of the reports which is mainly due to the addition of a new program in the IBM PCs used, delay in receiving catch data from the field, and shortage of computer facilities and manpower. Generally, however, the bulletin covering the annual fishery statistics for a particular financial year, is released at the beginning of the succeeding year.

### Marine Capture Fishery

Bangladesh has a limited area for its marine fish resource. The total fishing grounds inside the 10 m baseline is about 24,000 sq km. The shelf area of the Exclusive Economic Zone (EEZ) from 10 m to a depth of 200 m provides an additional of 42,440 sq km. However, salinity, dissolved oxygen and water temperature tend to limit the distribution of marine fish to the narrow belt and effective fishing area is reduced to only about 14,000 sq km.



Marine fishery resource includes industrial and artisanal fisheries. Marine fish production has been growing rapidly in recent years, this is partly due to the introduction of trawlers, mechanized fishing boats, and efficient fishing equipment. There has been a disagreement about the standing and harvestable stocks of marine fishery, but experts agree that the marine sector in Bangladesh suffers from over-fishing and overcapitalization and has limited growth potential. The marine capture fishery data includes:

- a) Number of fishing boats by area
- b) Number of fishermen by area
- c) Number of fishing units by type of fishing gear
- d) Catch by species
- e) Catch by fishing gear and by species

#### Inland Capture Fishery

Bangladesh is endowed with vast track of inland open waters in the form of rivers, flood plains, estuaries, lagoons and lakes, situated in the delta of the Bralmaputra, the Ganga, and the Meghna. Inland fishery in Bangladesh covers an area of 4.3 million ha of which 94% comprise open water for capture fishery including the three main rivers, 700 other rivers and streams, totalling 22,155 km dissecting various terrains in their linear drift. In addition, vast inland water resources in the form of 2.8 million ha of "baors" (flood plains), 114,161 ha of "beels" and 68,800 ha of other resources has tremendous scope and potentials for augmenting fish production through the adoption of culture-based fishery enhancement techniques. As many as 260 species of fish have been recorded in the inland waters. In recent years, the inland capture fishery production declined because of over-fishing caused by population pressure and the destruction of natural aquatic habitats by flood control and drainage projects. Data collected for inland capture fishery includes:

- a) Number of fishing boats by area
- b) Number of fishermen by area
- c) Number of fishing units by type of fishing gear
- d) Catch by species
- e) Catch by fishing gear and by species



## Aquaculture

Information on mariculture is not available, but it is reported that in coastal areas, "Bhekti" (*L. calcarifus*) and "Persia" (*M. persia*) are being cultured as a by-product of shrimp farms. The Fisheries Research Institute of Cox's Bazar is also involved in the culture of "Bhekti" but its detailed report is not yet available.

Brackishwater aquaculture production can be increased by expanding the culture area as well as further improving the existing culture technologies. At present, about 35 ha of new tidal area will be used to culture shrimp and brackishwater fish.

Facilities such as water distribution and drainage canals will be constructed in the shrimp and fish ponds. Large unmanageable lands will be divided into manageable units with the provision of adequate supply and drainage canals. Year-round and semi-intensive shrimp culture systems will be employed in areas where river salinity remains suitably high throughout the year.

In view of the fall of shrimp price in the world market, improved traditional and semi-intensive culture systems will be emphasized, carefully keeping the production cost as low as possible. The use of intensive culture system requiring high investment, costly feed and highly sophisticated water management, is being discouraged.

Shrimp farming in Bangladesh depends entirely on wild seeds. Attention is given to prevent colossal loss of seeds due to inappropriate handling and transportation, and also post-stocking loss due to inappropriate culture management. Exploration and spotting of new seed grounds, mass collection of the seeds and their temporary holding at collection sites, and later their transportation to the farming areas, will receive high priority. The landless rural community will be involved at various stages of the fry industry development.

In addition to the 146,890 ha of ponds and 5,488 ha of "baors," planned aquaculture will be introduced into a new area of 40,000 ha, consisting of irrigation canals, roadside ditches, low-lying paddy fields enclosed within flood control dikes or rural roads, and the low lying areas in and around the cities and towns. Wherever feasible, integration of aquaculture with agriculture and animal husbandry will be practised as a general farming system, in order to increase fish production from freshwater resources.

All large low-lying areas, lakes and canals in and around cities and towns, that retain or can be easily made to retain water by simple development works, for at least one meter of monsoon water for more than three months, will be urgently developed for production of fish, simultaneous with the improvements of the urban environment and public health, and beautification of the city areas. The "baors" will be used primarily for fish production. The utilization of the baor land and water for agricultural purposes must adjust with the fishery needs.

In order to support the massive open water stocking program and the greatly expanded aquaculture plan as proposed, an extremely well-concerted system for large-scale hatchery production and nursery rearing of adequate carp fingerlings of pre-planned species combinations, will be given serious attention.

### Price Statistics

Fish prices of both wholesale and retail vary by season, area, fish variety and size. The larger the fish the more expensive it becomes. Since fish demand is increasing faster than the fish supply, fish prices are also increasing faster than the prices of other food commodities. Fish prices also vary greatly in different parts of the country as shown below:

Fish Species	Wholesale Price (Tk/kg)	
	Highest	Lowest
Rohu	100 (Dhaka)	45 (Maherpur)
Catla	80 (Netrokona)	40 (Mowlivi Bazar)
Hilsa	65 (Faridpur)	28 (Cox's Bazar)

Source: World Bank Report 1991

## Economics

The fishery sector is important in the economy of the country in view of its contribution to foreign exchange earning, protein intake in the population, poverty alleviation, environmental protection and gainful employment opportunities. According to current estimate, the fishery sector is providing full time employment to about 2.0 million people who remain fully engaged in catching, handling, packaging, transporting, distributing, and marketing of fish.

### DISPOSITION OF CATCH

About 95% of the total fish production is marketed after deducting the producers' consumption, unauthorized export across the border and total loss which amount to about 5%. Out of this total, about 80% is marketed for direct consumption in fresh form and about 15% is marketed for conversion into indigenously processed fish, like dried, dehydrated, smoked, and salted.

About 7% of the quantity available for overall marketing is directly sold by the producers to the nearest consumers, about 12% is disposed, to the nearby retailers and about 2% is marketed by BFDC and the cooperatives. The remaining 79% is distributed and marketed in the entire country by a long chain of intermediaries.

Fishery products consist of frozen finfish, frozen shrimp, frozen frog's legs, dried fish, salted and dehydrated fish, shark's fin and fish maws, turtles, tortoise crab, other fish balls, fish cake, and by-products such as fish mond.

Export items consist of frozen shrimp, finfish, dried fish, salted fish which are exported to India, Japan, U.S.A., Holland, Canada, United Kingdom, West Germany, Italy, Singapore, Hong Kong, Malaysia, and the Middle East countries. About 12-14% of the total national export earnings comes from fisheries.

The country's major imports are fishing equipment such as synthetic twine and ropes, refrigeration equipment, lee plants, marine engines and parts, chemicals, HCG, rotenone.

## FISHERY SURVEY

Fisheries of Bangladesh is classified into ten sectors, according to their nature. Separate methods of data collection have been developed to collect fishery information from each sector.

### Riverine Fishery

All fishing villages along the river are identified and all fishing units enumerated by types of gear, through a frame survey. The country's rivers are classified as either primary, secondary or small rivers. In each district, three villages from the primary river, and another three villages from the other rivers, are selected for the catch assessment survey. In each selected village, one to five fishing units of each type of gear are selected according to the number of fishing units for recording the daily catch unit. Catch of the selected units are observed twice a month to estimate the average daily catch per unit.

### Pond Fishery

Number and area of culture, culturable and derelict ponds are also estimated through a frame survey. In each district, five ponds of each type are sampled for observing and recording the monthly catch and hence, the annual catch, i.e., production per unit area of pond. Total pond production is estimated from the unit area production.

### "Beel" Fishery

Total "beel" area by district is only estimated. Two typical "beels" in each "thana" are selected and catch from those beels are observed in order to get the estimated unit area catch for each district and then the total catch for each district is calculated from the unit area catch.

### **"Baor" Fishery**

Some "baors" are managed by DOF and their catch is recorded regularly. For privately managed baors, catch is estimated by stratified sampling techniques, involving two size groups, i.e., area of 100 acres and above, and below 100 acres.

### **Flood land Fishery**

In seasonal flood waters, subsistence fishing is undertaken by the villagers. An estimate of the number of subsistence fishing households in different localities of the country is therefore recorded. Two typical subsistence fishing villagers are selected to observe catch from a sample fishing unit and from this observation, daily and monthly catch per fishing unit is estimated.

### **Kaptai Lake Fishery**

The lake is managed by BFDC. Catch from the lake is landed at BFDC's landing centers at Rangamati and Kaptai, and is recorded by BFDC personnel.

### **Shrimp Farm Fishery**

Total shrimp farm area by "thana" has been estimated through a complete survey. Catch from 12 farms in Chittagong Cox's Bazar Zone and 20 farms in Khulna Zone area are used to estimate the per unit area catch from which total catch is calculated.

### **Sundorban Fishery**

All activities including fisheries in the Sundorban forest area are managed and controlled by the Forest Department which also records fishing effort and catch.

### **Artisanal Marine Fishery**

Marine artisanal catch is estimated from unit catch and total fishing efforts data already available through survey.

### Marine Industrial Fishery

As per marine fisheries rule, fishing traders record their catch and the data is provided to DOF.

#### PROBLEMS AND CONSTRAINTS

- a) shortage of trained manpower for data collection in the field
- b) inadequate transport facilities for data collection in the field
- c) insufficient budget allocation for the field level officers
- d) manpower shortage for data analysis at the Headquarters
- e) shortage of computer facilities
- f) lengthy official procedure for the publication of the Fishery Annual Report, causing delay in releasing the report
- g) lack of coordination among the agencies and offices involved in fishery information collection activities.



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## FISHERY STATISTICS OF BRUNEI DARUSSALAM

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### INTRODUCTION

The Department of Fisheries of the Ministry of Industry and Primary Resources, is the agency responsible for compiling all fishery statistics, although the Economic Planning Unit of the Ministry of Finance compiles and publishes all statistics for Brunei Darussalam. Every year, two publications on statistics are produced by the Economic Planning Unit, the Brunei Statistical Yearbook and the External Trade Statistics. The Brunei Statistical Yearbook includes information on fresh fish marketed by groups, quantity and value from local production and imports, fishing gear licensed by type of gear, and fishing vessels. The External Trade Statistics, on the other hand, includes information on seafood imports by commodity item and country of origin, expressed in quantity and value. Also included is the information on seafood re-exports, by commodity item and country of destination.

All sections of the Department of Fisheries are involved in the collection of fishery related data. Each section is responsible for collecting appropriate and relevant data. The Marine Fisheries Section, for example, collects data on fishing establishment, fishing boats and vessels, catch in quantity by fishing gear and by species, effort data which include the number of trips made per month and number of hauls (trawl) or set (purse seine) or gill nets by traps per day, and revenue and expenses by operators.

The Aquaculture Section, on the other hand, collects data on aquaculture establishment by type of culture; production by species, by establishment, by area cultured; area under culture; seed production by species; and revenue and expenses. The Enforcement Section collects data on number and type of fishing boats and vessels in terms of dimensions, tonnage, engine horsepower; number of fishing gear by village or district; number of fishermen by age groups, by status, either full-time or part-time; imported and exported seafood by species, by month; and imported ornamental fish by species, by month. The Post-Harvest Section collects data on processing establishments; production of fishery products, by operator, by product type; and revenue and expense of the processors. The Marketing Section collects data on quantity of fish marketed by species either from local production or imported; price of fresh fish marketed by species either from local production or imported; number of seafood trading establishment; and wholesale and retail price of cultured fish.

These sections are also involved in socio-economic studies for the estimation of gross domestic product and for the purpose of financial analysis. The socio-economic studies includes total expenditure and net or gross income by fishermen from commercial and small-scale operators, aquaculture operators, and processors.

#### DATA COLLECTION AND COMPILATION

##### Fishery Census

Since October 1989, fishery census has not been conducted in Brunei Darussalam. However, population and housing census was conducted in August 1991 by the Economic and Planning Unit of the Ministry of Finance. Thus, the statistical data relating to fishermen and their status were extracted from the said population census.

In 1991, a small group was formed within the Department of Fisheries to look specifically into improving the data collection system. Results of the group's study indicated that data and information are scattered among the various sections of the Department, and that there are duplications in the information collected. The group therefore, recommended the formation of a unit responsible for compiling information from the various sections. This unit is now the Information Unit within the Department of Fisheries.

The compilation system of fishery statistics has been improved since the establishment of the Information Unit in 1993. At present, there are 20 staff from the various sections who are involved in collecting and processing statistical data. These data are compiled and processed by the Information Unit which has one programmer and one computer operator doing not only compilation but also dissemination of the data to the users, who are mainly from the fishing industry, private firms, fishery offices or the scientific community. Although computers are widely available in the Department of Fisheries, processing of data is still done manually. This is because there is no specific computer nor statistical programs used for processing the data. The "end product" of the statistics is, however, processed using simple computer packages before its dissemination. Since the Unit is not capable, at the moment of analyzing the data, the respective sections within the Department of Fisheries have to carry out their own data analysis and for them to report the analyzed data to the Department of Fisheries, either quarterly or semi-annually.

Fishery information and statistics are being shared with other agencies in the country, particularly with the Economic Planning Unit of the Ministry of Finance, the Ministry of Industry and Primary Resources, the Ministry of Health, the Marine Department, and the Ministry of Communication. In addition, the Department of Fisheries also provides statistics data for the Fishery Statistical Bulletin for the South China Sea Area compiled by the Southeast Asian Fisheries Development Center (SEAFDEC) as well as provides inputs to the questionnaire from the Food and Agriculture Organization (FAO).

With the establishment of the Information Unit, the first fishery statistics publication is scheduled to be released in 1994. It is hoped that the annual publication of a statistical bulletin compiled by the Department of Fisheries would narrow the gap and time lapse, and at the same time provide up-to-date fishery information and statistics to the end users.

## FISHERY STATISTICS

### Marine Capture Fishery

The total catch in quantity by species is collected in two different ways, either by "log book" or by daily direct monitoring. For commercial capture fishery, the operators

of trawlers and purse seiners are supplied with log books early in the month to be filled up with information such as time they set out to sea, time they get back, number of hauls or operations made, location of hauls or operations, amount of catches per grade, revenue after selling the catch, and expenses on food, fuel, ice, maintenance, and repair of the vessels. These log books are collected at the beginning of the following month before a new log book is issued.

In order to check the data from the log books, daily direct monitoring of the catch from trawlers and purse seiners is done at the Muara Fish Landing Complex by the staff of the Enforcement Section. The staff collects data on catch by grades and the price per kilogram obtained for a particular trip. By the end of the month, all information collected from the log book are submitted to the Marine Fisheries Section for processing and analysis.

In order to obtain the total catch by gear and species, small-scale fishermen are selected by village and district and also by the type of gear operated, according to the following sampling scheme:

1 to 10 samples:	take all
11 to 20 samples:	1 of 2
21 to 50 samples:	1 of 5
51 and above	: 1 of 10

The staff of Marine Fisheries Section conduct interviews of the operators on a monthly basis, to find out the catch for each trip, the number of trips made each month and the number of fishermen participating in a particular trip, and also the types of gear used. The catch data are then estimated using as basis the number of gear licensed in a village. This gives the total catch per month. Data from the villages surveyed are totaled in order to obtain the total catch for a certain fishery, per district per month and per year.

In accordance with the Fisheries Acts and Regulation, Chapter 61, Law of Brunei, fishermen who sell their catch have to, by law obtain licenses for the fishing gear used. When applying for a license or renewing an old license, the fishermen have to fill in some information on a special form which includes name, address, age, whether full-time or part-time operator, types of gear used and their dimensions, types of boats used and their dimensions, types of engines and their power, and names and number of assistants

involved. The fishing boats and vessels have to be licensed by the Marine Department of the Ministry of Communication before the fishermen is granted a license for the fishing gear. The fishermen is charged a fee according to the gear and size of gear used. Issuance and renewal of fishing licenses is conducted yearly by the Enforcement Section. Thus, the number of fishing establishments by district and their detailed information, could be extracted from the license records.

On the other hand, before importers are granted new import permits, they have to submit a detailed information on imported seafood which should include quantity and value by species and by transshipment. For ornamental fishes, importers are asked to provide detailed information on imported species expressed in quantity and value upon arrival, before an inspection is carried out by the staff of the Enforcement Section.

### **Aquaculture**

There are two types of culture systems practised in Brunei Darussalam, namely, brackishwater culture and freshwater culture. Since the brackishwater culture is operated on commercial scale, collection of data for this sector is more systematic compared to that of freshwater culture.

Farmers who are permitted to develop an aquaculture venture, fill up forms with necessary information and particulars. They are also supplied with log books to record data such as quantity harvested, revenue and expenses. Site visitation is carried out once every fortnight for monitoring and advisory services, and for the collection of data recorded in the log books. From this information, the number of aquaculture establishments and production by culture system, area, and by district are extracted.

### **Processing**

Fish processors are given data forms in advance, for them to record such information as quantity produced, price per kilogram, expenses as well as revenue. The data are collected quarterly but production by product type are recorded for each month. For imported fishery products such as frozen, canned and processed products, information on



quantity and value are extracted from the External Trade Statistics compiled by the Economic Planning Unit of the Ministry of Finance. Since the time lapse for the compilation of these data is four years, the given information is usually outdated.

### Marketing

Data on quantity and price of fish marketed are collected through daily monitoring of the various markets in the country. The information is recorded in log books and transferred to the "Daily Market Survey" form. These forms are collected from all districts and processed at the end of every month and logged into the "Monthly Market Survey" form. The data is used not only by the Department of Fisheries but also by the Economic Planning Unit, for planning purposes. At the end of each year, all monthly market survey forms are processed into the "Yearly Market Survey." The information in the "Yearly Market Survey" includes quantity and price of fish by species, by district, by month. The Market Section is also responsible for compiling data on quantity and price of cultured fish. This is done through direct interview of the operators.

### PROBLEMS AND CONSTRAINTS

Lack of systematic organized training in statistics collection has hampered the country's efforts in improving its fishery statistics. The methodology and purpose of data collection should be spelled out to the staff concerned. Occurrence of information gaps in some cases, often results in unreliable data. For instance, the amount of catch recorded in the log book is only for marketable sized fish, while trash fish or fish which are not of commercial value or not in demand by consumers, are either discarded or its information not recorded. This is also true for the purse seiners as well, which usually do not report the quantity of trash fish in their catch. The amount of fish for own consumption by the operators are also not recorded. Thus the catch data is usually underestimated.

The lack of interest and cooperation by some fishing vessel owners and farm operators in providing information on production, expenses, prices and revenue of their operations, leads to the delay in the compilation and processing of data. Oftentimes, when such problem occurs, incomplete data are used as estimates by the sections concerned.



There is inadequate suitable computer programs or packages for processing raw data and statistical programs for data analysis, as well.

In order to upgrade the dissemination of information, suitable training is required for proper data collection and analysis. Availability of statistical programs will strengthen the accuracy of the data.

The time lapse for the publication of the Fishery Statistical Bulletin for the South China Sea Area by SEAFDEC, which is three years, makes the information in the Bulletin less valid to the users. Some items in the questionnaire regarding the Bulletin, in relation to fishing effort, are too detailed and could result in some degree of misunderstanding on the part of the respondents and eventually, end up with incomplete or inaccurate information.

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## FISHERY STATISTICS OF CAMBODIA

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### INTRODUCTION

For many years, fishery statistics in Cambodia is found to contain some gaps since a statistics specialist is not available in this sector. The collection of fishery data relies heavily on the declaration of licensed fishermen, fish farmers, fish processors, and fish exporters, who are obliged to record their data in a "burden book" provided to them by the provincial fisheries. The data, collected and processed by provincial fishery officers, are presented monthly and annually to the country's Department of Fisheries. Processing of the data do not make use of computers as these too, are not available in the fishery statistics system.

The country's official fishery statistics data is published by the Department of Fisheries. The classification of the country's fishing region as contained in that statistical publication, is geographically defined for provisional use only.

### DATA COLLECTION AND COMPILATION

Fishery census has not been conducted in Cambodia since 1970. However, a marine fishery resource research survey of the Exclusive Economic Zone (EEZ), has been conducted by Russian scientists in 1983-85, a biological research survey of freshwater fish was conducted by Vietnamese scientists in 1985-87, and a recent survey of fish consumption in one "Fish Deficit" province was conducted in 1993, by a Cambodian post-graduate student of the Asian Institute of Technology (AIT), Thailand.

The data available from the above studies related to Cambodian fishery resources includes (a) inland and marine (EEZ) areas, inland resources comprise the Great Lake area which is 3,000 sq km during the dry season and about 10,000 sq km during the flood season, (b) inundated forest area of about 681,000 ha, and around the Great Lake which is about 576,000 ha, (c) demarcated area for inland capture fisheries, about 298 lots, comprising riverine lacustrine fishing lots, bagnet fishing lots for fish, bagnet fishing lots for shrimps, bagnet fishing lots for *Panggasius* seeds, and bagnet fishing lots for *Cirilius julienia*, and (d) fish sanctuary in 15 locations.

On the other hand, marine resources include the EEZ area which is about 16,2000 sq miles and mangrove forest area which is about 16,000 ha.

#### **Marine Capture Fishery**

Statistics collected for this sector includes number of fishing boats by area, number of fishermen by area, number of fishing units by type of fishing gear, catch by species, and catch by fishing gear and by species in quantity only. The types of fishing gear are divided into gill nets, which uses small boats with less than 20 HP engines, constituting about 25%; and purse seiner, using boats with more than 20 HP engines and constituting about 75%. The catch data are transformed into steam fish, dried shrimp, dried squid, dried sea cucumber, dried fish and fish sauce, while the rest are used in fresh condition.

#### **Inland Capture Fishery**

Data for inland capture fishery includes number of fishing boats by area, number of fishermen by area, number of fishing units by area, catch by species, and catch by type of fishing gear and by species, quantity only.

#### **Aquaculture**

Data for mariculture includes species cultured, such as shellfish, notably oysters, seaweeds, marine fishes, and seed production of specified species. Production by species is recorded in tons.

Production data from aquaculture includes fish production expressed in tons, and crocodiles, counted by heads. The areas covered are Great Lake, Delta Mekong, and Upper Mekong.

#### **Fishery Products**

This includes data on import and export of fishery products. Import data comprises mainly of shrimp feeds which was about 5,000 tons in 1993, valued at \$US 4,800,000. On the other hand, export commodity which was mainly marine shrimps was about 4,000 tons in 1992 valued at \$US 15 million. In addition, Cambodia also exports freshwater fish and fishery products, such as live sand goby, common sheatfish, *Kryptoterus*, spotted leather back *Noptoterus*, dried fish, fish paste, smoked fish, eel, frozen fish, and fish sauce.

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**FISHERY STATISTICS OF CHINA**

by

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**INTRODUCTION**

The compilation of fishery statistics in China is being undertaken by each level of the fishery administrative departments, from the central government of the Ministry of Agriculture to the local governments of the provinces, autonomous regions, municipalities, counties, townships, and villages. This system is in accordance with the State Statistics Law and State Regulations, drawn up by the Ministry of Agriculture. The Division of Fishery Statistics and Information of the Department of Fisheries, Ministry of Agriculture, is the top agency responsible for the compilation of the national fishery statistics and the publication of the Year Book of Fishery Statistics of China, based on the annual fishery statistics materials collected from the local governments. Generally, the initial statistics data for a certain year could be obtained in April of the succeeding year. Compilation takes some time because of the lack of sufficient computers and fax machines.

## DATA COLLECTION AND COMPILATION

The fishery production data of China includes total output of fishery production, production output of marine catch, production areas of marine culture, production output of marine culture, production output of freshwater catch, production areas of freshwater culture, and production output of freshwater culture. In some cases, differences in the data occur, and this is due to varied statistical interpretations and the standards used.

### Marine Capture Fishery

Data in this sector includes catch from China's various sea regions, such as the Bohai Sea, Yellow Sea, East China Sea, South China Sea, and other minor seas. Marine catch is expressed in tons and grouped by major fishing gear and by species. The major fishing gear are trawl, seine, flow gill (for coastal operations), stationary fishery, longline, and others. The major species caught are: fish such as G.Y. croaker, Y. croaker, hairtail, clupedy, Spanish mackerel, pomfrets, sea bream, mackerel, trevally, anchovy, sardine, Pacific herring, eel, grouper, pike, goldtail fish, and scaper; shrimps and crabs; shellfish including inkfish; sea weeds; and others including jelly fish.

Marine fishery data also includes the number of motorized fishing boats by unit and by power, number of non-motorized fishing boats, number of fishermen, and number of fishermen in state-owned enterprises.

### Inland Capture Fishery

Inland catch data are expressed in tons and includes major species, such as fish, shrimps, crabs, shellfish, and others. Inland fishery data includes number of motorized fishing boats by units and power, number of non-motorized fishing boats, number of fishermen, and number of fishermen in state-owned enterprises.



## Aquaculture

Data for marine aquaculture includes total production of fish, shrimps, crabs, shells, and seaweeds; total area for fish, shrimps, crabs, shells, and seaweeds; and production of seeds including scallop fingerling, abalone fingerling, kelp seedlings, and laver seedlings. Data also includes total workers in state-owned marine aquaculture.

Production from freshwater fish culture, expressed in tons, includes such species as black carp, grass carp, silver carp, common carp, Crucian carp, Chinese bream, Tilapia, and crabs. Data also includes culture area and fingerling production of freshwater fish, such as total area of ponds and lake area used for aquaculture, as well as number of workers in state-owned culture farms. The "Small-scale Fishery," a non-state ownership fishery, comprises collective cooperations or individual fishery.

## FISHERY SURVEY

Investigations were undertaken on the status of marine catch, marine shellfish, and pond culture, in 1991 and 1992. Data collected for marine catch includes number of boats, by unit and by power; average number of fishermen; catch production, in tons; sale of products, in tons; income from sales; production cost; and expenses such as taxes and others. Data collected for marine shellfish culture includes number of households, average number of fishermen, culture area, culture production, sale of products, income from sales, production cost, and expenses such as taxes and others.

Data collected for pond culture includes number of households, average number of fishermen, culture area, culture production, sale of products, income from sales, production cost, and expenses such as taxes and others. In addition to these data, the amount of Chinese aquatic products exported by China is also monitored by quantity, in tons as well as by value in U.S. dollars.

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## FISHERY STATISTICS OF INDIA

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### INTRODUCTION

The fishery sector occupies a very important place in the socio-economic development of India. It has been recognized as a powerful income and employment generator, as it stimulates the growth of a number of subsidiary industries and is a source of cheap and nutritious food besides being a foreign exchange earner. Most importantly, it is the livelihood of a large section of the economically backward populace of the country.

According to quick estimates made by the Department of Statistics, the contribution of the fishery sector to the net domestic product of the country at current prices increased from Rs. 14,780 million in 1984-85 to Rs. 43,670 million in 1991-92, a three-fold increase over the period.

The pre-eminence of fisheries in the country's economy leads to the establishment of a sound and reliable data base for this sector, which was considered imperative in order to systematically plan its integrated development, make potential use of the resources, fix targets of production and productivity, and decide on the priorities of action.

The need to strengthen the database on fisheries was re-emphasized by the Working Group for the formulation of the Fourth Five-Year Plan on Agricultural Statistics (1965), Data Improvement Committee (1969), and the National Commission on Agriculture (1976). On the basis of the recommendations made by these committees, efforts were made by the Government of India to streamline and strengthen the database of the fishery sector.

#### DATA COLLECTION AND COMPILATION

The overall coordination for the collection, compilation, and dissemination of data on fisheries in the country is undertaken by the Planning and Statistics Unit, Fisheries Division of the Department of Agriculture and Cooperation, Ministry of Agriculture.

Other ministries and departments of the government dealing with the various aspects of fisheries also collect and compile statistics pertaining to their requirements. Thus, the Ministry of Food Processing Industries collects and compiles statistics regarding fish and marine products, processing units, and other relevant information regarding fish processing. The Ministry of Commerce collects information on exports of marine products and their value by species and ports. Similarly, organizations such as the Marine Products Export Development Authority (MPEDA) under the Ministry of Commerce, and the National Cooperative Development Corporation under the Department of Agriculture and Cooperation, collect and compile data on exports of marine products and fishery cooperatives in the country, respectively.

The Central Statistical Organization in the Ministry of Planning conducts economic census, which includes detailed information on activities such as fishing, its nature of operation as well as fishery enterprises. The National Sample Survey Organization, on the other hand, conducts a consumer expenditure survey which includes data on household expenditure for fish and consumption of fish at regular intervals.

At present, "Fishery Census" is not being conducted as a single operation by any agency in the country. However, data on important inventory items such as fishing vessels, fishermen, number of fishing establishments, among others are collected by various departments of the government and other organizations by complete enumeration. This effort is

coordinated by the Planning and Statistics Unit in the Department of Agriculture and Cooperation. There is however, a problem in this system as the data on all items are not available for the same period of time. Some statistics are collected decennially, some quinquennially and yet other information are collected on an annual basis.

All the 25 states and seven union territories (UTs) of the country have their own statistical units in the Fisheries Departments of the local governments or administrations, which look after the collection, compilation, analysis, and dissemination of fishery statistics with respect to their states or UTs. Much of the information pertaining to the resources, production, disposition and other aspects of fisheries for their states are periodically (generally annually) compiled by these units and furnished to the Planning and Statistics Unit at the central office. The state units also conduct statistical surveys on fishery resources as well as marine and inland production of fish. The production data are compiled on a quarterly basis.

Besides the statistical units at the Headquarters and states, the Central Fisheries Research Institutes (CFRI) under the Indian Council for Agricultural Research (ICAR), namely, the Central Marine Fisheries Research Institute (CMFRI), the Central Inland Capture Fisheries Research Institute (CICFRI), the Central Institute of Fishery Technology, the Central Institute of Freshwater Aquaculture, among others, have their own statistical units for collection and interpretation of statistical data on fisheries. The Planning and Statistics Unit at the central office also collects all relevant data from these institutes.

There are five technical officials engaged in designing and compiling fishery statistics in the Planning and Statistics Unit at the central office. In the states and UTs, a total of about 150 persons are involved in fishery statistical work.

### **Fishery Census**

Since fishery census is not conducted in the country as a separate and comprehensive activity, data on different inventory items such as fishing establishments, fishermen are collected by various organizations at different time intervals.

Data on different types of fishing vessels classified according to length, weight and power, number of full-time, part-time and occasional fishermen are collected and compiled by the state governments annually.

Detailed information on fishing activities, such as nature of operation, number of enterprises, ownership of enterprises by social groups, employment by sex, use of power are collected through the Economic Census conducted by the Central Statistical Organization (CSO). These are tabulated at different levels of aggregation of industrial categories as well as geographical areas by states and UTs. The data collected for fishing are related to the following sub-activities at the village or enumeration block level: ocean, sea, and coastal fishing; inland water fishing; pisciculture or rearing of fish; collection of pearls, conches, shells, sponge, and other sea products; and fishing and allied activities not elsewhere classified. However, an Economic Census is carried out once in ten years. Results are now available for the 1980 census, while the results of the next census which was conducted in 1990 are still being processed.

Data on fish processing establishments are collected and compiled through the annual survey of the industry by CSO.

All the above data, available from various sources, are collected by the Planning and Statistics Unit in the Department of Agriculture and Cooperation.

Data on the fishery resources are collected and compiled by the states every year. The area of continental shelf, number of landing centers, and number of villages are compiled by the state governments and are updated every year.

Similarly, data on inland fishery resources are collected by the state governments. However, in order to assess the vast inland resources of the states on a scientific basis, the Department of Agriculture and Cooperation has been conducting a sample survey under the Central Sector Scheme. Sixteen states, out of the total 25 throughout the country, are being involved in this survey at present, while resources are being assessed in 76 districts out of the total of about 450 districts in the country. It is envisaged that all districts would be covered under the scheme in due course.



Total fish production is divided into two categories, marine classified into coastal marine and deep sea, and inland classified into aquaculture and capture fisheries.

#### DATA PROCESSING

In order to achieve high efficiency and precision in the compilation and dissemination of fishery statistics, the use of computers was initiated by the Planning and Statistics Unit of the Fisheries Division. In the computerization of fishery data, a local area network (LAN) system provided by the National Informatics Centre (NIC) of the Planning Commission of the Government of India, is being used.

The entire processing of the "Handbook of Fishery Statistics" has been computerized using the LAN system. Documentation at all Parliament matters relating to the different aspects of fisheries has also been done through the user-interactive software, such as the Parliament Question Management Information System. Apart from the database management system approach, Spread Sheet packages have also been used to organize physical and financial data on time series basis. This is aimed at expediting the process of transferring information stored in the titles. Database management module approach is proposed to be used in combination with the Spread Sheet system for the computer-based processing of data.

NIC has recently launched a DISNIC-Plan on a pilot basis for the computerization of district-wise data. The Plan has been prepared for one of the districts of Maharashtra State. This contains village-wise details in respect to fisheries, viz., number of tanks used for fishing, number of fishermen families, fish seed production centers, fish seed availability centers, among others. It is envisaged to gradually extend the coverage of this work to all districts of the country. More information with respect to fisheries would be collected using this Plan.

#### FISHERY STATISTICS

The estimated production from coastal marine sector are compiled through a sample survey in all the maritime states. The design for this survey was developed by CMFRI and all the maritime states have been following this sample design in order to estimate production. In some states and UTs,



where there are only a limited number of vessels or boats, complete enumeration method is adopted in compiling the fish production. The states have been submitting quarterly production estimates to the Planning and Statistics Unit in the Department of Agriculture and Cooperation. The data on the number of fishing boats by area, the number of fishing units by type of fishing gear, catch by species (culture) are supplied by the state governments annually through the above-mentioned surveys.

### **Deep Sea Fishery**

The data on catch and effort with respect to deep sea fishing vessels are collected based on complete enumeration, i.e., obtaining data on pro-forma or "log sheet" distributed to the operators of state vessels or boats. In the case of government-owned vessels, data are obtained through the concerned organizations and institutes. However, the deep sea fishing operators were not reporting their data to the government in the past years. Efforts are now being made to persuade the deep sea fishing industry to furnish the government with data on fish landed. Therefore, in the absence of the data, estimates have been made on the average catch per boat and the number of boats in operation. The catch from deep sea fishing has been computed to be about 60,000 tons in 1992-93.

### **Inland Fishery**

On the other hand, production from the inland sector constitutes catch from freshwater aquaculture and inland capture fishery. In order to develop a methodology for estimating the production from the inland fishery sector, CICFRI formulated a design for a sample survey aimed at estimating fish production from all inland sources. The methodology in terms of tanks and ponds, is being implemented in 16 states utilizing certain selected districts. The survey is proposed to cover all the districts in due time. The methodology for other resources, such as, rivers and canals, reservoirs, lakes, floodplain lakes, estuaries, and brackishwater impoundments is still being test-checked. Thus, at present, production of fish from the inland fishery sector is only estimated without using any scientific method.

Production estimates at present by various states, are carried out on the basis of base-level annual productivities, worked out for various resources. The incremental productivity levels from year to year are due to the addition of inputs such as seeds, fertilizers, among others. The base-levels were worked out on the basis of various studies made by the National Commission on Agriculture, the Indian Institute of Management and many more. The data on fish production, estimated by states, are being furnished by the states and are being furnished to the Planning and Statistics Unit every three months, while the production from this sector for the country as a whole, is compiled also on this basis.

### **Aquaculture**

Mariculture in India is still at an experimental stage and few states, i.e., Tamil Nadu, have been doing some work in this regard. However, no regular detailed statistics have been collected on mariculture, as yet.

In addition to the data on coastal marine fisheries, data with respect to brackishwater culture are being collected from the Brackishwater Fish Farmers' Development Agencies (BFDAs), set up by the government under a centrally-sponsored scheme. An area of 11,500 ha is covered by the BFDAs, out of a total potential area of 1.412 million ha of brackishwater. Data regarding the number of establishments, area cultured, number of persons employed, and the quantity harvested are collected and compiled by the Statistics Unit.

About 0.36 million ha of ponds and tanks employ intensive fish culture under the management of the Fish Farmers' Development Agencies (FFDAs), operating in various states. Compared to the potential area of 2.212 million ha of tanks and ponds, FFDA water bodies of 0.36 million ha are monitored by the states and the Fisheries Division at the Headquarters, periodically. The data with respect to the state-wise area, catch by species, and other related data, are collected in detail for this area under FFDAs.

### **Fish Trade**

Import and export statistics of fishery products are being compiled by MPEDA. The data are available according to species, ports of exit, as well as quantity and value.

Efforts are recently made to collect the prices of certain types of fish at selected marketing centers in various states. Some states have positively responded to these efforts and the trade data are being collected and compiled for these centers. However, the data from all the states have not been reported in a systematic manner. The states and other field organizations are continuously urged to furnish such data to the Headquarters.

#### **Infrastructure Statistics**

The Statistics Unit at the Fisheries Division collects and compiles data on major and minor fishery harbors, fish landing centers and other relevant information, from time to time. Data on infrastructures and facilities such as number and capacity of freezing, canning, ice-making and fish meal plants, cold storage, and others are maintained by MPEDA. These data are available by state.

#### **Other Statistics**

The National Sample Survey Organization (NSSO) conducts large-scale sample surveys on employment, unemployment and consumer expenditure in the country. The data on consumer expenditure on fish and the quantity consumed per household in various states of the country as well as the statistics on self-employment and wage paid employment in fisheries, are also from these sample surveys. However, these surveys are conducted quinquennially and therefore, the above data are available with a five to seven years gap. The data from the last survey are available for the year 1987-88 and the survey for 1993-94 is still in progress.

The NSSO have also agreed to prepare tables on quantity and value of fish, dried or fresh, consumed per capita together with the number of households reporting on the consumption of fish for the years 1987-88 and 1993-94.

#### **Publications**

The fishery statistics on various items at different levels of aggregation, collected from various sources described above, are compiled and presented in useful tables by the Planning and Statistics Unit of the Fisheries Division. A "Handbook on Fisheries Statistics" containing all the data is prepared and released every year. However,

due to the non-availability of data on time from the states and other sources, the release of the handbook is sometimes delayed. It is endeavored to reduce the time lapse between the release of the two yearbooks to one and one half years only.

Statistical supplements updating the data available in the handbooks are also issued from time to time. On the other hand, all data required by the FAO Annual Questionnaire are collected from various sources indicated above. The data are supplied to FAO every year following the prescribed schedule of submission.

#### DISPOSITION OF CATCH

Data on disposition of fish catch are compiled according to such categories as: marketing fresh, frozen, cured, canned, reduced, miscellaneous purposes, and offal reduction. Data are collected and compiled by the state governments and furnished to the Fisheries Division at the Headquarters.

#### FISHERY SURVEY

Sample surveys are being conducted to estimate the (a) production of fish from the marine sector as well as inland fishery resources in the country, by state, (b) production of fish from different inland fishery resources such as lakes and ponds, rivers and canals, reservoirs, and others, and (c) consumer expenditure and consumption of fish per household.

#### Marine Resources

Marine fish landing takes place all along the coastline in all seasons, day and night. Since total coverage is not possible, a suitable sampling design was formulated to cover the entire coastal length for the whole year. The design used is multi-stage random sampling, stratification being over space and time. The stages for the selection of the sampling units are the fish landing centers, days within a month, and fishing vessels or craft. The days on which the survey is to be conducted are also selected randomly in a month. The survey is conducted consecutively for two days in each center adopting both enquiry and observation methods, using the following scheme: first day, between

12:00 noon to 6:00 pm, by observation; and second day, between 6:00 am to 12:00 noon, by observation with intermediary period of 12 hours between two days, i.e., 6:00 pm to 6:00 am by oral enquiry.

On a fixed time observation, the landings of the first ten fishing vessels are taken completely. When the fishing vessels exceed ten in number, additional sampling units are selected using the following scheme: every second unit in the next ten, up to 20; every fifth vessel up to the 50th; and every tenth vessel thereafter.

Night catches between the first and second days are ascertained by contracting fishermen and knowledgeable local persons at the landing centers. Estimates of marine landings for each block every month is obtained by the formula:  $(wt \times N \times D)/n$ , where wt is the total weight of fish calculated from all vessels observed during the day and night catches; N is the total number of landing centers in the block; D is the number of days in a month; and n is the total number of blocks.

The estimates arrived at, for each block are then used to calculate the catch for each district and later for the states for each month and finally, the annual estimate of marine landings is calculated for the state. The same sampling design is followed by all maritime states with minor changes that suit their respective local conditions.

### Inland Resources

Each state is divided into three zones or strata based on fish culture practices, rainfall, temperature, soil conditions, and other geographical parameters. A sample of three districts from high rainfall stratum, sample of two districts from moderate rainfall stratum, and one district from low rainfall stratum are selected.

The sampling frame of all the selected districts is prepared by enlisting all the villages of each district. The sampling frame prepared for each district is divided into three strata in such a way that the number of villages in each stratum is nearly equal. Geographical and administrative convenience is kept in mind, while identifying the strata. From each stratum within a district, six villages, which are known as key villages, are selected at random from the list of villages. A random sample of four villages surrounding each of the key villages



are then selected. In this way, a sample of six clusters of five villages each in a stratum, are selected. A cluster of villages will constitute the first stage unit and the ponds within the cluster as the second stage unit. Selected villages are surveyed completely and all water units in the villages are enumerated by physical observation for estimating the average area under water units.

After completing the above information, a random sub-sample of five water bodies are selected from each cluster for observing fish catch from the sub-sample of water units. Moreover, sampling in time may also be adopted so that each water unit is visited at least once in a month for recording the catch more accurately and for providing the estimates of the monthly catch. This sample will be used for the estimation of catch of fish from this class of resources.

#### **Expenditure and Consumption of Fish**

The data on quantity and value of fish consumed per household are collected through a large-scale sample survey carried out quinquennially by NSSO. The main subject of this survey is "Employment and Unemployment and Consumer Expenditure" which covers a broad spectrum of items of employment, unemployment and consumer expenditure on a number of items including fish. The sampling design adopted is a stratified two-stage sampling. The first stage units are the villages in rural areas and urban blocks in the urban areas, while the second stage units are the households. The sample villages are selected by probability proportional to population, and with replacement in the form of two independent inter-penetrating samples. The sample households in the second stage, taking two from each first stage units, are selected by systematic selection with a random start. The survey period of one year is divided into four sub-rounds each of three months duration, coinciding with the four agricultural seasons. The sample units are equally distributed over the four sub-rounds to provide valid estimates for each of the sub-round period. The averages based on the pooled data for all the four sub-rounds would be free from the impact of seasonability. The data required are collected from the sample households and the totals are estimated by suitable estimation procedure. The previous survey on the subject was conducted in 1987-88 and the next one is being carried out at present with 1993-94 as the reference period.



## PROBLEMS AND CONSTRAINTS

There are a number of gaps in the compilation of fishery statistics in India which hinder the development of an effective statistical system.

### Inland Resources

Data on inland fishery resources and the production therefrom are not accurate. Although the design of the survey for this data collection has been finalized, this is not being implemented in all states with respect to all inland resources. The Department of Agriculture and Cooperation is encouraging all concerned to implement the scheme expeditiously so that the data from inland fisheries for the whole country would be complete.

### Deep Sea Fishery

Production data from deep sea fishery has not been worked out in a more scientific way. Efforts are being made to improve the collection of deep sea statistics in consultation with the Ministry of Food Processing Industries, the deep sea fishing operators, and others concerned.

### Data Reporting

At present, there is a time lag in the reporting of fishery data from the state governments and other organizations. The time lapse between the period reported and the annual reporting should be minimized. This is being imposed to all agencies concerned so that reporting of fishery statistics could be done with a minimum time lag.

### Data Collection and Compilation

The Statistics Unit has prescribed certain pro-formae for reporting periodical data by the state governments and other organizations. However, many items on fishery statistics are being collected on an *ad hoc* basis. a regular system prescribing the standard pro-formae, indicating the items, due dates of submission, and other requirements, should be developed so that the collection and compilation of these statistics would be systematic.

### **Data Processing**

Computers which are being used at present for the compilation of fishery statistics in the Planning and Statistics Unit, are not adequate. In order that all available data are collected, compiled and disseminated in a systematic way, the computer system facilities available should be expanded. This is proposed to be done in consultation with NIC and other concerned organizations.

### **Statistical Units**

The technical staff dealing with statistics may not be sufficient both at the Headquarters and in the states, especially when all the improvements indicated above are implemented. The staff at the Statistical Units should be suitably strengthened to effectively collect, compile, analyze, and release the data on various items of fishery statistics to various organizations including FAO.

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## FISHERY STATISTICS OF JAPAN

by

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### INTRODUCTION

After 1949, fishery census in Japan has been conducted every five years, to generally clarify the existing situation and variation of basic conditions concerning fishery production such as the production and employment structures of the fishery sector in Japan, fishery-related facilities, and fishing area environment. The census also provides basic data for purposes of administration measures.

The "Ninth Fishery Census" was conducted by the Ministry of Agriculture, Forestry and Fisheries (MAFF) starting on 1 November 1993. This fishery census consisted of three types of surveys, namely, basic survey on marine fisheries, fishery management units and employed fishery households; survey on inland water fisheries, fishery management units concerned with inland water fisheries and inland fishery cooperatives; and survey on fishery districts, general conditions of fishery districts, fishery management organizations, the distribution system of fishery products, freezing, refrigerating plants and fishery product processing plants.

The basic survey on marine fisheries and survey on inland water fisheries are conducted by MAFF through the prefectural governments, municipal governments including cities, wards, towns or villages. The survey on fishery districts is also conducted by MAFF, through the regional offices of the MAFF Statistics and Information Office branches.

#### DATA COLLECTION AND COMPILATION

##### Fishery Census

For the basic survey on marine fisheries, the data collected are area including total area by sea region, by prefecture, and by fishery district.

For fishery management units: type of fishery, type of fishing vessels, number of fishermen, number of fishery working days, amount of catch sold, and area of marine culture.

For the household management units: number of household members, workers engaged during the past year, and number of working days by types of fishery work.

For the employed fishery households: number of household members, workers engaged during the past year, and number of working days by types of fishery work.

For the survey on inland fisheries: area indicating total, by prefecture, by city, by ward, by town or by village.

For the inland water culture management units: type of culture, species, number of workers, number of fishery working days, amount of catch sold.

For the inland water culture households: number of household members, number of workers engaged during the past year, number of working days by type of fishery work.

For inland water fishery cooperative associations: number of members, species cultured by the members, business activities such as seed-releasing, and number of people engaged in recreation fishing.

For the survey on fishery districts: area indicating total by sea region, by prefecture and by fishery district.

For the fishery district surveys: circumstances, environment around the fishing grounds, seed releasing operations, number of people engaged in recreation fishing, fishing port facilities, and dockyard.

For the fishery management organizations: fishery resources, fishery grounds, and amount of catch sold.

For the distribution system of fishery products: facilities and fish market transactions, management organizations, number of employees, wholesalers and purchasers.

For data on refrigeration and cold storage factories: the type of users, number of employees, and their capacities.

For data on fishery products processing factories: number of employees, operations per day, types of processing, and amount of products sold.

#### DATA PROCESSING

The staff at the branch offices conduct the surveys. Results are reported on-line to the MAFF Statistics and Information Office branch offices. After checking the reported survey results, the Statistics and Information Office branch offices prepare the total and estimate the figures for the area under their jurisdiction. The results are sent on-line to the Regional Office, where these are checked, from which the summary of the survey results for the block area are prepared and sent also on-line to the MAFF Headquarters.

Majority of the data that have been collected are finally totalled and analyzed using the computers at the MAFF Headquarters. The results are published, thus, providing important data for the Ministry's administration and activities.

#### FISHERY STATISTICS

##### Marine Capture Fishery

The data collected are number of fishing boats by area, indicating the total, by sea region and by prefecture, also by size of vessels, whether non-powered, or with outboard

engine, or powered which is grouped into less than 1 GT, 1-3, 3-5, 5-10, 10-20, 20-30, 30-50, 50-100, 200-500, 500-1000, 1000-3000, and more than 3000 GT; number of fishermen by area indicating total, by sea region and by prefecture, by sex and age which is grouped into 15-39 years old, 40-59, and over 60, and also number of fishermen engaged by type of fishery work, whether they are engaged in their own fishery activity or hired by others, also grouped by age; the number of fishing units by type of fishing gear, indicating scale of fishing vessels, and total area covered by sea region and by prefecture; catch by species indicating the type of gear used, and total by sea region and by prefecture; and catch by fishing gear and by species. The amount of catch is calculated by multiplying quantity by average price by species or by type of fishing gear.

#### Inland Capture Fishery

The number of fishing boats by area and number of fishermen by area which are available every five years indicating total by prefecture, city, ward, town or village; the number of fishing units by area which is not covered by the fishery surveys; catch by species indicating total area of major species by prefecture, or by major rivers and lakes; and catch by fishing gear and by species for designated specific rivers and lakes, are collected.

#### Aquaculture

Data are collected for major species of shellfishes, seaweeds, marine fish, and seed production. For each species, data on the number of establishments, area cultured or number of cages, number of persons engaged regularly, and quantity harvested, are collected. For each major species the total area by sea region and by prefecture are also collected.

For salmons, tilapia, sweet fish, carps, and eel, the data collected includes the number of establishments, area cultured, number of persons engaged, and quantity harvested, indicating total area by prefecture.

The Brackishwater Fish Culture is not included in the fishery surveys.



### Price Statistics

The data collected are prices at fish markets in landing ports, and prices at central wholesale market in consuming areas. The monthly average prices are available for fresh, frozen and salted fishery products of 102 commodities by national average in 42 landing ports and 88 commodities by national average in 10 large cities.

### Economic Statistics

Data collected are for enterprise fisheries and fishery households of individual management. For fishing unit of enterprise fisheries, data includes size of management; fishery enterprise economy indicating fishery profit, business profit, net profit after tax, assets and debts; and operation by fishing vessels, number of workers, and number of fishing days, which are available by national total. For each of the items, data are available for size of management, tonnage of vessels grouped into 10-30 GT, 30-50, 50-100, 100-200, 200-500, over 500 GT, and set nets. Data by type of management is also available.

For the fishery household of individual management, data collected are fishery household economy, indicating fishery income, business income, disposable income after tax, living expenditures, assets and debts; and operation indicating fishing vessels, number of household members and number of fishing days. The inland water fisheries and inland water culture under this category are not included in the fishery surveys.

These data are available by area indicating total area by sea region. Data by size of management, indicating tonnage of vessels grouped according to 1 GT, 1-3, 3-5, and 5-10, and small set net of 10 GT, are also available.

### Publications

Four types of annual reports on fisheries are published, namely, (a) Annual Statistics on Movement in Fishery Structure, from the surveys on production structure items, (b) Statistics on Fisheries and Water Culture Production, from the surveys on fishery production, (c) Report on Fishery Economy, from the surveys on fishery economy items, and (d) Annual Statistics on Marketing of

Fishery Products, from the surveys on marketing items such as prices, processed products and disposition. The time lapse before releasing these statistics is usually twelve to fifteen months.

#### DISPOSITION OF CATCH

Shipment quantity of fresh and frozen fishery products of 19 commodities are available at 33 landing ports. Data are available by type of utilization for fresh food, fish paste, canned, other processing food, fish oil, feed or fertilizer, fishery baits, and culture baits. Data are also recorded by destination indicating home prefecture fish market and others.

#### Fishery Products

Fishery products of 107 commodities are classified into 12 classes: dried, salted-dried, boiled-dried, smoked and dried, salted, cured fishes, fish paste, frozen, other products, fish oil, feed or fertilizer, and frozen stocks.

Commodity classifications of fishery products are based on the "Harmonized Commodity Description and Coding System" or the so-called HS-TREATY.

#### FISHERY SURVEY

Except the following two, fishery surveys are generally conducted making use of the enumeration units. However, the Survey of Fishery Economy makes use of sampling survey. The population is derived from the Census and a two-stage stratified sampling is employed, where the primary sampling units are the fishery districts, while the secondary sampling units are the fishery management units. On the other hand, the Survey on Fish Prices and Disposition is done by purposive selection.

#### PROBLEMS AND CONSTRAINTS

There is a need to review the classification of type of fishing gear and of species in view of the changes in the fishing methods or catch fish resources as previously designated.

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## FISHERY STATISTICS OF LAOS

by

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### INTRODUCTION

The main fishery resources of Laos are the River Mekong and its tributaries, lakes, reservoirs, innumerable ponds, banded rice fields and swamps. These resources are not well-managed and many are not utilized for lack of adequate funds, technical manpower, fishery infrastructure, efficient communication, processing and preservation facilities, and marketing avenues for both domestic and export markets.

Among the reservoirs, the Nam Ngum hydro-electric reservoir occupies about 37,000 ha. The other small resources are the Nam Souang, Nam Houm, Nam Tan, Selabam, Nam Dong, and Nam Moun which occupy about 20,000 ha. Nam Ngum's productivity which was about 50 kg/ha in 1975, was estimated to have declined to about 20 kg/ha in 1988. The production of Nam Ngum and other reservoirs was estimated to be over 1600 t in 1983 and which also declined to 1140 t in 1988. Further decline was reported in 1991. However, the exact statistical reports on fish production are not available, hence only estimates are reported based on information, either written or verbal, received from government authorities and farmers, respectively. It seems

that there was an evidence of increased aquaculture activities in ponds and rice fields, but a decline of the catch per unit effort was reported for the fishery of the River Mekong by about 20%.

The decline in this fishery seriously affected the people who depend on this resource for their livelihood and has aroused national concern. The causes of the decline were reported to include over fishing and lack of technically sound fingerling stocking program aimed at replenishing the depleting stocks. Such constraint warrants the implementation of a proper resource conservation policy. The national government has attempted to regulate the fishing operations at the River Mekong, but no technical program is operational to stabilize the fishery and to check the declining trend.

#### FISHERY DEVELOPMENT PROGRAM

With the new liberal policy of the national government, such as the privatization in land ownership and trade, a sound development of the valuable aquatic resources of the country is foreseen. Benefits from the latest but simple field technologies are expected to reach the poor population in the remote villages. Along this direction, the country has received valuable international assistance through the United Nations Development Programme (UNDP), the Food and Agriculture Organization (FAO), the Interim Mekong Committee, the International Development Research Centre (IDRC) of Canada, as well as from bilateral cooperations and non-government organizations (NGOs). The contributions from the external sources have brought about a new awakening among the people and the government, whose keen interest is now visible in the development and exploitation of the fishery resources. At present, the fishery sector development is being supported by UNDP through FAO for a four-year project on fish culture extension which would primarily take care of developing target progressive farmers and demonstration fish ponds and farms at the village level in ten provinces out of the 17 provinces in the country. Another project is being funded by IDRC for research on indigenous commercial species with regard to their propagation, culture, conservation, which was operational from 1990 and likely to continue up to June 1994 (Phase I).

The previous projects funded by UNDP and executed by FAO from 1979 to 1989, laid a firm foundation for aquaculture development in six provinces, which involved the upgrading of existing fish farms and training of manpower at various levels, from the extension workers to the farmers. The present UNDP/FAO project is a follow-up assistance on aquaculture extension development in the country.

The capture fishery development is confined mainly to the Nam Ngum Reservoir, the largest man-made hydro-electric reservoir. The development of commercial fish farms at Tha Ngone, Vientiane Prefecture and the initial assistance to Nong Teng fish farm by the Interim Mekong Committee, have also made some notable contributions to the country's fishery development. However, the past and present international support were, as expected, specific in their areas of operation and the government still finds several areas as gaps in fishery development strategy which need urgent international and bilateral support.

#### FISH STATISTICS

Only unpublished data are available on the estimate of fish and aquaculture production. Total production data for aquaculture production includes pond fish culture (intensive), pond fish culture (extensive), irrigated rice fields, rain-fed rice fields, swamps, reservoirs such as Nam Ngum and others, and rivers such as Mekong and its tributaries. Data from capture fishery may also be available but these too are not published.

#### PROBLEMS AND CONSTRAINTS

The non-availability of published data on fish production strongly suggests the need for a proper fishery statistical data collection system for the country. The acute dearth of funds and trained manpower have seriously affected this important activity. Collaborating agencies or donor organizations are therefore requested to look into the possibility of assisting the country in setting up a fishery data collection system through direct funding and manpower training.



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## FISHERY STATISTICAL SYSTEM IN MALAYSIA

by

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### INTRODUCTION

The main organization responsible for the collection, compilation, processing and reporting of fishery statistics in Malaysia is the Department of Fisheries, Ministry of Agriculture. The other statistical aspect dealing with trade data on fish and fishery products is the responsibility of the Department of Statistics Malaysia.

At the Headquarters of the Department of Fisheries in Kuala Lumpur, 12 staff and five computer personnel are involved in the compilation and processing of fishery statistical data. At the ground level consisting of 65 fishery districts, a total of 62 field staff, 32 in Peninsular Malaysia, 15 in Sarawak and 15 in Sabah, are responsible for the collection and compilation of statistical data. On the other hand, in the aquaculture sector, a total of 102 part-time field staff are involved in the collection and compilation of aquaculture production statistics also at the ground level. Generally, the marine fishery staff are involved full-time while the aquaculture staff are involved part-time only in statistical data collection. The aquaculture staff have other extension duties to perform aside from collecting statistics.



## DATA COLLECTION AND COMPILATION

### Fishery Census

In Malaysia, fishery census is not carried out. However, a Population Census which is a major national census, is being carried out once in ten years by the Department of Statistics. In the National Population Census, certain items pertaining to fisheries, fishing population and fishery establishments are included. Data on these items are extracted from the National Census for planning purposes by the Department of Fisheries. Moreover, data projections are done in order to obtain reliable statistics for the intervening years between each National Census.

The Department of Fisheries is responsible for the collection, compilation and reporting of fishery statistics which involves four aspects, namely: marine capture fishery, aquaculture, inland and public water body fishery, and fishery trade data. These statistics are published annually in the Fisheries Statistical Report.

### Marine Capture Fishery

The Department of Fisheries collects, compiles and reports data pertaining to capture fishery, such as (a) number of fishermen working on licensed boats by ethnic race, gear group, state, and district, (b) number of licensed fishing vessels by state, horsepower, gear group, type and tonnage class, and district, (c) number of licensed fishing gears in operation by state and fishery district, (d) catch data of marine fish by state, gear group, month, and species, (e) fishing efforts and catch data of trawls and purse seine by tonnage class and species, (f) fishing efforts, including number of fishing days and hauls by gear group and state, (g) prices of fresh fish by monthly average, e.g., vessels, wholesale, retail, (h) value of marine fish landings, wholesale and retail by grade and gear group, (i) disposition of marine fish landing and processed marine fish products, and (j) ice factories and refrigerated facilities.

### **Inland Capture Fishery**

Data from inland fishery and public water body fishery are merely estimates depending on the availability of time of the ground staff who collect the statistics. The staff rely mainly on interview of some inland fishermen involved in fishing while they are on extension visits. The data collected from inland water bodies such as lakes, rivers, inland water impoundments, includes catch data by species and months, wholesale and retail prices of fish, and wholesale and retail value of fish.

### **Aquaculture**

Statistics on aquaculture are also collected, compiled, processed, and reported by the Department of Fisheries. Aquaculture is divided into freshwater aquaculture and marine/brackishwater aquaculture. Statistics on aquaculture are further divided by aquaculture systems, namely, pond culture, cage culture, disused mining pools culture, and concrete tanks culture. In each culture system, the data collected and compiled are (a) estimated number and area of ponds, disused mining pools, cages, and tanks, (b) number of fish culturists by culture system, (c) estimated production of fish by species, state and district, (d) wholesale, retail and ex-farm prices of fish, (e) estimated wholesale, retail and ex-farm value of fish by species, (f) production of fingerlings of fish/prawn from government and private hatcheries, (g) distribution of fish/prawn fry for public water body stocking and culturists, and (h) production and value of ornamental fish.

### **Fish Trade**

Import and export of fish and fishery products are collected by the Department of Customs at the various exit points throughout the country. The Customs Act requires all importers and exporters of goods including fish and fishery products to fill in the Customs declaration forms. The forms are channeled to the Department of Statistics where these are compiled and processed using computers. The trade data on fish and fishery products are then extracted by the Department of Fisheries for publication. These data include quantity, value and types of import and export of fish and fishery commodities, and import and export of fish and fishery commodities by country of origin and destination, using international standard classification.

## FISHERY STATISTICS

### Marine Capture Fishery

The methodology employed in collecting statistics for commercial fishery and traditional fishery are basically similar. Commercial fishery in Malaysia refers to trawling and fish purse seining, while the latter refer to other fishery, such as drift nets, hook and line, and traps. There is another relevant classification, i.e., off-shore fishery which are confined specifically to trawling and fish purse seining in waters beyond 12 miles from the baseline to the outer limit of Malaysia's Exclusive Economic Zone (EEZ).

There are basically two types of data gathering, one by observation and the other by enquiry. Sixty-three field enumerators are stationed in the fishing districts in all states in Malaysia. Each state have between two to eight enumerators. Their main duty is to collect marine fishery landings from local vessels. The data from landings of Malaysian fishing vessels in foreign countries, however, can not be compiled. The working manuals, prepared for the field enumerators, contain a list of fishing gear, catch sample, catch estimates for the state, fish price sample, landing value estimates, and fishing effort data.

The work schedule of the field enumerators are drawn up very clearly, as follows:

- a) The last three weeks of each month are involved in field survey, i.e., 18 working days. The field work includes visit to the main landing places, fishing complexes, offices, houses, and market places. While on field trips, the enumerators who are Fisheries Assistants, obtain sample from observations and through enquiries. The observation method is employed on trawlers and fish purse seine landings. Enquiries are normally conducted for the sample data on traditional fisheries. The field work also involves collection and verification of the Log Book filled in by off-shore vessels. Each numerator covers a sample of about 10-12 by observation and 15-20 by enquiry, each day. Thus, on the average each month, a total of some 250 samples can be covered by each enumerator. This procedure has proved to be workable and reasonable for full-time enumerators.

- b) On the first week of each month, the district enumerators work at the State office to process, compile and perform computer entry data work in order to get the monthly total for the State. The computer application system at each state has been established in order to minimize error, achieve standardization and save time. The State staff are given intensive training by the Headquarters in computer data entry and processing. The state data are sent in the form of diskettes, to the Headquarters in Kuala Lumpur.
- c) At the Headquarters, ten personnel are involved in the processing, compiling, computing, data entry, tabulation and documentation of fishery statistics. The monthly total from the states are computed to get the national aggregate using computer application system developed for the purpose. The on-line system implemented has reduced the processing time and thus, gain advantage in the final form for earlier publication and distribution of the Fishery Statistics Report.

The important components in the collection and processing of catch data includes:

- a) Gear Listing - the district determines the number of population, i.e., the number of gear in operation per month. This is obtained through investigation and enquiry in order to update the master list. Changes may occur due to seasonality or repair work lay off. The population sample is then coordinated by the State in order to get the total for the State. The State then distributes the sample size proportionately between the districts and between the gear groups.
- b) The sample size is stratified by gear groups. Trawlers and fish purse seines, are further stratified into tonnage groups, i.e., 0 - 9.9 GT, 10 - 24.9, 25 - 39.9, 40 - 69.9, over 70 GT.
- c) The total number of samples for each gear in each state are determined at 35 to 75 units, depending on the total population of the gear in operation. The computation follows:

## First step after listing

Number of gear in operation	Number of samples for 0 - 100 units	Additional samples	Total Samples
100	35	0	35 (min)
150	35	5	40
200	35	10	45
400	35	30	65
500 and above	35	40	75 (max)

## Second step, by gear group

Districts	Number of gear in operation	Total Sample
A	350	44
B	200	25
C	50	6
Total	600	75

## Off-Shore Fishery

The Log Book system was introduced in the country in January 1989, for the complete enumeration of off-shore vessels. Complete enumeration is still possible since the number of vessels are still relatively small. The operators are imposed by regulation to fill in the Log Book accurately and submit this to the Department of Fisheries on a monthly basis. Thorough briefing sessions on how to fill in the Log Book were given to the boat owners and skippers. The Log Book serves not only as a source of catch data but also as a monitoring and assessment mechanism of the performance of the off-shore vessels in Malaysia.

The Log Book contains the following information: Section A - boat registration number, tonnage of boat, type of engine and horse power, type of gear, fishing base, name of owner, equipment; and Section B - per trip, includes dates of departure and return from sea to the base, supplies of inputs - volume and value, number of crew, number of hauls, marketing - major species, volume, price and value by destination (local and overseas), and landing details for every haul - species and volume.



### **Inland Capture Fishery**

The methodology employed in data collection for the inland fishery is similar to that of aquaculture. In Malaysia, inland fishery refers to the fishing activities from public water bodies, i.e., rivers, lakes, disused mining pools, and reservoirs. It is acknowledged that data gathering from inland fishery is very difficult due to several factors which include scattered localities, minimal activities and remote water bodies. It is found out that the coverage is not as wide as it is intended to be.

### **Aquaculture**

Aquaculture in Malaysia is defined as an activity of aquatic organisms including fish, molluscs, crustaceans, and aquatic plants. Aquaculture means intervention in the process of growing for the purpose of increasing productivity such as stocking, feeding and protection from predators. Aquaculture also means selection of stocks by individuals or corporations.

The types of aquaculture covered in the surveys are freshwater pond culture, freshwater cage culture, freshwater disused mining pool culture, freshwater concrete tanks culture, brackishwater pond culture, brackishwater cage culture, and cockle, mussels, oysters, and milkfish culture.

Data collected for every type of culture includes number and area of ponds and cages, number and ethnic distribution of culturists, production of freshwater and brackishwater fish and prawn, wholesale or retail and ex-farm price of fish and prawn, wholesale or retail and ex-farm form value of production, and production by species, months, and states.

Prior to 1993, complete enumeration of all fish farms were carried out by some 105 part-time enumerators. The data are collected at the district level by field enumerators or Extension Fisheries Assistants. The data are then transmitted to the state office for checking and to the Headquarters for compilation.

Data obtained by complete enumeration however, are found to be inaccurate and hence, the process is a waste of resources. Complete enumeration carried out in 1993, is described as follows:



- a) An inventory of fish ponds and farms is carried out once a year to determine the number of area under culture, their size, type and number of culturists. The inventory is updated every month during the monthly extension visits of the enumerators.
- b) A 10% sample farms are selected for each culture system, with the minimum of 10 and maximum of 35 farms a month. The field enumerators visit the sampled farm during the month and record the fish production by species for the month.
- c) Ex-farm prices, retail and wholesale prices by species are obtained on a monthly basis from farmers and major markets in the district. The average prices by species, district and state are calculated.
- d) Production of fish by culture system is aggregated at the state level and then transmitted to the Headquarters level for the national aggregate.

#### Economic Survey

Cost and Earning Surveys for fishery enterprises are carried out monthly, since 1987. A sample size of three trips for each gear is collected from every state every month. The total sample for the State is processed and analyzed in order to present the national analysis. The information required includes (a) gear used - main and supplementary, (b) quantity and value of landing - by composition, either fish, prawn, cuttlefish, and trash fish, (c) cost of operation per trip, (d) maintenance costs and other costs; capital costs, (e) share system; number of workers, and (f) details of the vessels.

Analysis on the economic performance of the main fisheries are published from time to time. These include the commercial fisheries, i.e., trawlers and purse seining, traditional fisheries, and off-shore fishery.

Interview is done through enquiry and heavy reliance is placed on the information given to the enumerators. In some cases, especially the commercial fisheries and off-shore fisheries, owners allow the field staff to obtain data directly from their books of account. The extent of cooperation relies heavily on the understanding and rapport on the ground, while some others have chosen to be

conservative and not cooperative in their reporting due to obvious reasons like fear of income tax payment and bank loan repayment despite assurances of secrecy by the Department of Fisheries.

The depreciation of fishing assets is computed on a straight-line basis. The life span of the assets is computed as follows: hull of wooden vessel - 15 years; hull of non-powered boat - 10 years; inboard engine - 10 years; outboard engine - 5 years; nets (3 sets) - 5 years; refrigerated seawater system - 10 years; radio communication sets - 7 years; and winch - 10 years.

The standard forms used in various stages of data collection at the state level includes listing of the number of fishing gear in operation; sample - fish landing and fishing efforts; and total sample at state level. Finally, computation and tabulation of the catch data are done at the state level.

#### DATA PROCESSING

Data from marine capture fishery, aquaculture, and inland fishery are processed using personal computers (PCs) which are installed in all states and at the Headquarters. The field enumerators go to the State office to input their data into the PCs. Diskettes are used to transmit the data from the State to the Headquarters for final compilation and computation.

The Department of Fisheries, through a bilateral agreement with the Government of Canada, embarked on a project called the Monitoring Control and Surveillance in Fishery Resource (MCS) project. The project which will take three years, was started in 1992. Under the project, a national network linking the PCs in the districts and state fishery offices to the Headquarters will be developed by Canadian experts. Since marine and aquaculture data are among the priority areas to be implemented, these statistics will be on-line to the Headquarters in due time and up-to-date data can already be obtained from the field in the shortest time possible.

### PROBLEMS AND CONSTRAINTS

The problems are mainly administrative in nature. Some field staff do only part-time work in collecting fishery statistics as they have other non-statistical duties to perform. As a result, they are unable to collect and send their data on time. There is also a need to constantly upgrade the skills of the staff. Meetings and workshops should be constantly carried out at the Headquarters in order to keep the staff updated on their skills.

Fishery statistics for Sabah which is collected by the Department of Fisheries Sabah, constitutes a constraint as a different system of statistical collection is employed. However, Sabah is now in the process of changing its method of collection and computerization with the help of the Headquarters.

Aquaculture data from Sarawak is collected by the Department of Agriculture in Sarawak. As such, the collection, computation and processing of aquaculture data in Sarawak is constantly delayed. The data are collected by part-time staff and are sent to the Headquarters once a year.

The import and export of fish and fishery commodities are collected and computed by the Department of Statistics from the Customs declaration forms. Due to the work load of the Department of Customs, the publication of the Fishery Statistics Report is often times delayed. In order to overcome this problem, the Department of Fisheries publishes the Annual Fisheries Statistics so that fishery statistical data could be available for the users.

The Department of Fisheries also caters to the requirements of the Southeast Asian Fisheries Development Center (SEAFDEC) and the Food and Agriculture Organization (FAO) statistical publications. Presently, the national data has to be manually converted into the requirements of SEAFDEC and those of FAO. This always takes up a great deal of time for the staff of the Department of Fisheries. These agencies, in conjunction with the national body, should work out a system in data processing using the computers, whereby the national data can be converted to the requirements of the agencies using PCs.

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## FISHERY STATISTICS OF MALDIVES

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### INTRODUCTION

Maldives consist of 1190 islands of which 202 are inhabited. On all but a few of these islands, the major occupation is fishing. The islands are scattered over an area of roughly 750 km from north to south and 120 km from east to west in the Indian Ocean. Fishing is the main traditional occupation of the people. Reports in 1990 indicated that about 20% of the national labor force of 51,200 are engaged in fisheries with 11,500 active fishers.

Most fish caught are small surface-swimming tunas taken by live bait pole and line fishing. This is carried out from locally-built vessel called "masdhoni." Mechanization of these vessels, 8 - 12 m long, started in 1974. The small vessels, 5 - 7 m long, known as "vadhu dhonies" or trawling boats are also engaged in various types of fishing. Masdhonies usually leave their islands before dawn, spend a couple of hours catching bait and then proceed to the fishing grounds outside the atolls, returning to their islands by mid or late afternoon.

Fishery statistics data have been collected and compiled without any break in the Maldives for at least 30 years. The type of data varied from time to time and the details have also changed in the light of the changing conditions and the requirements of the fishery sector. The

Ministry of Fisheries and Agriculture (MOFA), formerly the Ministry of Home Affairs, started collecting catch and effort data in 1959. It required island chiefs from each of the 202 inhabited islands to record the total number of tuna caught by each masdhoni each day. The catch is counted at the end of each day's fishing by the boat owner for purposes of a catch-sharing system which had been established since time immemorial. Starting in 1974, catch by mechanized masdhonies were separately recorded. This system of total enumeration has proved to be workable. Records from each island are submitted to the MOFA through the atoll office on a monthly basis.

#### DATA COLLECTION AND COMPILATION

The present system of analyzing fish catch and effort data is based on total enumeration and had been satisfactory. The island office collects the catch data recorded in a daily form for each vessel. At the end of each month, the total catch is transferred to a monthly report form and are sent to the Economic Planning and Coordination Section (EPCS) of MOFA through the atoll office. On the other hand, landings in Male', the capital island, are reported by each vessel directly to EPCS in a daily form. To verify the reported catch, an inspector from EPCS also record the landings at Male' Market. At MOFA, the data are compiled according to atoll, type of gear, type of fishing boat and species. The catch, reported in terms of number of fish, is converted into volumes by applying a pre-determined conversion factor shown in Table 1. In addition to fish catch statistics, the island offices also collect monthly fish reports, lobster catch and turtle catch.

Table 1. Conversion factor for transforming catch into volume

Species	Ave. weight per fish (kg)
large skipjack	5.70
small skipjack	2.10
yellowfin	2.60
little tuna	0.60
dog-tooth tuna	6.00
reef fish (group 1: shark, wahoo, etc.)	20.00
reef fish (group 2: jack, rainbow runner, etc.)	1.10
reef fish (group 3: horse mackerel, scad, etc.)	0.15



Average weight of fresh fish required to produce 1 kg of fish product:

Maldive fish	5.00
Salted dried fish	3.00
Canned fish	3.00

Source: Ministry of Fisheries and Agriculture

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Other information published in the statistical year book are collected from the relevant department and compiled by EPCS. Information booklets are published quarterly, biannually and annually as provisional statistics. Five-year statistics are published on a permanent basis. The information in the annual statistical booklet includes number of fishermen, number of registered vessels, average number of fishing vessels engaged in fishing, fishing trips by vessel type, boats mechanized on credit and boats with completed bond period, fish catch by month, fish catch by atolls, fish catch by type of vessel and species, fish catch by fishing methods, fish catch by vessel type and locality, conversion factor used, export of marine products, export value by country, fish production and exports, fresh fish purchased, commercial prices of oil, commercial prices of fish, turtle report, and lobster catch.

Fishery catch and effort data collection, analysis and publication are the responsibility of EPCS. In addition, EPCS is also responsible in collecting, processing and analyzing fishery and agriculture statistics for the purpose of planning and assessing levels of development; collecting, processing and analyzing fishery and agricultural socioeconomic data; the publication of statistical and socioeconomic information of agriculture and fisheries; maintaining a database of statistics and socioeconomic information on agriculture and fisheries; conducting economic analysis on resource data and undertake analysis for purposes of policy formulation, strategic planning and project evaluation; monitoring tuna producer prices in relation to world market prices for frozen, canned and traditionally produced tuna, and fresh tuna production costs; and monitoring and evaluation of agriculture and fishery products.

EPCS has a total of 22 staff, 11 of whom are involved in the compilation and analysis of fishery statistics. In addition, six field officers are employed and are based in the atolls.



The task of the Statistics and Database Unit of EPCS includes (a) collecting, processing and analyzing fishery and agricultural statistics, (b) preparing computer programs and database required for the section, and (c) preparing annual, biannual and quarterly agriculture and fishery statistics summaries.

#### DATA PROCESSING

Fish catch data were collected and analyzed manually from 1959 until the first Apple computer which was introduced in 1985 under a project of the Bay of Bengal Programme, strengthened the capability of the statistics section. From 1985 to 1987, fishery statistics were processed using the Apple computer. IBM compatible computers (PCs) were introduced in late 1987 and at present EPCS has four PCs in operation. The existing system makes use of the software DBase III+ since 1988 and uses a mixture of manual and electronic processing. In terms of existing system goals, these methods work well and is hoped to continue to perform adequately perhaps for some time.

The present system, known as Fishery Record System, has three components. The components deal with the monthly report form 1 containing fish catch and effort data, monthly report form 2 indicating the number of fishermen and registered vessels and the export data which contains the monthly customs report. Each of the components uses very similar programs and methods of processing. Each month the data are entered, as and when received and then moved to a monthly data file. The input data file is the only file that can be changed within the system. The monthly data files are used to produce interim report and tables which usually satisfy the *ad hoc* needs of users as well as enquiries.

Under the Third Fisheries Project, EPCS receives assistance to strengthen the fishery statistical system. The existing system was reviewed and a new database system using the software FOXPRO is now being developed. In the existing system, the monthly report form are summarized manually before inputting the data. The new system, on the other hand, is designed to avoid duplication of work. Data entry is done using vessel information straight from the monthly report received from the island.

## FISHERY STATISTICS

### Data Collection Forms

Daily catch report form for the island office consists of one form per fishing vessel per month. After each day's trip, the skipper reports information on his fishing operation to the island office and use such information to fill in the daily report form. At the end of each month, the island office prepares the total from the individual forms, transfers this to the monthly report form, and forwards the report to the atoll office. This form is very detailed and has the potential to provide much information on the composition of catch. The fishermen are fairly consistent in reporting their trips since boats are required to fish 120 days per year in order to satisfy the fishing vessel registration requirements. However, certain amount of "nil" reporting also exists. Some boat owners only try to satisfy trip requirements without giving much effort in recording the fish catch.

The monthly report forms are filled in using a separate sheet for each type of vessel. This form includes a box to tick on how the large skipjack, which is above 2 kg or above 5 kg per fish, is categorized. The categories are sometimes filled in roughly differing from one atoll to another. The "large" or "small" distinctions for skipjack and yellowfin rely on the skipper's judgment. Although this procedure may be good, it is not as precise as the distinction used by the Collector Vessel purchases where fish are weighed.

The monthly report form 2 is also filled in by the island office. This form summarizes the number of fishermen as well as the number of fishing vessels by type owned by the island residents. The second section of the form is designed to record the quantity of various processed fish and other marine products exported from the island during the month. The third section of the form records the miscellaneous catch by different gear.

One possible weakness in the report is "the export from the island" section which is, on most occasion, never completed and as a result any detail which are supplied are not analyzed. Miscellaneous catch are also not reported as consistently as the mechanized dhoni trips.

The Male' fish catch report form is completed by the fishermen for each fishing trip. The forms are submitted to EPCS every two weeks.

The lobster report is filled in by the atoll office each month. It records the number of lobsters caught in each of the three categories. These categories are not recorded separately and there is some doubt whether the officers filling in the forms know the details of the forms. The earnings may not be completely compatible with the number of lobsters caught.

The turtle report form is filled in by the atoll office each month. It records separately Hawks Bill turtles and other turtles. The data are collected by the island offices.

The daily weather and fish catch report is collected by contacting the atoll office through telephone. Details on weather, number and type of fishing vessels, number and fish species caught are reported together with report on the three islands with highest catch. The details are summarized and forwarded to the National Radio Station, Voice of Maldives which broadcast the information throughout the country. This information also provides aggregate data on the location of the best fishing areas. There is however one weakness on this as the data are likely to be very approximate based on general observation rather than on detailed recording.

Fish price statistics are not covered in the country. The present fish pricing system which operates outside the market has been discarded. A pricing formula was recently established mimicking the market conditions. Fish price statistics are collected from Male' market on a daily basis by an inspector. Compared to fish prices in other parts of the country, the price of fish at Male' market is fairly high and fluctuates depending on the catch.

Fishery economics data are not collected on a regular basis. However, some surveys have been conducted on an *ad hoc* basis. Based on the information from these surveys, the cost and earnings of vessels are calculated. The newly formed Economics Unit collects and analyzes economic data relating to fisheries on a regular basis.

#### Other Statistics

Bait fish information are collected by the field officers stationed in different atolls. Required information are collected from one dhoni each day and are used by the Marine Research Section (MRS) for research

purposes to determine seasonal availability and regional variation of the bait fish used in pole and line fishery.

The length frequency measurements are also recorded by the field officers for research purposes mainly to determine the migration patterns of the tuna stock and to provide the conversion factor for EPCS. The sample is taken three days in a week by the field officers stationed in the atolls and by the field staff of MRS four days a week at the Male' market.

Data on purchase of fresh fish are collected by the Maldives Industrial Fisheries Company (MIFCO) through collector vessels and the Felivaru Canning Factory. Data on these are compiled by MIFCO, however, EPCS receives the summarized form on daily, weekly and monthly basis. These information are used as inputs for the publication of the statistical booklet by EPCS.

Statistics on export of marine products are collected by the Customs Department and reported to EPCS monthly. From the report, information on quantity and value of the marine products are also used in the statistical booklet published by EPCS.

#### DISPOSITION OF CATCH

In 1992, tunas accounted for 90% of the total landings of which skipjack is the dominant species followed by yellowfin and frigate mackerel. Mechanized pole and line vessels account for the most catch of fish.

The local fishermen sell their catch to collector vessels in fresh form, otherwise when the collectors are not available, fish are landed on the beach. Local traders buy the surplus catch to be salted and dried or processed into dried fish. In 1992, 54% of the fish landed, excluding those used for home consumption, was purchased by MIFCO while the remaining 46% by the private sector. The private sector has been successfully competing with MIFCO in the purchase of fresh fish. It is anticipated that if MIFCO does not change their pricing policy, it will end up as the buyer of last resort.

Export accounts for 63% of the total fish production in 1992, of which 11% is exported as fresh frozen fish, 44% as canned fish, 14% as salted fish, and 31% as dried skipjack. Local consumption and stock is 44% of the total catch.

### PROBLEMS AND CONSTRAINTS

Although the system of data collection in Maldives has been adapted to the fishery, the requirement has not been fully met by available statistics. One large source of error in the statistical system originates from the conversion factors used in transforming the number of fish into weight. The conversion factors, although reviewed periodically, are however suspected to have some extrapolation errors. The conversion factors are used throughout the country irrespective of seasonal variation.

Some fishermen tend to estimate while others underestimate their fish catch. They provide information on their fishing trips just to comply with the legal requirement of 120 days a year fishing. On the other hand, the volume of reef fish landings are grossly unreported since most of the catch around Male' atoll are sold directly by the fishermen to tourist resorts and hotels without proper recording. Similarly, the reef fish caught in the tourists resorts as sport fishery are not accounted for.

Newly developing fishery such as the "beche-de-mer" and shark fishery are not fully accounted for mainly because the present statistical system is geared towards the tuna stock. Major review of the statistical system is therefore required.

A major fishery census has not been attempted in the past. In order to obtain a clear understanding of the fleet size, number of fishing units, cost and earnings of fishing vessels, it is important to initiate a fishing census in the near future.

Major constraints in developing the statistical system include shortage of trained and experienced manpower. EPCS, for example, which is the oldest section at the Ministry, has only one graduate indicating that not much emphasis has been given to long-term training. The middle management staff though experienced, find it difficult to undertake certain tasks without much direction and control due to inadequate academic background. In order to obtain maximum benefits, emphasis should be given to train the senior as well as the junior staff.



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## FISHERY STATISTICS OF NEPAL

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### INTRODUCTION

The fishery sector's contribution to the economy of Nepal has been attributed to fish, being the supplementary source of high-valued animal protein at a comparatively cheaper cost. The fishery sector has also the potentials for increased job opportunities and it also leads to the rational exploitation and utilization of land and water resource.

The fishery development program in Nepal started systematically in early 1960s but the dramatic increase in fishery activities was observed in the 1980s only. The fishery development program makes use of water resources which are mainly the small annual and big perennial rivers. The glaciers and snow melts of the Himalayas, constantly supply water to the three main river systems of the country. The total water surface area of the country is 4000 sq km and the natural water bodies comprising rivers, lakes, reservoirs constitute about 0.4 million ha. There are about 5000 ha of village ponds and about 325,000 ha of irrigated paddy fields.

Ten warm water and cold water fish species and one freshwater prawn species were introduced in Nepal since 1956. There are other 176 indigenous fish species in the country. The exotic fish species are the common carps (*Cyprinus carpio*), silver carp (*Hypophthalmichthys molitrix*), bighead carp (*Aristichthys nobilis*), grass carp (*Ctenopharyngodon idella*) along with three high value indigenous major carps rohu (*Labeo rohita*), mrigal (*Cirrhina mrigala*) and catla (*Catla catla*). Exotic species like rainbow trout (*Onchorhynchus mykise*), tilapia (*Oreochromis*



*niloticus*), common carp (*Cyprinus carpio*) and puntius (*Puntius gonionotus*) are being cultured on an experimental basis by the different fisheries development research centers of the country.

The fiscal year of Nepal is from 16 July to 15 July of the following year. At the end of the fiscal year, the annual fishery statistics is collected from all sectors of agriculture.

#### DATA COLLECTION AND COMPILATION

Compilation and publication of the annual statistics usually takes five to six months so that by the end of December or January, statistical data are already available for the users. Nepal is a land-locked country and therefore, there is no marine nor brackishwater fisheries. The main survey items covered by the census which takes place every ten years include number of pond holdings, area of the ponds, number of holdings of paddy fields with fish culture, number of fishing units by area, catch by species in quantity and value, catch by type of fishing gear, by species, and by quantity.

The main organizations responsible for the collection and compilation of fishery statistics before 1989 were the Central Bureau of Statistics (CBS), Department of the Development of Food and Agricultural Marketing Service (DFAMS) and the Department of Agricultural Development, Fisheries Development Division (FDD). DFAMS was dissolved in July 1992 and the Agriculture Statistics Division (ASD) was formed under the Ministry of Agriculture. About ninety per cent of the staff of DFAMS are now working at CBS which is responsible for the compilation of fishery statistics.

Agricultural statistics units were established by ASD in 52 districts with due consideration for maximum economy and efficiency in field operations and are operating under the administrative and financial supervision of the FDD and DFAMS. They are also fully responsible for organizing, directing and supervising over all current agricultural statistics activities in the districts in accordance with the instructions of ASD.

The staff members of the agricultural statistics units in each of the 41 cadastrally surveyed district (CSD) consisted of one technical assistant, a junior technical assistant and a number of "Mukhiya" or non-gazetted third

class. Additional "Kharidar" or non-gazetted second class are employed in districts having 50 or more village development committees or village blocks. In non-cadastral districts (NCSD), the staff of the agricultural statistical units generally consisted of one Kharidar and two more Mukhiyas.

In order to assist the Agricultural Development Officer in carrying out the agricultural statistics activities, the Technical Assistant in CSD is stationed at the Agricultural Development Office.

At present, there is a Chief Statistician at ASD, three second class statisticians and one assistant staff working under him. The statisticians are supported by six Junior technicians. ASD is responsible in analyzing and compiling previous data for incorporation in the present statistical report.

In 1983, a baseline survey on fishpond operation and self-employment in the fishery was conducted by ASD with the help of the Food and Agriculture Organization (FAO). It was only during 1983-84 that ASD started collecting and compiling fishery statistics.

In the organizational structure of CBS, there are two main divisions under the Director General, the Social Statistics Division and the Economic Statistics Division. There are 33 district offices which are commissioned to collect and compile statistical data of the whole country.

Under the Social Statistics Division, there are six sections, namely, Population Census Section, Social Statistics Section, Data Processing Section, Household Survey Methodology Development and Sample Design Section, Training Section, and Section on Publication, Dissemination, Cartography, and Library.

The Economic Statistics Division has also six sections, namely, National Account and Other Economic Account Section, Establishment Census and Survey Section, Price and Index Section, Agriculture Census Section, Crop Statistics Survey Section, and Livestock, Fisheries, Horticulture Survey Section.

There are 660 staff working at CBS and 494 staff including 33 officers in the district offices. On the other hand, 106 staff are working in the different sections of the Central Office at Kathmandu. CBS takes census every ten

years for the whole country. In the census, about 2000 temporary staff are recruited for the census on agriculture while about 25,000 to 30,000 temporary staff are recruited for the population census.

The census of fishery includes number of ponds, number of holdings, total area in hectare, number of holdings in paddy fish culture, and number of holdings anywhere.

#### DATA PROCESSING

Computers are not available for the compilation of fishery statistics at the Regional Directorates, district Agriculture Development Offices and service centers. However, at the ASD, DAD, PDD and the Aquaculture Development Project Offices as well as at CBS, computers are used for data processing.

#### FISHERY STATISTICS

Under the Department of Agriculture Development (DAD) are five Regional Directorates and 25 District Agriculture Development Directorates. In the 21 potential districts of the country, a Fisheries Extension Officer is responsible for the extension of fisheries in the district. Each district is divided into seven service centers and few sub-service centers, where Junior Technicians work under the Fisheries Extension Officer. The service centers collect and compile yearly fishery statistics of their area. These are submitted to the District Agriculture Development Office which in turn sends the fishery statistics to the Regional Directorates. There, the data are compiled and forwarded to DAD which collects and compiles the fishery statistics of the country. These data have been considered more accurate than those collected by the other organizations of the country. The fishery statistics consist of total area of ponds, water surface area of ponds, stocking density of fingerlings, number of fish farmers, number of nurseries and hatcheries and their production of fry and fingerlings, and estimated annual fish production.

#### Aquaculture

There are 12 government farms in the country. In addition, there are 26 private hatcheries which produce fish seeds. About 51 million of fingerlings are produced in the

country, of which 39 million are produced by the private sector. The total water surface area of ponds used for fish culture was 4664 ha in 1991-92 (Source: FDD). The estimated number of farmers involved in fishery activities was 175,500, the number of families 34,550, while the number of direct beneficiaries was 207,000 (Source: FDD). The total fish production in the country in 1991-92 from freshwater fish culture was 11,235 mt and another 5281 mt from natural waters (Source: FDD).

### **Fish Prices**

There is variation in the price of fish due to several factors, such as season, location of sale, size, species of fish, and inflow of fish from neighboring India. In general, a continuous rising trend has been observed in the retail price over time. However, on the average, the real price of fish at the retail level for the same period appears to be fairly stable. This indicates that the rise in nominal price may be basically due to inflation. The annual increment of fish price during the past ten years has remained at the range of 5 to 21 per cent.

### **Fishery Products**

In Nepal, fish are generally sold fresh. There is no canning industry for fishery products although in remote hilly areas of the country, fish is smoked and sold in big markets. Small-sized fish are generally sun-dried before these are sold in the markets.

### **DISPOSITION OF CATCH**

Marketing of fish starts immediately after harvesting from the ponds. Farmers who have access to roads or live near the markets sell the fish by themselves. Otherwise, fish are sold to traditional fishermen traders called "Mallahas."

Fish is usually sold fresh and in round or whole form. Thus, post-harvesting of fish by the traders include grading, packing, transporting, and selling only. Storing of fish is done at the collection centers for a few hours only and are dispatched immediately to the terminal markets. At the terminal markets, unsold fish are stored for a day or two, using ice for preserving the fish.

When there is a need to transport fish to a distant market, it is packed in ice and kept in bamboo baskets with banana leaves and other big leaves covering the whole lot of fish. The capacity of the baskets are generally from 40 kg to 150 kg. For short distances, fish is put in earthen or metal containers. Fish, especially in the rural areas, is transported by bicycles or by bus service if available. Wholesalers and exporters prefer to transport the fish to distant markets in night buses.

### FISHERY SURVEY

The methodology adopted by ASD is purposive sampling for the districts and random sampling for the fish pond operators within the selected districts. Specifically, the methodology adopted follows:

- a) The complete list of fish pond operators and area under fish culture are obtained from the agriculture profile of the Agriculture Development Office of each selected district
- b) Twenty per cent of the fish pond operators are randomly selected for each survey district having less than or equal to 100 fish pond operators
- c) Ten per cent of the total fish pond operators are randomly selected for the survey in districts with more than 100 fish pond operators
- d) Data on number of ponds, area, water surface area, production, harvesting period are collected by interviewing the fish pond operators, employing enumerators in each sample district for the survey.

Recently, CBS has taken over the responsibility of collecting and compiling the fishery statistics. At present, the methodology to be adopted by CBS is not yet known.

### Fish Marketing Survey

The major fish producing areas in Nepal are the Lerai districts but the flow of fresh fish is towards the population centers with good communication facilities. So the survey is carried out in the centers and also in



"periodic" markets or "Haat Bazaars." The market survey is done four times in one year in order to study the seasonal trade. The traders in each market, whether permanent or periodic, are sampled using the following scheme:

If a market has less than ten retailers selling fish, all of them are enumerated.

If a market has more than ten retailers selling fish, the actual number of traders are counted. The total is divided by 10 to arrive at a figure which could be used as interval between the first trader interviewed and the next to be interviewed. The first trader to be interviewed is selected randomly from the total number of traders operating in a market.

#### **Fish Consumption Survey**

Fish produced in the lerai is partly consumed in and around the production areas and the rest is transported to other markets and districts. Taking this into account, the number of districts in the lerai and hills are selected.

One urban, if available, and one rural settlement are selected from the chosen districts for the purpose of the consumption survey. Road accessibility or nearness to a road head is considered in the selection process. From each of these selected settlement, one or two wards are chosen randomly. Using systematic sampling technique, 30 households are selected from each of the wards. The households are enumerated using the structured household survey questionnaires.

The fish consumption surveys are conducted in three seasons, i.e., summer, rainy and winter over a period of one year in the same districts and in the same areas previously surveyed. This way, changes if there is any, in the fish consumption behavior during the study period could be properly traced.

#### **PROBLEMS AND CONSTRAINTS**

The technicians of the Agriculture Development Offices are the appropriate channel in the districts to collect fishery statistics. However, the technicians are oftentimes occupied with technical problems in the field, so they can



not spare sufficient time for the collection of data. Therefore, statistical units must be organized in the districts in order to collect various data from the districts.

CBS takes a census of the country once every ten years only. However, fishery statistics must be made available to the central and district agriculture offices for planning and evaluation every year. Although fishery statistics are available, these may not be complete and accurate due to lack of manpower and budget. Therefore, adequate manpower should be provided to CBS in order to collect and compile fishery statistics as well as other agricultural sector statistics throughout the year.

#### RECOMMENDATIONS

A national coordinator for information and statistics should be assigned in every country in Asia. The coordinators should then meet regularly to exchange information and statistics of the region, and other problems related to statistics. Technical cooperation should also be promoted among the Asian countries regarding institutional development of information and statistics in each country.

In Nepal, there is a good potential for development of fisheries. Job opportunities can be provided to the rural masses through this sector while serving as a good source of income for the farmers. The area under fish culture is expanding every year in the country. Lack of communication facilities, budget and manpower hinders the flow of information and collection of fishery statistics in Nepal. Planning and evaluation of the fishery sector has become difficult due to lack of adequate fishery information and statistics. The system of collecting and compiling fishery statistics should therefore be improved. Technical cooperation should also be promoted among the Asian countries to help solve the problems encountered by each country, especially Nepal.

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## PHILIPPINE FISHERY STATISTICS

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### INTRODUCTION

The government agency responsible for conducting fishery census and in compiling import and export statistics on fishery products in the Philippines is the National Statistics Office (NSO). Fishery census is conducted in the country every ten years, the last of which was done in 1991 as part of the Census of Agriculture and Fisheries (CAF). The data generated were (a) types of fishing activity, like gathering of fish, crustaceans, molluscs, and other aquatic products, (b) fishing boats used, gross tonnage, fishing gear used, and (c) aquafarms such as fishponds, fishpens, fish cages, oyster farms, mussel farms, and seaweed farms.

All municipalities were covered in the 1991 CAF, however, only 50% of the barangays were enumerated due to budgetary constraints. On the other hand, a separate census of fishing establishments was conducted in 1992.

Until 1988, fishery statistics were generated by the Philippine Bureau of Fisheries and Aquatic Resources (BFAR). After 1988, the Bureau of Agricultural Statistics (BAS) was mandated to do the collection, compilation, analysis, and dissemination of statistics, not only for crops, livestock,

or poultry, but also for fisheries. As a result, seven personnel of the former Fishery Statistics Section of BFAR were transferred to BAS but the budget for fishery data collection was not transferred. In 1988, an actual fishery survey was conducted by BFAR but the data processing and analysis were delegated to BAS. Although BAS was able to do the newly assigned task, the activity was completed much later.

## DATA COLLECTION AND COMPILATION

### Marine Capture Fishery

Data to be collected includes number of fishing boats and fishermen by area, number of fishing units by fishing gear, catch by species in quantity and value, and catch by fishing gear and by species, quantity only.

### Inland Capture Fishery

Data collected are number of fishing boats, number of fishermen, number of fishing units by area, catches by species in quantity and values, and catch by fishing gear by species, quantity only.

### Aquaculture

Data are classified into shellfish, seaweeds, and marine fish, and are grouped according to species cultured. For major species cultured, the data includes number of establishments for the fishery industry only, area cultured, number of persons engaged on a regular basis, and quantity harvested.

Only the quantity harvested is reported on such major commodities as milkfish, shrimps, sea bass, grouper, carps, catfishes, prawns. The data also includes hatchery production of shrimps and production from tilapia hatcheries.

### Fish Price

Fish price data are for selected species only and includes retail and wholesale prices. This is the only item that is reported weekly, while the foregoing statistics are reported annually.

### Economic Statistics

This includes data on cost and earnings from enterprise fisheries as well as income and expenditures from small-scale fisheries. Data from the former are reported occasionally while data for the latter are considered only in special studies.

### Trade Statistics

Quantity and value for import as well as for export of fish and fishery products are reported on a monthly basis.

### DATA PROCESSING

Six units of computers (PCs) with three units printers are being used by the Fishery Statistics Section for processing, summarizing and compiling fishery data. Computerized processing of data is also being piloted in selected five provinces in the country in order to eliminate manual summarization at the provincial level.

### FISHERY STATISTICS

Results of the commercial and municipal fishery as well as the aquaculture surveys are disseminated mainly in print through statistical handbooks, bulletins and other reports. Final estimates of the annual fishery statistics are available six to nine months after the reference year while advance quarterly estimates are available three to four months after the reference quarter. The following publications are generated on fishery statistics: Quarterly Production Performance of the Fishery Sector - presents a comparative performance of the current production compared with that of the previous year, on commercial and municipal fishery, and aquaculture sectors, at the national and regional levels, and also presents the prices of selected major fish species; Fishery Situation and Outlook Report - provides comprehensive trend and outlook analyses of production, prices, and export and import situation of specific fishery species of major economic importance using time series data; Handbook on Selected Fishery Statistics - a yearly publication containing a yearly and a ten-year series data on production, prices, export and import, and other relevant fishery information generated by BAS and

other agencies; and Quarterly Production Performance of FSP Priority Bays - provides a situation analyses on the municipal fishery sector production of the country's 12 FSP priority bays.

Fish catch data generated by BAS are available yearly while Census data generated by NSO are available every ten years. Due to budgetary constraints, data on number of fishing boats and fishermen by area, and number of fishing units by fishing gear for both marine and inland capture fishery are not yet available. The 1992 data on the number of fishing establishments is however, available.

#### FISHERY SURVEY

The 1989 fishery survey was confined to only 54 commercial fish landing centers due to budget limitations while the design was good only at arriving at regional and national estimates. On the other hand, estimates for the municipal fisheries and aquaculture were based on time series models and on indicators obtained from few selected and knowledgeable key informants in these sectors.

Starting in 1990, the Fishery Sector Program (FSP) of the Department of Agriculture (DA) was implemented, a sub-component of which is the National Fisheries Information System (NFIS). It is tasked to generate more accurate and reliable fishery statistics from the commercial, municipal, and aquaculture sectors. However, the budget for NFIS could only finance the surveys for 75 commercial fish landing centers and 354 municipal fishing landing centers in the 12 priority bays of PSP. The estimates, therefore, for other provinces are based on indicators given by key informants and on trends. Likewise, estimates for aquaculture are also based on key informants in 19 provinces.

Under NFIS, 83 contractual statisticians were hired, 65 of whom are assigned in the field offices to collect survey returns, supervise data collectors, and process the survey data into monthly summaries before these are submitted to the Central Office. The rest of the statisticians are assigned at the Central Office to assist in reviewing the summary sheets, data processing and computerization, and data analysis. These contractual staff are supervised by the nine permanent staff of the Fishery Statistics Section. The head of the section and assistant head, are responsible for the preparation of the work and financial plan, supervision of all activities assisted by the other permanent staff of



the section, and documentation and analysis. Moreover, about 880 enumerators and 60 data processors are hired by FSP to collect data every other day for the commercial and municipal fishery surveys and assist in the processing of the data. Seventy-two Provincial Agricultural Statistics Officers (PASOs) supervise the field data collection and summarization while ten regular staff at the Central Office review, validate and analyze the results.

At the field office, one enumerator is hired to collect fish catch loaded every other day in each sample landing center. Contractual data enumerators are being supervised by the contractual NFIS statisticians and regular PASOs. The infusion of more funds into FSP in 1991, enabled the updating and validation of frames for commercial and municipal fisheries, and brackishwater fishponds. However, for the actual survey of commercial fishing, the same survey design was adopted which was good only at coming up with regional and national level estimates.

With bigger FSP budget in 1992, the survey design was improved in order to generate provincial level estimates. The number of landing centers covered was increased from 75 to 138 for the commercial fishery survey and from 354 to 719 landing centers for the municipal fishery survey. The conduct of a quarterly survey on brackishwater fishponds covering 2,500 operators, was also started during that year. Moreover, updating and validation of frames for other aquafarms and inland fishing were done.

In 1993, the budget for NFIS was increased again not only to finance the conduct of commercial and municipal fisheries, and brackishwater fishpond surveys but also for the conduct of surveys for other aquafarms that include freshwater fishponds, fishpens, fish cages, oyster farms, mussel farms, and seaweed farms, as well as municipal inland surveys.

#### **Commercial and Municipal Fishery Surveys**

The Commercial and Municipal Fish Landing Center Surveys are geared towards the collection, compilation and analysis of statistics on commercial and municipal fishing. Specifically, the survey intends to gather data on fish catch by fishing gear type, species, fishing ground, landing center, by province and region, and gather data on fish prices by species, landing center, by province and region.



The Commercial and Municipal Fishery Surveys cover 48 provinces and Metro Manila, and 61 provinces, respectively. For these surveys, the frequency of data collection is every other day during a 24-hour monitoring period.

Data collection for these surveys are done through actual interviews using structured questionnaires, of all fishing boat operators unloading fish and also from actual observation during peak unloading time. Inquiry from knowledgeable persons stationed at the landing centers, is also made for transactions that transpire before and after peak unloading hours.

#### *Sampling Design for Commercial Fishery Survey*

The domain of the study is the province. The sampling design involves sampling over space and time. In sampling over space, the sampling units are the fish landing centers (FLCs) which are stratified into two groups. Group 1 consists of provinces with one to two FLCs, while Group 2 comprises the provinces with three or more FLCs. Complete enumeration of commercial FLCs is adopted for Group 1. On the other hand, for Group 2, the landing centers are again stratified into major and minor strata based on the volume of fish catch, the data of which is obtained from the updated frame of the commercial landing centers. Major landing centers that contributed about 35% of the total fish catch are completely enumerated while two landing centers are selected systematically from the rest of the landing centers that contributed the remaining fish catch for the province.

In sampling over time, a systematic sampling of days within a month is employed using day 1 or day 2 as starting point. If the first day of the month is used as the starting point, the enumerators visit and collect data from the sample FLCs in all odd-dated days of the month, i.e., day 1, day 3, ... , day 31. If the second day of the month is the starting point, the enumerators visit and collect data from the sample FLCs on all even-dated days of the month, i.e., day 2, day 4, ... , day 30.

Data collection include three types of activities, namely, counting or monitoring the number of mother or catcher boats unloading fish either directly or indirectly through carrier boats, actual interview of

all fishing boat operators unloading fish during peak unloading time, and inquiry on the transaction before and after peak unloading time.

#### *Sampling Design for Municipal Fishery Survey*

The domain of the study is also the province. The sampling design involves sampling over time and space. In sampling over space, the sampling units are the landing centers which are arrayed from highest to lowest based on the number of fishing vessels unloading fish catch and classified into major and minor landing centers. For the 12 priority FSP bays covering 23 provinces, sampling fractions of  $1/2$  and  $1/10$  are employed in selecting the samples systematically for major and minor landing centers, respectively. For landing centers outside the 12 bays, sampling fractions of  $1/10$  and  $1/20$  are employed for major and minor landing centers, respectively. The survey covers 736 landing centers. Sampling over time makes use of the scheme used for the commercial survey.

#### **Brackishwater Fishpond Production Survey**

The objective of this survey is to gather data on production and prices of species cultured by small-scale and big-time fishpond operators, ownership grouped by province and region, type of culture, and system of culture employed. This survey covers 60 provinces with brackishwater fishponds distributed in Luzon (26), Visayas (16) and Mindanao (18). Actual interview of operators or caretakers is done at the pond site using a structured questionnaire done on a quarterly basis.

The sampling domain is the province. Fishponds are grouped into private and government-owned. Each group is stratified based on the extent or system of culture being practised by owners or operators, i.e., either extensive, semi-intensive or intensive.

After stratifying all brackishwater fishponds in each province into extensive, semi-intensive or intensive, simple random sampling without replacement is used in selecting samples. The Neyman's allocation principle is used in determining the minimum sample size for the desired variance.

### Surveys on Other Aquafarms and Municipal Inland Fishery

The objectives of these surveys are to generate data on inland freshwater and mariculture production by province, region, by type of culture, method of culture and by species; and gather data on inland municipal production by province, by region, by fishing gear and by species.

The survey domain is the province. Inland municipal fisheries is stratified according to types of fishing grounds, e.g., lakes, rivers, dams, reservoirs while both inland culture and mariculture are stratified according to culture method being practised by owners or operators of the fishing establishment. All inland culture and mariculture aquafarms in each province are stratified using these strata. After stratifying, all inland culture and mariculture aquafarms by method of culture in every province, sampling is done within each stratum using systematic sampling without replacement.

### PROBLEMS AND CONSTRAINTS

Most of the ongoing expanded fishery statistical activities are funded through the NFIS project of the FSP under DA which will end in 1994. NFIS has enabled BAS to generate more timely and reliable statistics on the commercial and municipal fishery sectors, and also on aquaculture. If FSP will not be extended, and the regular government budget for fishery statistics will not be increased, BAS will face a problem on sustaining the ongoing fishery statistical activities while maintaining the release of improved and reliable fishery statistics on a continuing basis.

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## FISHERY STATISTICS OF SRI LANKA

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### INTRODUCTION

Sri Lanka is located in the Bay of Bengal in the Indian Ocean, Southeast of India. The island has a land area of approximately 66,000 sq km and a coastline of 1770 km. The continental shelf which averages about 15 miles, rarely extends beyond 25 miles. The total area of the shelf is about 28,000 sq km which is around 11% of the total area of the Exclusive Economic Zone (EEZ) of Sri Lanka. Since the declaration of the EEZ in 1978, Sri Lanka has sovereign rights over 230,000 sq km of the ocean.

Rainfall in the island has three types, monsoonal, convectional and depressional. The annual average rainfall varies from below 1000 mm at certain places on the southwestern slopes of the hills. The four rainfall seasons during the year are roughly estimated as southwest monsoon from May to September, inter-monsoon following southwest from October to November, northeast monsoon from December to February, and inter-monsoon following northeast from March to April.

The last Population Census conducted in 1981 reported the total population of Sri Lanka at 14.4 million. Adjusted on the basis of the annual growth rates, the estimate for 1992 is 17.2 million. The population is still predominantly rural in character. In 1981, the rural sector accounted for 80% of the total population. The country's adult literacy

rate was 87.2%, the comparative percentage for males and females being 91.1% and 83.2%, respectively. In the urban areas, the rate is slightly higher at 93.4% as compared to the rural areas where the rate is 85.4%. The adult literacy rates of the country are among the highest in the developing world.

Sri Lanka also fares comparatively well with many of the developing countries in relation to accepted indicators of health and nutrition standards such as government hospitals, hospital beds and nurses per 1000 of the population. The daily calorie supply per capita was 2292.

#### FISHERY STATISTICS

Total fish production of Sri Lanka in 1992 was 206,168 metric tons, of which 21,000 tons came from inland fishery and 185,168 tons from marine fishery. There are 111,335 fishermen, 98,444 of them are engaged in marine fishery and 12,891 in inland fishery. The main fish commodity exported by Sri Lanka are tuna varieties, followed by prawns, crabs, lobsters and live fish.

#### FISHERY SURVEY

Important findings from the fishery survey conducted by the Ministry of Fisheries and Aquatic Resources in 1989 are summarized below. The same findings also show the relative position of fishery in Sri Lanka as of 1989.

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Fishing Population (1989):

Marine Sector	- 412,200
Inland Sector	- 55,909
Total	- 468,109

Projected population of Sri Lanka in 1989	- 17,433,200
Fishing population as percentage of total population	- 2.78%

## Active Fishermen (1989)

Marine Sector	-	98,444
Inland Sector	-	12,891
Total	-	111,335

## Fishing Households (1989):

Marine Sector	-	87,802
Inland Sector	-	11,451
Total	-	99,259

## Fleet Strength (1989):

Marine Sector:		
Inboard craft	-	2,357
Outboard craft	-	9,028
Non-mechanized craft	-	15,136
Inland Sector	-	4,058
Total	-	30,579

## Number of Fishing Villages (1989):

Marine Sector	-	1,050
Inland Sector	-	1,289
Total	-	2,339

## Gross domestic Product (GDP) in current prices:

Contribution of fishery in GDP	-	Rs. 5,677.4 million
Per cent contribution of fishery to the GDP of Sri Lanka	-	2.2%



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## FISHERY STATISTICS OF TAIWAN

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### INTRODUCTION

Taiwan's coastline is about 1800 miles and there are more than 70 small islands around it. As early as 1946, sources of fish products for consumer depend mostly on imports. Taiwan is a small island but it is densely populated. Its dependence on fish products is high. Fisheries develop rapidly and the amount of fish products increase year after year, its average growth rate is reported to be 7%, making the fishery sector the top producer among the agricultural economic sectors. In 1990, Taiwan's fishery catch ranked 18th in the world.

The fishery catch has reached 1.3 million tons at the end of 1992 valued at \$US 3.0 billion. Export of fish products amounted to 342,183 tons valued at \$US 1.3 billion. On the other hand, imports amounted to more than 484,984 tons and valued at \$US 0.5 billion. Based on the future prospect of foreign trade, the import of high-valued fish products is foreseen to increase while export decreases year by year.

In order to stabilize and rationalize fishery production, the government gives its strong support in terms of policies and strengthen its investments in terms of public facilities annually. The government's assistance is in the promotion of the refinement of fish products, enhancement of planned production and planned sales, counseling far-sea operators through correspondence on the international cooperation of ecological protection and resource management, retiring fishing boats which are found to be inefficient, developing fishery cultivation and regulation on off-shore and coastal fishery, and improving the aquaculture environment.

#### DATA COLLECTION AND COMPILATION

For purposes of catch statistics, Taiwan's fisheries is divided into ocean and inland water fisheries. Ocean fishery is further divided into far-sea fishery, offshore fishery, coastal fishery, and sea surface aquaculture. On the other hand, inland water fishery is divided into inland aquaculture and inland fishing. Traditionally, Taiwan's fisheries was divided into far-sea or deep-sea, offshore, coastal, and aquaculture. In the Fishery Statistical Bulletin for the South China Sea Area, published by the Southeast Asian Fisheries Development Center (SEAFDEC), far-sea fishery production is partly subtracted from total catch for the South China Sea only.

Far-sea fishery applies to areas beyond 200 nautical miles from the coast or in other countries' Exclusive Economic Zone (EEZ). Data for far-sea fishing exceeds half of the total fishery production of Taiwan. For offshore fishery, the large, medium and small offshore fishing boats operate within the area ranging from 12 to 200 nautical miles. The amount of their catch is about 20% of the total production. Meanwhile, for coastal fishery which is within the limited sea area of 12 nautical miles, fishermen catch aquatic species along the coast by means of sampans, rafts, fishing nets and other fishing gear. Catch from coastal fishery occupies 3.3% of the total fish production. The total production from aquaculture which occupies an area of 74,000 ha, is 23% of the over all fishery production.

The highest fishery authority in Taiwan is the Fisheries Department of the Council of Agriculture of the Executive Yuan. The Taiwan Provincial Fisheries Bureau (TFB) and the Kaoshiung Municipal Fisheries Department form the first level local fishery authorities, while 21 county governments form the second level local fishery authorities.

According to the Statistical Law of Taiwan, the Directorate-General of Budget, Accounting and Statistics of the Executive Yuan is responsible for the collection of basic statistical data including fishery data. Taiwan's Provincial, Taipei's Municipal, and Kaoshiung's Municipal Budget, Accounting and Statistics Departments are the first level authorities for statistics. Twenty-one counties have statistical offices serving as second level local authorities for statistics.

There are many organizations, agencies and academes which compile fishery statistics. These are either entirely funded or undertaken by government sources and are pursued in the general interest of developing fisheries for the benefit of the nation. However, TFB plays a major role in these activities concentrating on the compilation of fishery statistics and information in Taiwan. Although TFB is a provincial level organization of Taiwan, it covers all the fishery statistics compilation of the whole country.

The fishery statistical system of Taiwan can be divided basically into five categories, namely, basic fishery statistics for the Annual Fishery Yearbook with self-enumeration procedure through reports from county governments, fishery census with interview through visits of assigned surveyors in counties or towns, socio-economic survey with interview of a member of the fishermen's associations, fishery resources survey with self-enumeration through the owners or from telegraphic daily reports on fishing effort by fishing boat, and other projects aimed at collecting information on market and aquaculture.

### **Fishery Census**

Fishery census started in 1955 and is repeated with interview procedure once every five years. It is part of the Agriculture, Forestry, Fishery, and Husbandry Census of Taiwan. A commission handles the census comprising a number of scientists, administrators and experts in various fishery fields and is sponsored by the Directorate-General of Budget, Accounting and Statistics of the Executive Yuan. Under this commission, a technical study team is organized for reviewing and deciding related programs, plans and rules. In this operational system, four hierarchical parts can be differentiated to facilitate census procedure. The Directorate-General of Budget, Accounting and Statistics is in charge of the whole system. Questionnaires are distributed by temporary surveyors who visit fishery households or companies. An incipient data processing is

carried out by the regional work teams, which are established as subsidiaries of the town administration. From the top to the lower levels of the system, there are county or provincial or municipal, as the case may be, statisticians verifying the reliability, consistency and reasonableness of the data to guarantee their quality.

TFB is responsible for the processing of the fishery statistics for the Taiwan area and the Fifth Division is responsible, not only for the survey system, methodology and program tabulation but also for scrutinizing the data and the compilation as well as publication of the data.

There are 21 local fishing sections in 21 counties in Taiwan Province and one at the Kaoshiung Municipal Fishery Department, 18 of which are attached to the Agriculture Bureau or Construction Bureau of the county government. At present, fishery statistics including data collecting and processing is an official routine work of the Fishery Section. Fishery statistics are grouped under agriculture statistics in the yearly report submitted to the District Magistrate and the Director of Agriculture.

Very few inland fishery are being operated in Taiwan. There are 37 fishermen's associations whose offices which are located along the coasts, also serve as major collection stations for fishery data.

#### *Data from Fishery Census*

During the 1991 population survey, data on fishing household and fishing boats were recorded. At that time, there were 51,479 entities in Taiwan area broken down into four classes, namely, sole proprietorship household (47,698), partnership household (2,722), corporation (1023) and others (36). The 1990 report includes fishery units by industries, type of organization, number of fishermen by scale of marine fishery, by scale of fish culture, by revenue; number of fishermen by type of organization, by property of employment and sex, whether on-boat or on-land and property of employment, whether on-boat or on-land and age, whether on-boat or on-land and level of education; fishery units by operation inclination for 1991-93 and operation difficulties; fishery units' main demand for fishery policy measures; fishery household of sole proprietorship by number of family members, by industry, whether full-time or part-time, by persons engaged in own fishery and persons engaged in non-fishery, by scale of marine fishery, by scale of fish culture, and by number of

successors; population of fishermen households of sole proprietorship, 15 years old and above, by property of work and industry in non-fishery, by regular work, by man-days of working in own fishery, by sex and education of working in own fishery, by sex and age, by sex and education; fishermen household of sole proprietorship by living facilities and by type of equipment and installations; general status of marine fishery and fish culture; marine fishery units by type of organization, by number of fishermen, by quantities of fish catch, by value of fish catch and by number of fishing boats; powered fishing boat by tonnage, by type of organization, by ownership, by horsepower of major engine, by hull and kind of engine, by age and insurance, by water area operated, by operation days, by number of shipment, by equipments, by type of marine fishery and by cause of non-fishing; non-powered boats of marine fishery by type of organization and by operating days; number of without boat, by species of marine fishery; fish culture units by type of organization, by type of equipment and installations, by number of fishermen, by quantity of fish yield, by value of fish yield and by scale of fish culture; area measure of fish culture by ownership, by type of fish culture and status of utilization, by type of organization, by water sources, and source of fish fry; average fish culture's area of every fish culture unit by type of organization; fish culture units by type of equipment and installation; fishery director of fishery households of sole proprietorship by regular work and by annual man-days engaged in own fishery; livelihood maintainers of fishery households sole proprietorship by annual man-days engaged in own fishery and by regular work; successors of fishery households of sole proprietorship by man-days of working in own fishery and by regular work.

#### DATA PROCESSING

For purposes of data processing, there are many computer systems used for fishery statistics in Taiwan. In fact, many fishery statisticians have been relying on computer-generated information since 1980. Statistics have become directly involved in the calculation using packaged softwares and application programs from main frame to personal or notebook computers. All data sets are processed, tabulated and stored in computers. For example, fishery census data are processed using a main frame while basic fishery statistics collected from the stations are processed using personal computers (PCs). Similarly, fishery resource surveys are also processed at the workstations using PCs. Fishery management information



system makes use of a main frame through a fishery authority on-line real time system for integral management of fishing boats and fishermen while market price information are monitored through a value-added network of databases using PCs. Aquaculture information also makes use of PCs with application system softwares. Unfortunately, data-sharing of fishery statistics in Taiwan is still difficult as it is time-consuming.

At present, large computer fishery network have been designed for fishery statistics and information. The scope is contained in a wide area network of the main frame computer and local area networks for PCs.

#### FISHERY STATISTICS

Many fishery statistical publications are available in Taiwan like the Fisheries Yearbook for Taiwan Area published by TFB, the first issue of which was published in 1954. The latest Yearbook includes 20 chapters which contain statistical data on fishermen, fishery households, fishermen's associations, fishing boats, fishery production, fish marketing, fishing value, fishery products, processing plants, export and import, aquaculture measure, fishery investment, disasters of fishermen and fishing boats. All fishery-related activities are included and become the main source of fishery statistics for both practical and academic uses. On the fishery socio-economic survey, the Report on Economy of Offshore, Coastal and Aquaculture Fisheries is published annually also by TFB while the Report on Economical Analysis of Far-sea Fisheries is published annually by academic organizations.

Some fishery statistics are prepared by the National Taiwan University, the National Taiwan Ocean University and other related academes. Publications from their works include the Annual Report of Effort and Catch Statistics by Area on Taiwan Demersal Fish Fisheries, the Annual Report of Effort and Catch Statistics on Taiwan Gill Net Fishery, the Annual Catch Statistics of Taiwanese Tuna Gill Net Fishery, the Annual Catch Statistics of Taiwanese Tuna Long Line Fishery, the Statistics of Deep Sea Jigging Fishery of Squid in Southwest Atlantic Region, the Annual Statistics of Taiwanese Drift Net in North Pacific, the Annual Report on Catch Statistics and Resource Survey of Offshore Coastal in Taiwan Area, and the Report on Catch Statistics and Resource Survey of Offshore and Coastal Fishery published by TFB using the data collected by related academic organizations.



## Marine Capture Fishery

### *Number of fishing boats by area*

Fishing boat operations are registered by fishery authorities in order to obtain fishing operation license. Boat size of less than 20 tons are registered at the county government, those from 20 to 100 tons at the provincial and municipal governments, while those over 100 tons are registered at the Council of Agriculture. Thus, all fishing boat data could be obtained from the fishing boat registrations. In addition, newly constructed fishing boats or change of boat registration numbers are monitored through the fishery management information on-line real time system of the fishery authorities concerned. This system has been used successfully in monitoring fishing boat data physically, whether static or active.

The Fishery Yearbook has two chapters describing the number of fishing boats by district. The number of newly built fishing vessels and fishing craft by area are documented by tonnage, type of fishery, county presented, number of boat body materials, and horsepower. The variables on tonnage could be differentiated into two major categories of non-powered fishing craft, such as sampan and fishing crafts which are very small in size and work in a limited range. Powered boats are divided into ten classes by tonnage, such as, powered sampans, less than 5 tons, 5 - under 10 tons, 10 - under 20 tons, 20 - under 50 tons, 50 - under 100 tons, 100 - under 200 tons, 200 - under 500 tons, 500 - under 1,000 tons, and greater than 1,000 tons. Most of the small boats under 50 tons constitute 80% of the powered boats. The type of fishery, on the other hand, is divided into otter trawl, bull trawl, large type purse seine, tuna long line and so on.

### *Number of fishermen by area*

The number of fishermen by area are also tabulated in the Fishery Yearbook. The table contains number of fishermen by area by fishery type and whether full-time or part-time. The crew and landsmen are also recorded.

### *Number of fishing units by type of fishing gear*

The number of fishing units by type of fishing gear are contained in the Report of Fishery Census rather than in the Fishery Yearbook. These data could also be obtained from the fishery management information system.

### *Catch by species*

Domestic as well as foreign base landings are used to estimate the amount of fish catch. Data from domestic landings can be obtained from the local markets when fish is auctioned. The auction information is transmitted through an administration channel, i.e., from fish market to the fishery section of the county government, transmitted monthly, then finally to TFB for data processing. Catch landed in foreign bases are reported by fishing companies or landing port agencies, also monthly, sent to Kaoshiung municipal government then forwarded to TFB for further processing. The daily catch and fishing effort of fishery resource survey, which have not been utilized in the Yearbook, are monitored by a log book recovery system. Log books are handed out when fishing boats apply for operating license to operate at sea. Self-enumeration, collecting daily fishing reports of telegraphical station and import data from foreign country, is also undertaken by academic organizations. Several report forms for specific fishing gear being engaged such as trawlers, tuna long liners, gill netters, squid jiggers, purse seiners and so on are given to operators. The reports are electronically processed from which annual reports are published. Global positioning system and resources statistics system have been set up for collecting data, but there is a plan to modify the whole system of data gathering, processing and sharing.

The Yearbook also includes information on catch landings in quantity and value by species, fishing gear and culture types. Catch by species and district including foreign, oversea ports in quantity and value are also included in the Yearbook.

### *Catch by fishing gear and by species*

Catch by fishing gear and species from far-sea fishery as well as catch by species, fishing port and months of operation are reported.

### **Inland Capture Fishery**

Inland capture fishery is not common in Taiwan. Production from this sector is less than 400 metric tons per year. The catch data are grouped by inland water and reservoir correlated with species, number of fishing boats by area, number of fishermen by area, number of fishing units by area. These information are included in the table

with marine fishery by species in quantity and in value. Catch by type of fishing gear and by species from inland fishery are not independently reported at the moment.

### **Aquaculture**

Aquaculture is divided into shallow sea culture, marine cage culture, other marine culture, brackishwater pond culture, freshwater pond culture, inland cage culture and other inland culture. Information such as the number of aquaculture entity, area of ponds, rearing duration and marketing are monitored by the clerk of the county government. At present, the aquaculture survey project including licensing system, rearing survey and geographical information system of aquaculture are used by TPB to check the reporting system of the county governments.

There are about 15,000 ha of mariculture areas in Taiwan which covered shallow sea culture, cage culture and others. Statistics collected are in quantity and value, listed by species and by district. On the other hand, aquaculture data are shown by species, by area in hectares and by culture system, i.e., either mono-culture or polyculture. The data for ponds and tanks, enclosures and pens, raceways and silos, and barrages have not been collected in the current system.

The production of milkfish, shrimp, sea bass, grouper, carps, catfish, freshwater jumbo prawn and others are included in the Fishery Yearbook tabulated by type of culture and species in quantity and in value, by type of culture, by district and by month. Types of culture recorded in brackishwater is only pond culture, however, for freshwater, the types of culture includes pond culture, cage and others. Data on seed production and aquaculture area are also reported.

### *Shellfish Culture*

The number of establishments and number of persons engaged regularly in shellfish mariculture are not contained in the Fishery Yearbook but in the Census Report. Data includes area in hectares, species cultured, indicated by region and quantity harvested. Shellfish species includes grass shrimp, kuruma shrimp, sand shrimp, giant freshwater prawn, red tail shrimp, spiny lobster, oyster, hard clam, freshwater clam, purple clam, small abalone, blood cockle, short-necked clam, and crabs.

### *Seed Production*

Production of fish fry by month and species are shown in quantity and in value. The data by region and by species are cross-tabulated also in quantity and in value. In addition to fish fry, data are collected for soft shell turtle, shrimp juveniles, crab juveniles, and abalones, recorded by 1,000 pieces. However, data for other shellfish seeds are collected in metric tons.

### **Price Statistics**

There are 38 local markets at the producer side while 29 at the consumer side. Fish products are marketed by auction at the producer markets then transported by the wholesalers to the consumer markets or to distributors. Once the products are auctioned, the transaction bill can be used to get information on quantity and price. As far as major products are concerned, Kaoshiung City has landed most of the products in Taiwan and is the largest fish supplying center. At the consumption end, the Taipei Fish Market is the largest center. Statistics are being collected by TFB through enumeration and through telecommunication reports from the markets. The data are processed and included in the Yearbook.

### **Economic Statistics**

Fishery economic survey consists of two major parts, namely, commercial fishery enterprise and household fishery economy. The Kaoshiung Municipal Fisheries Department is in charge of the survey on commercial fishery enterprise. This is done through interview of the fishermen's association conducted by designated surveyors. On the other hand, TFB covers the survey on household fishery economy. The data collected for fishery enterprise are related to far-sea fishery and includes company organization, fishing type, operation situation, labor force, cost and earnings, and company financial status. The data for household fishery are related to small-scale fishery and aquaculture, and includes household revenue and expense, employment, housing condition, operational income and expenditure, and income and efficiency. A fishery household bookkeeping system has been designed by TFB and implemented on a daily basis for collecting detailed data on household fishery.

## Trade Statistics

The main source of data on import and export statistics on fishery products is the Customs-General Department. The data includes quantity and value by species, month, nation, and product types, and are processed by TFB.

## DISPOSITION OF CATCH

Fish catch are processed on boat for fish preservation. Far-sea fishing boat have freezing equipment while offshore and coastal fishery make use of ice for disposing their catch. Aquaculture products are transported to the market, fresh or live.

## Fishery Products

Processed fishery products are divided into food-products and non-food products. Food products include canned, in brine, in oil and with seasoning; frozen and cold storage products, includes cold-stored food and processed frozen food; smoked, dried and salted products, includes salted dry-salted, simply dried, and cooked and dried; and dried/seasoned such as shark fin, fish roes, fish paste, and others including fish liver, fish oil, and agar.

Non-food products are classified into meals such shell lime and fish meal, fish oil, fish cake, fish soluble, and ornaments such as corals, shells, fish bones, fish leathers and others. Statistics for fishery products are collected by the county government through survey and submitted to TFB where these are processed. The data, tabulated in the Fishery Yearbook, are cross-classified by month and by product, by district and by product in value and quantity.

## FISHERY SURVEY

In addition to fishery census which is conducted every ten years, fishery sample surveys are also conducted every five years. The last census was made in 1991 and includes data on fishing entity, full-time aquaculture workers and artisanal fishermen who are considered directly engaged in fishing activity as most of their income come from the sale of aquatic products. During the census, fishermen satisfying the following conditions were considered artisanal fishermen: those who individually, in a pre-determined time interval, harvest aquatic plants or animals



by using powered fishing boat or craft; those who culture aquatic plants or animals in an area of no less than 0.05 acres; and those who has a revenue from aquatic harvests of no less than 20,000 NT\$.

The sub-district offices, fishermen's associations and fish markets fill in the report forms or questionnaires either monthly or yearly, following the standard methods in the Fishery Statistical Handbook. The data are transmitted to the district level for recording and tabulation. The completion of the report forms is actually done by the Fishery Section and the Kaoshiung Municipal Fisheries Department which are then forwarded to TFB for further scrutiny and aggregation.

Landed fishery production from overseas is collected by the Kaoshiung Municipal Fishery Department through the landing port agencies using self-enumeration procedure. Fishery export and import statistics, on the other hand, are gathered by the Statistical Department of the Directorate-General of Customs under the Ministry of Finance.

All data are finally transferred to Provincial or Municipal fishery administration where these are summarized on an annual or monthly basis and then the data are published.

Data on fishery resource statistics are collected either through self-enumeration or daily catch reports obtained from fishing boats and transmitted to the landing telegraphic stations. Appropriate questionnaires are used as tools for the daily operation report and are given to boat owners and skippers. Sampling method used is purposive.

For socio-economic survey, purposive sampling is also used to collect data with interview. This is done by visiting the households and fishing companies. Data from this method are double-checked using trade statistics data as reference. For aquaculture information, data are collected by the geographical information system using either air photo, pond side survey using purposive sampling or registration licenses. The statistics for aquaculture are not recorded regularly and hence are used only as reference for basic fishery statistics.

On the other hand, the fishery management information system has the record of registered fishing boats and fishermen. These data are also used as reference in collecting fishery statistics. For fish market information,



the data are collected from the products and consumer markets by TFB for processing. However, the market information system provides only transaction data for consumers and producers rather than relevant statistical systems required in the Fishery Reports.

#### PROBLEMS AND CONSTRAINTS

The FAO sea area or data definition can not be activated completely as far as the data collection system on fishery statistics of Taiwan is concerned. The definition should be reviewed by fishery statistics authority in order for Taiwan to satisfy the requirements for fishery data by international organizations.

Fishery categories are overlapping and are not clearly classified by range from the baseline of territorial sea. Thus, area operated, work-time, number of trips, catch species and catch should be included completely in future data collection activities.

The source data make use partly of production statistics when no auction is held in fish markets. Moreover, fish products from mainland China smuggled to Taiwan can not be calculated. Furthermore, oversea fish landing data may have overlapped with concerned countries. In this case, a bilateral arrangement should be made for accurate and efficient data recording.

The low level of education of the fishermen makes them not interested in the use of statistics for the development of fisheries, and makes them think that data collection is done for taxation purposes only. Some data collectors do not have sufficient knowledge in statistical surveys while some fishery surveyors are part-time workers only so that high-quality data can not be guaranteed. There is however, a present program in the country which is aimed at improving the current statistical system and training of statistics staff for more accurate statistical data.

Proceedings of the Regional Workshop  
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## FISHERY STATISTICS OF THAILAND

by  
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### INTRODUCTION

The statistical system of Thailand is decentralized in the sense that each ministry in the government has its own statistical unit which collects statistics relevant to its own administrative purposes. There is, however, the National Statistical Office (NSO) which plays the leading role in producing basic statistics at the national and regional levels. It is one of the government agencies with a departmental status under the Office of the Prime Minister. Under the Statistical Act, NSO is responsible for conducting all censuses including the Marine Fishery Census.

### DATA COLLECTION AND COMPILATION

#### Fishery Census

The marine fishery census was conducted in 1967 and in 1985 by NSO and the Department of Fisheries (DOF). In order to establish a sound fishery statistics system, NSO and DOF planned to conduct the third census in 1995. The objectives of the 1995 census are (a) to collect data on basic economic structure of marine capture fishery and coastal aquaculture, (b) to collect data on socio-economic characteristics of fishery establishment, fishery employees' households and demographic characteristics of fishermen, and (c) to provide data to be used as a sampling frame for related survey.

The 1995 Marine Fishery Census covers all marine capture fishery and coastal aquaculture establishments and fishery employees' households which are located in 24 coastal provinces in the central and the southern parts of the country.

#### Data Collection

Complete enumeration by interview method is applied in the census. The field work is divided into two phases, namely, a listing of all households in the area covered in order to identify the fishery establishments and the fishery employees' households, and subsequently, the enumeration of all fishery establishment and fishery employees' households.

The survey items include marine capture fishery and coastal aquaculture, indicating the number of fishery establishments by type of management, type of fishery, fish marketing channel, and source of fishery loan; marine capture fishery establishments, indicating the number of marine capture fishery establishments by size of management, number of fishermen during peak season, type of fishing gear mainly employed, number of fishing months, type of payment system to employee, and ownership of boat, the number of fishing boats by type of boat, gross tonnage, type of engine, horsepower, type of equipment installed for inboard powered boats, number of crew, fishing gear mainly employed, and fishing area mainly operated, are also included; coastal aquaculture, indicating the number of coastal aquaculture establishments by type of main culture, area under culture, number of regular workers, tenure of area under cultures, and source of fish seeds; socio-economic structure, indicating the number of fishery households and number of fishery employees' households by extent of dependency on fishery, possession of consumer durable goods, and fishery activities groups membership; number of fishermen classified by sex and age, level of education, and type of fishery work; facilities for fishery and infrastructure in fishing villages; and number of fish processing establishments by type of management and type of processing.

#### Publications

Results of the 1995 census will be published in two volumes. A preliminary report presenting the data in list form is released within six months after the field work and

the final report of two series showing statistics covering the coastal zone and statistics covering the whole Kingdom, comprising 24 provinces, which will be released from April 1996 to March 1997.

#### DATA PROCESSING

All census data will be processed using a computer main frame at the NSO Head Office. For the preliminary report in list form, data is processed using micro-computers (PCs) at the local level.

The Fishery Statistics Sub-division under the Fishery Policy and Planning Division, DOF, is responsible for the development of the fishery statistical collection system, computerization and publication of fishery statistical yearbook and other statistical reports.

In order to compile and compute fishery data, PCs are used at the Head Office. In the future, these computers will be on-line from the Central Office with the local level in order to expedite the computation and compilation of fishery statistics.

#### FISHERY SURVEY

##### Marine Fishery Production Survey

The production from marine fishery in Thailand has been estimated by the Fisheries Statistics Section from the results of the Marine Fishery Production Survey. The Survey is classified into four sections, namely, production from major fishing methods of fishing gear, production from fishing gear used by fishing communities other than the major fishing methods, production from coastal aquaculture, and production from particular fishing methods other than the first three aforementioned sections.

Using the results from the 1967 Marine Fishery Census, a new marine fishery production survey was designed and a sample survey was launched in 1969. The commencement of the new survey was considerably delayed due to certain difficulties including sourcing of the budget and in recruiting and training the field personnel.

The main objective of the Survey is to secure the data necessary for fishery administration and fish stock

assessment by providing catch data by species and fishing efforts for each type of fishing gear.

The survey commenced in May 1969 and covered catch from marine fishery leaving out the coastal culture. Unfortunately, the new survey in 1970 again encountered shortage in budget, thus, the survey covering the entire calendar year 1970 was not fully implemented until 1971.

The survey is being conducted through a DOF field set-up with six supervisors and about 70 enumerators. The survey covers all types of marine fishery including mariculture and brackishwater culture.

#### Structure of the Survey

Marine fishery in Thailand are broadly classified into large scale or off-shore fishery where the number of fishing units is relatively limited but productivity per fishing unit is quite high, small-scale or coastal fishery which are scattered along the entire coast of the country but productivity is generally low, coastal culture in certain limited areas, and specialized fishery, e.g., collecting shellfish, sea cucumber.

Four types of survey are being implemented, namely, Log Book Survey which covers otter-board trawl, pair trawl, beam trawl, Thai purse seine, Chinese purse seine, anchovy purse seine, luring purse seine, king mackerel gill nets, mackerel encircling gill nets, and push nets; Fishing Community Survey which covers all types of fishing methods which are not covered by the Log Book Survey, Coastal Culture Survey, and Specialized Survey; Coastal Culture Survey which covers shrimp culture, blood cockle culture, sea mussel culture, and horse mussel culture; and Specialized Survey, includes data from collecting shellfishes, seaweeds, sea cucumber, jellyfishes, surf clam, and turtle eggs.

#### Log Book Survey

This survey is applied to major types of fishing methods. In 1971, the estimated catch from the Log Book Survey was about 70% of the total catch.

When the survey was commenced in 1969, it covered only, i.e., otter-board trawl, Thai purse seine, Chinese purse seine, and bamboo stake trap. However, after 1983, the



number of fishing methods was increased to eleven. In the future, the coverage of the Log Book Survey may be expanded to include some of the fishery which are currently being covered by the Fishing Community Survey. The reasons for this are: (a) compared with the Fishing Community Survey, the Log Book Survey provides estimates with greater accuracy, and (b) for the estimation of the fishing effort, the Log Book Survey is much easier to use than the Fishing Community Survey.

In the Log Book Survey, a fishing unit is regarded as a sampling unit. A fishing unit is defined as a technical unit for a fishing operation normally consisting of boats, gear and crew. In the case of pair trawl, two boats form one fishing unit. As for the Chinese purse seine, one mechanized boat and two non-powered boats are regarded as a fishing unit. Each set of bamboo stake trap is considered as a fishing unit.

The operator of a sample unit is requested to keep a record of catch and fishing efforts for each trip by means of a log book. Such record is verified by an enumerator with the invoice of the fish transaction kept by the operator. However, in the case of beam trawl and push net fishing, the operators do not always keep an invoice of fish transactions, therefore, a sample operator is asked by the enumerator on the number of fishing days and average catch per day in the previous month. The catch is then estimated from this information.

Four types of questionnaires are used for the Log Book Survey, this is in order to fix the operational conditions of each fishery. These are for the otter-board trawl and pair trawl; Thai purse seine, Chinese purse seine, anchovy purse seine, mackerel encircling gill net, king mackerel gill net, and luring purse seine; bamboo stake traps; and beam trawl and push nets.

A simple estimation method, applied in the Log Book Survey, makes use of the formula:  $T = N/n \sum x_k$ , from  $k=1$  to  $k=n$ , where  $T$  = estimate of the catch,  $N$  = total number of fishing units by strata,  $n$  = number of sample fishing units and  $x_k$  = catch of the  $k$ th sample fishing unit.

Estimation is done at the Fisheries Statistics Section on a monthly basis when all questionnaires have been recovered from the enumerators and reviewed by the supervisors and the number of fishing unit registered for the year becomes available. Monthly data estimated is accumulated to come up with the annual total.



The number of fishing units actually operating each month may vary from month to month due to shortage of field staff. Also, due to the absence of fishery cooperatives, it may not be possible to obtain the exact figures. For the estimation of monthly figures, the number of fishing units registered in the year (N) is always used. This may result in some bias on the estimates.

#### **Fishing Community Survey**

This survey is applied to small-scale fisheries employing a variety of small fishing gear. A fishing community, identified during the 1967 and 1985 Marine Fisheries Census, is used as a sampling unit.

For purposes of fishery statistics, the entire coast of Thailand is divided into five regions as described previously in the survey of fishery inventory items. Within each region, fishing communities are stratified into A and B in terms of the weighted number of boats.

The enumeration for each sample fishing community is done only once a year in January using the following steps to estimate catch by gear and by species in the previous year.

#### *Listing Survey*

A complete list of the fishing households in the previous year is prepared with the help of the chief of the community or fishermen who are acquainted with the fishery status of the community. For each fishing household, the type of fishing method employed in the previous year is then recorded.

#### *Production Survey*

Based on the results of the listing survey, at least five fishing households are selected at random from each type of fishing method. An enumerator visits the sample fishing households and records data from such survey items as fishing season and the total number of months in operation, average monthly catch and species composition in terms of per cent of the total. Using this information, an annual catch by species for each sample fishing household, is estimated.

After completing the field work, the enumerator submits the questionnaire together with the data recorded to the Fisheries Statistics Section, where the catch is estimated by type of fishing method for each sample fishing community using the formula:  $T = \sum x_k (N/n)$ , for  $k=1$  to  $k=n$ , where  $T$  (est) = estimate of catch for the  $j$ th sample community,  $N$  = total number of fishing households,  $n$  = number of sample fishing households and  $x_k$  = catch for the  $k$ th sample fishing households.

For each type of fishing method, the total catch is estimated using the formula:  $T$  (est) =  $(M/m) \sum T_j$ , for  $j=1$  to  $j=m$ , where  $T$  (est) = total catch by estimation,  $M$  = total number of fishing communities,  $m$  = number of sample fishing communities and  $T_j$  = catch for the  $j$ th sample fishing communities. This estimation is done separately for each type of fishing method and region.

#### **Coastal Culture Survey**

The Coastal Culture Survey is done in order to estimate the total annual production of each type of culture, e.g., shrimp farming, sea mussel farming, blood cockle farming, horse mussel farming; and to estimate the yield per unit area (per rai) for each type of culture. Collection of data is done using two methods.

#### *Listing Survey*

The list of types of culture from the previous year is prepared at the Central Office. The enumerator brings the list to the chief of a "tambol" where it is reviewed and revised. In case a complete list is not available from the chief of a "tambol", a list is prepared with the help of the owner of the coastal culture farming or someone who is acquainted with the coastal culture farming in a "tambol."

#### *Sampling Survey*

A sample survey is undertaken simultaneously with the listing survey by interviewing a sample farmer on their yield during the previous year. The sample farmer is systematically selected for each "tambol" as follows:

Total number of farms in "tambol"	Number of sample farms
1 - 5	complete enumeration
6 - 25	5 samples
26 and above	one fifth of farms

A ratio estimate is applied in order to get the total yield:

$$Y \text{ (est)} = A \frac{\sum_{k=1}^n Y_k}{\sum_{k=1}^n a_k}$$

where, Y (est) = total estimate of yield  
 A = total area of culture farms  
 $Y_k$  = Yield reported by the kth sample farms  
 $a_k$  = Area of culture farm responded by the kth sample farm

The estimate for the total yield gives the total annual production of culture farm by type and yield per unit area (per rai) for each type of culture farm.

### Specialized Survey

This survey is undertaken in order to estimate the annual production from shellfish collection together with other coastal culture, e.g., seaweeds, sea cucumber, jellyfish, turtle eggs.

The staff of the Fisheries Statistics Section visit the fishing villages identified every January and collect the respective production data from the previous year. No specific questionnaire is used for the survey. However, in order to avoid any unreasonable error, the enumerators are urged to contact as many local people as possible including fishermen. From them, the catch data is collected and the total annual production of shellfish, jellyfishes, sea cucumber, seaweeds, turtle eggs are reported.

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## FISHERY STATISTICS OF VIET NAM

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### INTRODUCTION

The fishery sector is destined to play a leading role in the economic and social development of Viet Nam. In order to provide a sound basis for planning, regulation and management of the fishery sector of Viet Nam, a fishery statistical system is urgently required. The present fishery statistical system is comparatively limited especially for purposes of planning, regulation and management of the fishery sector of Viet Nam.

Little fishery statistical data have been collected or collated since 1990, apparently due to lack of resources for this exercise in several of the provinces especially data on fishery production. Thus, most of the production data are consequently believed to be under estimated.

Additional efforts in data collection and processing are therefore, desirable for the long-term management, development and sustainability of the fishery sector of Viet Nam.

### DATA COLLECTION AND COMPILATION

The government organization responsible for conducting fishery census from which important inventory items such as number of fishing establishments, fishing vessels, fishermen, fishery products, aquaculture establishments are obtained, is the Ministry of Fisheries (MOF). However, collection of statistics obtained from fishery or agriculture sections at the villages and districts level, is the responsibility of the Provincial Fishery or Agriculture Departments. Data collected are submitted to the Ministry of Fisheries.

On the other hand, the statistical data from centrally-owned fishery establishments and institutions are reported directly to the Ministry. The statistical data, after counter-checking, are used for the Ministry's report and further for the General State Statistical Office.

After the unification of Viet Nam in 1975, a country-wide fishery census was conducted in 1978. The census was however, conducted irregularly at the government level as only some provinces make periodic assessments. An example is the Haiphong Province where a district level survey is conducted every five years.

The organization responsible for the collection and compilation of annual fishery statistics are the Provincial Fishery or Agriculture Departments and the Statistical Division under the Planning and Investment Department of MOF.

The number of technical staff engaged in designing and compiling fishery statistics in local offices is 1 - 2 persons at the villages and districts level, 2 - 3 persons at the provincial level and 5 - 6 persons at the Head Office or ministry level.

### **Fishery Census**

The survey items covered by the fishery census include fishery resources, in terms of biomass, species composition, total allowable catch; fishing fleet, indicating fishing crafts, fishing gear; infrastructure and service facilities such as fishing ports, ice-making and cold storage facilities, boat building facilities; fishery production from capture fishery, culture fishery; aquaculture classified as mariculture, brackishwater culture, freshwater culture; processing sub-sector; export and import statistics; and socio-economic issues including labor force, education.

### **DATA PROCESSING**

Due to inadequate facilities, insufficient budget and lack of technical staff, the use of micro-computers at the Head Office and local offices to expedite the computation and compilation of fishery statistics is very limited. As of this time, only personal calculators are used. However, computers are used widely in the State Statistical Office.

Based on the annual reports of the provincial fishery or agriculture departments, centrally-owned establishments, institutions, MOF prepares an annual report by summing up the achievements attained during the past year and pointing out directions and objectives for the succeeding year.

The annual report of a certain year is usually released in January of the succeeding year. From April to June, the statistics data on fisheries are submitted to the State Statistical Office. Official statistical data on fisheries and other sectors of Viet Nam are released in the annual statistical yearbook of the State Statistical Office every October of that year.

## FISHERY STATISTICS

### Marine Capture Fishery

Data includes number of fishing boats, by type and tonnage; labor force, classified as full-time or part-time; fishing gear by type such as trawl, purse seine, lift net, gill net, line, set net.

### Inland Capture Fishery

Although MOF statistics do not explicitly separate inland and brackishwater capture fishery from culture fishery production, reports showed that in recent years, capture fishery accounts for less than 20% of the total inland and brackishwater fish production. However, it was considered likely that production from inland capture fishery is underestimated especially considering the fact that no explicit estimate is made on subsistence harvest.

### Aquaculture

Mariculture activities are limited to some seaweed culture and cage culture of grouper and some marine fish species such as king fish (*Rachycentron canadus*), lined silver grunter (*Pomadasys hasta*), yellowtail, amberjack (*Seriola* sp.), red snapper (*Lutjanus* spp.).

Other species such as milkfish (*Chanos chanos*), mullet (*Mugil* spp.), *Bostrichthys sinensis* are also being cultured in brackishwater ponds.



### Marine fish

There are about 100 commercial species of marine fish, of which more than 50 species have high economic value. Grouper of the *Epinephelus* genus, namely the orange spotted grouper (*Epinephelus tauvina*), *E. bleekeri*, *E. malabaricus*, *E. facialatus*, *E. akaa*, are being cultured in floating cages. The availability of wild juvenile fish to be stocked in the grow-out cages is the main constraint on the expansion program for the grouper culture in Viet Nam. Yellowtail and amberjack are also cultured in cages. The major difficulty in this fishery is the production of fry for stocking in the cages.

### Seaweeds

Seaweeds of *Gracilaria* genus is cultured in the North and Central regions. The most important species cultured are *Gracilaria verrucosa* and *G. blodgettii*. Three methods of culture are employed, namely, extensive method which is used in ponds of 5 - 20 ha, without or very limited quantity of seeds producing an average of 0.5 mt/ha/year; semi-intensive method utilizes ponds of 1 - 5 ha with an application of seeds at 200 - 300 g/sq m, producing about 1.0 mt/ha/year; and the intensive method which makes use of small ponds of about 100 sq m to 1.0 ha, producing 2 - 3 mt/ha/year. The Research Institute of Marine Products, Haiphong City, Viet Nam is able to produce *Gracilaria* seeds for the farmers.

### Shellfish

There are about 33 commercial shellfish species in Viet Nam, however, only few species such as clam (*Meretrix* spp.), pearl oyster (*Pteria martenssii*), common oyster (*Crassostrea gigas*) are being cultured at very limited areas and on a small-scale basis.

Pearl oyster production is being undertaken in Campha District (Quang Ninh Province) under a joint-venture between the National Aquaculture Service Company and a Japanese Company. However, there is insufficient natural shell, so the industry has to develop sources of imported seeds or develop pearl oyster hatcheries in the country. On the other hand, some experiments on artificial breeding of shellfish are being carried out but results from these studies are still very limited. There has been no reports on the productivity and yield of shellfish culture.

### *Shrimp*

The total area of brackishwater used for shrimp culture was estimated at 150,000 ha in early 1980s and about 205,000 ha by the end of 1992. The main species cultured are white shrimp (*Penaeus merguensis*), giant tiger shrimp (*P. monodon*) and greasy back shrimp (*Metapenaeus ensis*). The main culture method employed is traditional extensive which produced a maximum of 300-350 kg/ha/year. Giant tiger shrimp is cultured using the semi-intensive method and has produced about 700 - 1500 kg/ha/year. By the end of 1991, it was reported that the areas used under the different methods of culture were, for extensive culture - 168,000 ha, for improved extensive culture - 20,000 ha, semi-intensive - 1000 ha, and intensive - 200 ha.

There are 222 shrimp hatcheries in the country producing about 300 million shrimp fry annually. In 1991, the shrimp culture production in South Viet Nam was 33,000 mt comprising about 80% of the total shrimp culture production of the whole country.

### *Sea Bass*

Sea bass (*Lates calcarifer*) is being cultured in brackishwater ponds. The fry are collected from the wild and then reared to marketable size.

### *Mud Crab*

Mud crab (*Scylla serrata*) is being cultured using juveniles collected from the wild. Crab farming is mainly undertaken in Quang Ninh, Haiphong, Thanh Hoa and Minh Hai provinces. Some studies on the rearing of soft-shelled crabs were undertaken in these areas. The production of crab is concentrated during the autumn - winter seasons. However, the technology for crab artificial breeding has yet to be established in Viet Nam.

### *Freshwater Fish*

The main freshwater species cultured in Viet Nam are *Pangasius* spp., *Puntius* spp., *Clarias macrocephalus*, *Ophiocephalus micropettes*, *Cyprinus carpio*, *Hypophthalmus nobilis*, *Ctenopharyngoden idellus*, *Tilapia mossambica*, *Osphreminus geramy*, *Clarias lazera*, *Labeo rohita*.

Freshwater cage culture has seen a major growth in Viet Nam. There are now about 7000 cages in the Red River Delta provinces and more than 2000 in the Mekong River Delta provinces. In northern Viet Nam, the main species cultured is grass carp (*Ctenopharyngodon idellus*), however farmers are now culturing bighead and Indian carps. In the northern and central parts of Viet Nam, polyculture of carps is a very common practice. In the southern part, intensive monoculture of catfish in cages is practised in some areas of the Mekong Delta. The average annual yield from freshwater fish culture in small ponds and lakes is about 1.5 mt/ha/year, in paddy fields about 150 kg/ha/year and in big reservoirs about 80 kg/ha/year.

Catfish (*Pangasius micronemus*) is the main species cultured in the southern provinces of Viet Nam. Since 1980, studies were undertaken to develop the spawning technology for the catfish. Two hatcheries in Thu Doc (Ho Chi Minh City) and Cai Be (Tien Giang Province) have produced more than 500,000 seeds with average body length of 8 - 10 cm.

Common carp (*Cyprinus carpio*), silver carp (*Hypophthalmichthys molitrix*), grass carp (*Ctenopharyngodon idellus*) and Indian carp (*Labeo rohita*) are the main cultured species. Production from carp polyculture in well-managed systems is about 7 - 8 mt/ha/year, however, majority of the fishponds produced only 50 - 500 kg/ha/year.

#### *Freshwater Prawn*

Freshwater prawn (*Macrobrachium rosenbergii*) is cultured using two methods, extensive method which produces about 80 - 150 kg/ha/crop and semi-intensive producing about 500 - 1000 kg/ha/crop. The country's production of freshwater prawn in 1991 was 3000 mt.

#### *Freshwater Oyster*

The freshwater oyster *Hyriopsis cumingii*, is found to give the best quality of pearl formation. Several state enterprises and households are experimenting on the production of this freshwater pearl oyster in lakes and rivers.

### Price Statistics

There are no official statistics on prices of fish at the landing sites due to varied buying prices for the same product in the different provinces in Viet Nam. The data available consisted of fragmented statistics collected from various processing plants for some export products.

### DISPOSITION OF CATCH

Fish products are classified into fresh, frozen, dried, salted, roasted, cooked, canned, live; and fish powder, fish meal, fish sauce, fish liver oil pill, surimi value-added forms.

Among the fishery and fish product exported are frozen shrimp, frozen squid and cuttlefish, frozen fish, dried products, and surimi.

### FISHERY SURVEY

Fishery survey is carried out using questionnaires, field visits, interviews, discussions, observations, inspection, reports provided by fishery establishments, reports from research institutions, production tax documents, Customs Office documents.

### PROBLEMS AND CONSTRAINTS

Since 1989, when the centrally-planned and subsidized regime of Viet Nam was changed into the Market Economy regime, it has become difficult to collect fishery statistical data especially data on fishery production and species composition from both the inland and marine fishery. The major constraints in improving the collection and compilation of fishery statistics are outlined below.

There is inadequate capital or budget to finance the operating activities related to the conduct of fishery census, as well as regular and timely collection of fishery statistical data.

Technical assistance in terms of facilities such as micro-computers and software technology, is lacking. There is also a shortage in trained technical staff in all levels of the activities. Added to this is the low educational level on the part of the fishermen which makes it difficult to extract from them accurate fishery data from them.

There is no standard methods of data collection and sampling techniques at all levels. Moreover, an integrated computerized information and management system is also lacking.

Therefore, in order to develop the national fishery statistical system for the better management and monitoring of the fishery sector of Viet Nam at all levels, action plans are identified as improving and modernizing the system of data collection and validation at the village, district and provincial levels; establishing a centralized computerized information system based on the networks of data gathering centers at the landing sites; enforcing the skippers and owners of motorized fishing boats to make a "note book" recording of their fishing activities; training of technical staff and providing computer facilities and software technology at all levels; implementing necessary training on appropriate data analysis and communication systems; and establishing cooperation and coordination with other countries and organizations at the regional and international levels.

Proceedings of the Regional Workshop  
on Fishery Information and Statistics  
in Asia (Vol. II)

**FISHERY STATISTICAL BULLETIN FOR THE  
SOUTH CHINA SEA AREA**

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**INTRODUCTION**

Since 1978, the Southeast Asian Fisheries Development Center (SEAFDEC) has published annually the Fishery Statistical Bulletin for the South China Sea Area starting with the statistics for 1977. The Bulletin is aimed at providing reliable and comparable fishery statistics with standardized definitions and classifications to facilitate the exchange of information for the management of fishery resources and the planning of various fishery development programs for countries bordering the South China Sea. This Bulletin has been recognized as a valuable source of reference on fishery statistics in the region and is well-accepted by all organizations and agencies as well as personnel concerned with the management and development of fisheries in Southeast Asia.

In 1973, SEAFDEC organized the Technical Seminar on Fishery Resources of the South China Sea in Bangkok, Thailand. One of the recommendations during the seminar was for SEAFDEC to establish a coordinating mechanism in a form of a working group consisting of responsible workers in the field of fishery statistics from its Member Countries and countries bordering the South China Sea. This is in order to complement the activities of the existing IPFC/IOFC Joint Working Party of Experts on Western Pacific and Indian Ocean Fisheries Statistics in implementing statistical programs within the area. The SEAFDEC Council of Directors during its Seventh Council Meeting in 1974, endorsed the recommendation thus, the First SEAFDEC Technical Workshop on Fishery Statistics was organized in Singapore in November 1976.



### FISHERY STATISTICAL BULLETIN

The First SEAFDEC Technical Workshop on Fishery Statistics aimed to exchange information on the statistics among the countries bordering the South China Sea Area and standardize the classifications and definitions of fishery statistics so that the national fishery statistics could be comparable within the region. The workshop discussed in general, production and fishing effort statistics required for regional fishery development and management planning. It was also agreed that, problems relating to the development of fishing effort data for regional use should be discussed in more detail at subsequent workshops.

The report of the workshop which including recommendations was submitted to the Ninth SEAFDEC Council Meeting in Tokyo in December 1976, where it was agreed that SEAFDEC should arrange a working party comprising international experts and national statisticians to finalize the content and format of the proposed Fishery Statistical Bulletin for the South China Sea Area.

The Second Technical Workshop on Fishery Statistics was convened in Bangkok in October 1977 in order to establish a clear definition for every statistical item based on FAO definitions, if available; review the proposed statistical tables and to lay-out the exact format of each table; examine and finalize classifications to be used for the Bulletin and to establish a clear definition of each statistical category; and work out questionnaires by which data required for each table are to be reported by the national fishery offices.

The workshop agreed on the following issues:

- a) Units of measurement used in the Bulletin should be standardized and that production, export and import statistics, in quantity should be represented in metric tons, while production, export and import statistics, in value should be expressed in US \$1,000; and that statistics concerning areas under culture should be reported in hectares
- b) Fishing boats, fishermen and marine catch, and the principles governing the area where they are located, should be defined
- c) Standard symbols and abbreviations should be used throughout the tables in the Bulletin

- d) For the summary of fishery production, the fishery sub-sector should be divided into marine fishery (capture only), inland capture fishery and aquaculture
- e) For marine fishery statistics, the order of the tables should be re-arranged and the terminology for the classification of fishing establishments should be by type of management
- f) Under inland fishery production, the tabulation of statistical data should be done on the same lines as in marine capture fishery, giving as far as possible, the gear-wise and species-wise classification of production for each important water body in a country
- g) Aquaculture production should be divided into mariculture, brackishwater culture and freshwater culture. Production statistics for each sub-sector should be divided into type of culture
- h) The disposition of catch should follow FAO's classification adding the category of live fish. This is also followed for the three fishery sub-sectors, namely, marine fishery, inland fishery and aquaculture. The unit of measuring catch disposed should be wet weight in metric tons
- i) The classification under fish processing, import and export statistics based on FAO classifications, was revised and modified
- j) Finally, the workshop recommended that the compilation and publication of the Fishery Statistical Bulletin for the South China Sea Area should be carried out by SEAFDEC.

In pursuance of the recommendations at the second workshop, the Third Technical Workshop on Fishery Statistics was convened in Bangkok in October 1978 in order to review the first issue of the Bulletin with a view of improving its contents for the subsequent issues, and exchange views and experiences on national fishery statistics with particular reference to the collection of statistics on small-scale fishery.

After reviewing the first issue of the Bulletin, the workshop agreed that:

- a) For powered and non-powered boats, the FAO classification of fishing boats as guideline, should be adopted

- b) A clarification on the concept of fishing establishment and its distinction from the notions of fishing unit and fishermen, should be provided
- c) On the standard classification of fishing gears, the classification adopted by FAO should be followed in order to assist the countries in the region to standardize their statistics, thus making the information comparable
- d) Regarding the distinction between mariculture and brackishwater culture, species according to their biological characteristics should be re-grouped. The column for milkfish culture in freshwater culture should be added
- e) The statistics of Export and Import in terms of countries of destination and origin should be retained only for the top ten most valuable fishery commodities.

In order to improve the subsequent issues of the Bulletin, the workshop agreed that the statistics for sub-areas of marine fishery should be provided, gear classification proposed by SEAFDEC should be adopted, a comparative data on general demographic, geographic and economic conditions of the countries concerned, should be included, and a brief diagrammatic presentation of summary statistics should be included.

The workshop finally recommended that the Bulletin be issued on an annual basis in view of the need for up-to-date statistics for the development of fisheries in the region and the increasing value of cumulative time series in planning and academic research.

After the third Technical Workshop, several developments took place regarding the fishery statistics program implemented by SEAFDEC. The format of the Bulletin was improved in response to the recommendations of the workshops. Some demographic and economic data in the general statistics section were already included while the format of the export and import of fishery commodities section was revised as recommended.

In 1979, the Fourth Technical Workshop on Fishery Statistics was convened in Bangkok in order to review the second issue of the Bulletin with a view of improving its

contents for the subsequent issues and to exchange views and experiences among national fishery statisticians and researchers including stock assessment specialists with particular reference to fishing effort statistics.

In order to assess the second issue of the Bulletin, the questionnaire used together with notes for its completion, was revised on the basis of the recommendations made at the third workshop and which were sent to the participating countries. Meanwhile, new statistics such as general geographic, demographic and economic statistics, statistics on price of fresh fish and summary statistics by type of fishing gears were added. On the other hand, statistics on the following items were revised: export by countries of destination, import by countries of origin and mariculture and brackishwater culture.

Moreover, some statistics were improved such as the marine fishery statistics of Peninsular Malaysia by area (West Coast and East Coast), the marine fishery statistics of the Philippines (in quantity) by area (Luzon, Visayas, Mindanao), and the annual series of Fishery Production Statistics although some of the data for Brunei, Cambodia and Viet Nam were obtained from the FAO Yearbook.

During the discussion on national statistics with emphasis on fishing effort statistics, it was noted that many countries in the region conduct surveys concerning fishing effort statistics. The workshop therefore, recommended that the Bulletin should be issued on an annual basis in view of the significance of up-to-date statistics for the development of fishery in the region, and that the subsequent issue of the Bulletin should include a brief diagrammatic presentation and analysis of the major statistics.

Since stock assessment study was considered a top priority, it was also recommended that catch and effort data be collected and compiled and that these data be included in the Bulletin. Furthermore, the SEAFDEC Council of Directors asked SEAFDEC to consider the standardization of a system for stock assessment study and relevant data collection with special reference to pelagic resource except for tuna and tuna-like fishes. Based on these developments, the fifth workshop was convened in 1980 where stock assessment and relevant statistics particularly catch-effort data, were discussed.

The issue was further discussed during the Seminar on Stock Assessment of Pelagic Resources with Emphasis on Shared Stocks which was held in Bangkok in 1981. The Seminar, which aimed to improve the existing method of stock assessment of the pelagic fisheries in the region also recognized the usefulness of compiling catch and effort data in relation to stock assessment of fishery resources for the area.

Thus, for the period from 1976 to 1980, five regional workshops were organized from which a positive outcome was the Fishery Statistical for the South China Sea Area. Nevertheless, there existed a growing demand to improve the content of the Bulletin in order to meet the requirements of fishery administrators and researchers in the region.

In 1986, the Sixth Regional Workshop on Fishery Statistics was convened in Bangkok to discuss the requirements for fishery statistics of fishery administrators and researchers in each participating country, review current practices for the collection and compilation of fishery statistics in each participating country and to exchange experience in improving the fishery statistics, review the contents of the Bulletin and suggest improvements for the convenience of various users, and discuss constraints in improving fishery statistics in the region.

The workshop discussed the important fishery statistics required for planning, management and development of fisheries in the region and compared the statistics available in each participating country based on the published statistical reports. Moreover, the standard classification for fishing gear in the region to meet recent technological developments, was amended.

The workshop agreed to review the standard classifications of fish species in order to meet the requirements of the various users and that SEAFDEC revise the species classification for small tuna in the Bulletin. The workshop also identified important data which could be improved in each country and encouraged an exchange of experiences among the participants, specifically on data related to catch-effort, economics, prices, aquaculture and inland fishery. The workshop also recognized the need to examine the definition of aquaculture and fish propagation.

The workshop further agreed that the objective of the Bulletin is to facilitate international comparison of fisheries between countries bordering the South China Sea



area. The standard classification of fish species was also reviewed at the workshop, particularly with regard to mackerel, tuna and shrimp. It was proposed that the name frigate mackerel be changed to frigate tuna but no decision was taken and the participants agreed to leave the issue to SEAFDEC, for further study.

The workshop agreed that Catch and Effort Statistics should be published separately from the Bulletin, and that the statistics should give data for each specific fishing ground.

The workshop finally recommended that SEAFDEC review and revise the standard classifications for fishing gear and species included in the Bulletin in order to meet the current situation of fisheries in the region. SEAFDEC should also establish an appropriate classification for aquaculture and develop statistical tables suitable for comparative analysis of productivity among the participating countries.

As the data are important to the users, these should not only be reliable but that these should be consistent with the data published and used by other organizations. It was noted that the growing number of organizations collecting data is placing an increasing demand on the national authorities for the supply of the needed information.

It was with a view of tackling these issues, along with some other recent developments which complicate the problem of collecting data, e.g., aquaculture and joint venture operations, that the Seventh Regional Workshop on Fishery Statistics was organized in Bangkok in 1989. The workshop aimed to examine the methods by which statistics are collected in participating countries, their coverage and reliability; consider means to encourage the cooperation between statistical collecting agencies, e.g., SEAFDEC and FAO, and to examine the possibility of a joint approach to national authorities for data collection; and review special problems in the collection and classification of data.

Major issues were discussed during the workshop, such as:

- a) Development of a common system for the collection of fishery statistical data, specifically a combined SEAFDEC and FAO questionnaire for the collection of



fishery statistics. This however, was not considered possible as SEAFDEC not only collects more information than FAO, but that national data are submitted to SEAFDEC much later than to FAO

- b) Adoption of the provisional definition of fisheries and aquaculture as proposed by SEAFDEC
- c) Adoption of the geographical basis for reporting of data as proposed by FAO, i.e., the boundaries of fishing areas 57 and 71 with several minor modifications
- d) The revised statistical classification of marine species was considered
- e) Modification of the SEAFDEC codification of species in line with the International Standard Statistical Classification of Aquatic Animals and Plants (ISSCAAP) and also with the distribution of commercially important species in the region, was considered
- f) Catch data of fishing vessels operating in foreign waters should be examined as regards their system of recording especially foreign landings
- g) Minimizing the problems in compiling data for the Bulletin such as timing and the long delay in the reporting of the data, as these have contributed much to the reduction of the value of the data for the users
- h) Review of the fishery statistics in Malaysia, Thailand, Indonesia, and the Philippines in order to get an overview of the fishery statistics in the region. It was noted that since 1965, the staff engaged in fishery statistics have been strengthened in these countries and the use of microcomputers for data processing has been introduced. However, in most countries, it still takes considerable time before fishery statistics for any given year can be released. On the other hand, the national fishery statistical standards have been fairly well developed in the countries where fishery censuses are conducted. Nevertheless, some improvements are needed in the statistical standards of many countries
- i) Regarding tuna catch statistics, data are collected from countries fishing for tuna and tuna-like species in the Indian Ocean and the Southeast Asian area. Many

countries are assisting the Indo-Pacific Tuna Management Programme (IPTP) in collecting and compiling data which could not be provided immediately by the national statistics

- j) The task to revise the form for the collection of data on fishery products was given to SEAFDEC

#### DATA COLLECTION AND COMPILATION

Data for the Bulletin are collected by means of a set of questionnaires. Together with the notes for their completion, the questionnaires are sent to the participating countries at the beginning of each year with the exception of Cambodia and Viet Nam. As for Malaysia, separate questionnaires are sent to Peninsular Malaysia, Sabah and Sarawak. For Indonesia, separate questionnaires are sent to the Central Bureau of Statistics and to the Directorate-General of Fisheries. This has resulted however, in some duplication of the data reported.

The completed questionnaires are returned to SEAFDEC by the participating countries. Since the compilation of data has not yet been possible for Viet Nam and Cambodia, the statistics on the Annual Series of Fishery Production are obtained from the FAO Yearbook of Fishery Statistics.

Data received from each country are checked against the entries in a country's yearbook, i.e., the Fishery Statistical Yearbook as in the case of Indonesia, if available. The data are then compiled and processed by SEAFDEC using LOTUS 1-2-3 software.

#### PROBLEMS, CONSTRAINTS, AND RECOMMENDATIONS

The major problem in the publication of the Bulletin is the timing and the long delay in the return of the questionnaires causing much reduced value of the statistics to the users. Other problems included submission of incomplete and incorrect information.

In order to expedite the publication of the Bulletin, statisticians from the participating countries are encouraged to submit data to SEAFDEC within the indicated submission period, i.e., not later than September of each year. It was also suggested that due to the heavy work load of the statisticians, an incentive allowance for the statisticians who complete the questionnaire may be provided.

Also, the staff responsible for compiling the questionnaires should check carefully all data before these are submitted to SEAFDEC. Furthermore, national agencies responsible for fishery statistics in each country should accomplish all items in the questionnaires with data available. Latest issue of the National Yearbook of Fishery Statistics, if available should be provided to SEAFDEC, as soon as possible in order to facilitate compilation and counter-checking of the data.

Proceedings of the Regional Workshop  
on Fishery Information and Statistics  
in Asia (Vol. II)

**SUGGESTED AMENDMENT TO THE CLASSIFICATION  
OF FISHERY COMMODITIES IN THE  
FISHERY STATISTICAL BULLETIN FOR THE  
SOUTH CHINA SEA AREA**

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**INTRODUCTION**

The Fishery Statistical Bulletin for the South China Sea Area provides useful data and figures on fishery production, price of fresh fish and production volume of various fish products and others. Over the years, many fish products are made available and are consumed in the region. The SEAFDEC Marine Fisheries Research Department (SEAFDEC/MFRD) conducted a survey on the Fish Products in Southeast Asia in 1985 and in 1989. The survey was designed to list the fish products available in the region and the technical problems and constraints in meeting the market requirements. The first survey had successfully listed down all the local fish products which can be classified into eleven main categories based on their processing outlooks and final products. Results of the survey indicated that some of the fish products can be upgraded to value-added products if attention is given to quality and better packaging.

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\* until January 1994

The 1989 survey recorded additional fish products not listed in the first survey, e.g., canned, frozen and comminuted products. Data on the pricing of raw materials and its final product, and the production and export volume of the products were documented from 1984 to 1987. It was noted that either these data are normally not available or are difficult to collect. The Bulletin, as recommended during the Sixth Regional Workshop on Fishery Statistics in Southeast Asia, Bangkok, July 1986 has helped solve this problem by adopting the same classification of products, except powdered product which is consumed in small quantities, as used in the inventory. The standardization of the classification and format for the compilation of data is needed to enhance fishery research information.

#### CLASSIFICATION OF DISPOSITION OF CATCH AND FISH PROCESSING SECTION

Many varieties of fish products which are consumed in the region are listed in SEAFDEC/MFRD's Inventory of Fish Products in Southeast Asia. The Inventory concentrates on the data and information on fish products of Southeast Asia listed into eleven categories, alphabetically, as follows:

- |               |                    |
|---------------|--------------------|
| 1. Boiled     | 7. Fish Meal       |
| 2. Canned     | 8. Frozen          |
| 3. Comminuted | 9. Powdered/flaked |
| 4. Cured      | 10. Smoked         |
| 5. Dried      | 11. Others         |
| 6. Fermented  |                    |

Data on these products include cost of raw materials and final products, production and export volume (1984-87), and shelf-life of the products. On the other hand, the category of fish products has been revised in the Section under Fish Processing in relation with the Inventory. These are listed under nine main categories in the Bulletin as follows:

- |                        |                           |
|------------------------|---------------------------|
| 1. Frozen              | 6. Cured                  |
| 2. Canned              | 7. Comminuted             |
| 3. Dried/salted/smoked | 8. Reduction              |
| 4. Fermented           | 9. Other fishery products |
| 5. Steamed/boiled      |                           |

The Bulletin has re-categorized the list of products based on the list in the Inventory except for "powdered/flaked" products which was temporarily removed as

this was not widely processed. However, this product is presently produced in Thailand as prawn dust and in Malaysia as fish floss although their production data are not yet available. As proposed during the 1986 Workshop on Fishery Statistics, this category should be included in the future should its consumption and production in the region substantially increase. Under the "Dried/salted/smoked" category, salting is part of the processing in the final dried and smoked products. Salting is also part of an important process in the processing of the other fishery products, e.g., cured, fermented, steamed/boiled products. In the cured product, the fish material is preserved in salt, vinegar or sugar without drying, e.g., shrimp in salt, pressed salt fish. Thus, salting is therefore a necessary process of the fish processing. In the "Dried/salted/smoked" category, the term Dried and smoked reflects the definition of the final product while salted indicates part of the process in the final product. It is therefore suggested that the term "salted" be removed from the category which should now be "Dried/smoked."

On the other hand, the categories of products for processing in the Disposition of Fish (Table 1) remains unchanged over the years although the fish are now processed into many popular fish products. The consumption of these fish products has increased and is now getting popular. It is therefore recommended that the listing of fish products in this section be made similar to the above categories, as in Fish Processing Section (Table 2) and hence, Cured and Comminuted Products could be included in the listing and that Comminuted should be split into Surimi and Other comminuted products, as in 1989.

Table 1. Disposition of Fish

Disposition	Type of Commodity Produced
1. Live fish	Live products: live for human consumption, fry and fingerling for aquaculture
2. Fresh fish	Fresh products: fresh, chilled or iced, round or dressed, fish fillets, cutlets, for human consumption



- |                               |  |
|-------------------------------|--|
| 3. For processing             |  |
| a. Freezing                   | Frozen products: frozen, round or dressed, fish fillets, cutlets                                 |
| b. Canning                    | Canned products: packed in airtight tin cans   |
| c. Dried/salted/smoked        | Dried, salted, smoked products   |
| d. Steamed/boiled             | Steamed, boiled products   |
| e. Fermented                  | Fermented products: sauces, juices, pastes, pickled  |
| f. Other fishery Products     | Comminuted products, powdered/flaked crackers and other processed products for human consumption |
| 4. For reduction              | Oils: edible and inedible oils, fish meals and fertilizers                                       |
| 5. For miscellaneous products | Bait, animal food stuffs, shell products, and products not described above.                      |

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Table 2. Fish Processing

Group of Commodities	Type of Commodities
1. Frozen	Frozen products: round or dressed fish, fillets, cutlets
2. Canned	Canned products: packed in airtight containers
3. Dried/salted/smoked	Dried, salted, smoked products
4. Steamed/boiled	Steamed, boiled or cooked fish
5. Fermented	Fish sauce, fish/shrimp paste, fermented fish/squid

- |                           |  |
|---------------------------|--|
| 6. Cured                  | Cured in salt or vinegar without drying, e.g., shrimp in salt, pressed salt fish   |
| 7. Comminuted             | Frozen surimi<br>Other comminuted fish products: fish jelly product, fish portion, e.g., fishball, fish sausages                       |
| 8. Reduction              | Fish oils, fish meals, fertilizers   |
| 9. Other fishery products | Crackers, seasoned dried cuttlefish, satay fish, fish floss, fish protein concentrate, products widely produced in the countries, etc. |

Moreover, under the Section on Exports by Fishery Commodity, many Miscellaneous products of aquatic plant origin are listed, such as:

- |                    |   |
|--------------------|---|
| 91. Brown seaweeds | 93. Green seaweeds                            |
| 92. Red seaweeds   | 94. Miscellaneous aquatic plants, e.g., algae |

The term algae refers to a group of plants, one-celled or many-celled, containing chlorophyll and having no true root, stem or leaf; and is found in water or in damp places. This therefore, includes fresh water aquarium plants.

On the other hand, seaweeds is any plant or plants growing in the sea, especially any marine algae and is important commercially for human food. Brown algae is also used either as human food, animal feed or fertilizer. It is therefore, suggested that items in the Miscellaneous category be clearly defined as cultured aquarium plants and seaweeds are used for different purposes.

Production data from Miscellaneous category has been increasing during the recent years especially now that red seaweeds is common in the Southeast Asian region while brown seaweeds is found in the temperate climate, e.g., China, Japan. Thus, it is suggested that data on red seaweeds of Southeast Asia be recorded on a separate column to give more emphasis on this product which is gaining popularity and is exported especially by Indonesia and the Philippines.

### PROBLEMS AND CONSTRAINTS

Problems were encountered during the compilation of the Survey on Fish Products in Southeast Asia. These problems are summarized below in order to avoid their duplication, in the future:

a) *Questionnaire forms*

Forms should be completely filled with data, unless otherwise indicated "NA" or "NIL." Responsible country coordinators should make sure that all forms are completed before returning these to the compilers. Unfilled, incomplete and delayed forms constitute a major problem in the compilation and processing.

b) *Information received*

Respondents should provide accurate data as much as possible. It has been very obvious that some data provided are misleading and are inaccurate. This is true in the case of export volume which oftentimes exceeds production volume.

### CONCLUSION

The Bulletin is a very useful source of data and information for the Southeast Asian region. It is hoped that with future edition incorporating the suggested improvements, the Bulletin could provide better service to scientists and other users in the region.

Proceedings of the Regional Workshop  
on Fishery Information and Statistics  
in Asia (Vol. II)

## THE FISHERY STATISTICS PROGRAMME OF FAO

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### INTRODUCTION

The FAO constitution requires that the Food and Agriculture Organization (FAO) should "collect, analyze, interpret, and disseminate information on nutrition, food and agriculture including fishery and forestry." The discharge of this responsibility as far as fisheries is concerned, is undertaken by the Fishery Information, Data and Statistics Service (FIDI) of the Department of Fisheries, FAO. It is assisted in this task, especially in the field of data required for econometric analysis, or for nutritional analysis, by other units in FAO.

To facilitate the reporting of consistent and accurate statistics, FAO has provided internationally agreed definitions for determining the nationality of the catch, i.e., by the flag vessel and the definition of aquaculture, in which the deliberations during the Regional Workshop on Fishery Statistics organized by the Southeast Asian Fisheries Development Center (SEAFDEC) in Bangkok, in October 1989, played an important role.

The concepts underlying fishery trade statistics are those established by the United Nations Statistical Commission. On the other hand, information on catches and landings is collected annually from the relevant national offices concerned with fishery statistics. Questionnaires are dispatched during the first half of the year for the preceding year's data, i.e., the 1993 data is requested in early 1994 and is aimed for publication in early 1995. This may seem a long time scale but it is conditioned by the speed with which national offices produce the data. Earlier

publication could be achieved but the information would be less complete with many repeated figures or estimates. Information on specific areas, species or countries is of course often available directly from the Fisheries Department's database ahead of the publication and could be used in making the estimates.

In the case of some aquatic products, data are also obtained from trade associations or other specialized international organizations to which such data are also submitted. In this way, the statistics are reviewed by subject matter specialists such as the International Whaling Commission and in the case of certain reptiles, by the World Conservation Monitoring Centre which is part of the IUCN - World Conservation Union.

Information on trade is generally derived by FAO from national sources either from published volumes of trade statistics or microfiche, made available by the UN Statistical Office, or in some cases, is derived from computer readable versions of the data. Obtaining information in this way saves time and effort for the supplying country, but the information made available by countries, often with fiscal consideration in mind, is not arranged in such a way as to be immediately useful for economic or nutritional analysis. Thus, imposing a further burden on FAO.

### QUESTIONNAIRES

Two basic series of questionnaires are presently in use for the collection of statistics on fishing, namely, the FISHSTAT NS (National Summary) and the STATLANT.

#### *FISHSTAT NS*

- NS 1 The most generalized request is the form NS 1. This is a computer printout containing national totals of species by area of capture. It contains data for the previous seven years, thus, permitting the possibility of revision with a blank for the most recent year. Data are requested in tons.
- NS 6 As in the case of the NS 1, the NS 6 contains a seven year time series for information on marine mammals. Data are requested in numbers.

- NS 7 Similar to other NS forms but this is for information on alligators which is cross-checked with the data from other international sources. Data are requested in numbers.
- NS 8 Similar to other NS forms but this is for information on sponges, pearls, and coral. Data are requested in kilograms.
- NS 9 For information on aquatic plants.

#### *STATLANT*

The STATLANT forms are for information on a more detailed basis such as where the fish are caught, than that of NS 1. The STATLANT system is thus, operative only in those marine areas which are sub-divided into smaller sub-areas. The STATLANT forms which collect information for only one year at a time, were introduced in the 1950s when the law of the sea issues were under active discussion and there was considerable international fishing activity. It was, however, never applied to the Western Pacific and is thus, for marine fishing which is of interest only to those countries which fish in waters where it is applied, i.e., the Atlantic and adjacent seas and the Antarctic. In 1988, in preparation for the proposed extension of the Coordinating Working Party on Atlantic Fishery Statistics mechanism to the Pacific Ocean, a questionnaire known as STATPAC 87A was established for countries fishing the southeast Pacific Ocean.

#### *FISHSTAT AQ*

The STATLANT system has been, however, adopted to collect information on other aspects of fisheries notably in 1984, for aquaculture using the FISHSTAT AQ questionnaire which is of interest to all Asian countries.

FISHSTAT AQ Three environments are recognized here, namely, freshwater, brackishwater and marine. Information on the annual production from hatcheries for further on-growing and for release to the wild is also requested. Unlike the catch reporting questionnaires, information is also sought on the price per kilo of each individual species identified. It is thus, possible to make comparisons on the more



relevant value of production rather than only the quantity produced. A separate section of the questionnaire requests information on the number and size of culture facilities by type of culture. The information collected is published in the FAO Fisheries Circular: Aquaculture Production.

Other FISHSTAT questionnaires are presented as a time series, thus, permitting also revisions of historical data. These include the following:

FISHSTAT FF FAO requests information on the number of vessels in national registers, their tonnage, length, horsepower, and type of vessel. The information relates to all national flag vessels available for fishing at 31 December of the year reported including industrial, artisanal and subsistence fishery and vessels employed in aquaculture operations. These data are published in the FAO Bulletin of Fishery Statistics: Fishery Fleet Statistics.

FISHSTAT FM Parallel to enquiring on the composition of fishing fleets, FAO also enquires annually on the number of persons engaged in fishing and fish or shellfish farming. Countries are requested to report full-time and part-time employment separately. However, since fishing may be a seasonal occupation, the criteria established include consideration of fishing as a source of livelihood as well. The FAO questionnaire includes a section in which countries are asked to provide annual statistics according to their national classifications.

FAO is in the process of revising its FISHSTAT FM questionnaire on fishery workers to take into account the international standard classification of occupations revised by the International Labour Organization in 1988, which allows the separation of those engaged in aquaculture activities from those employed by fishing and to introduce dis-aggregation of workers by sex.

**Disposition of Catch** - The questionnaire on disposition of the combined quantities of catches and landings and aquaculture is sent to countries annually to obtain information on the main forms of utilization of domestic production in live weight equivalent. In addition to "marketing fresh," three categories of food manufacturing channels are identified, namely, freezing; curing, i.e., drying, salting, smoking; and canning. Two categories are reserved for reduction to meal and oil, namely, whole fish destined for reduction and residual raw material from other forms of food processing, and "offal for reduction." The questionnaire defines a seventh category for other miscellaneous non-food uses.

**FISHSTAT FC** FAO also requests annual information on production of processed fishery commodities. This enquiry specifies the need for information on the net weight of fishery products produced both ashore and on board fishery vessels. Products produced from imported fish are also required to be reported. The questionnaire requests the provision of codes and a systematic list of species as well as standardized translations of fish names.

There are a number of other questionnaires which are not dispatched on a regular basis. These are:

**FISHSTAT CF** This questionnaire is utilized to collect the factors used by national authorities for the conversion of landed weight to live weight equivalent for various methods of processing fish on board the vessels. The frequency of this enquiry is occasional.

**FISHSTAT IW** A questionnaire for reporting catches in inland waters on behalf of the European Inland Fisheries Commission. This is limited to European countries only.

**FISHSTAT REC** This questionnaire was designed for an *ad hoc* survey to estimate recreational catches which are generally not reported in the FISHSTAT and STATLANT systems. The survey is not recurrent.

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## THE QUALITY OF CATCH AND AQUACULTURE STATISTICS SUBMITTED FAO

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### INTRODUCTION

There is an increasing awareness that fishery statistical information plays an important role in the formulation of policies, sectoral development plans and fishery management. The purpose of this paper is to review the quality of catch and aquaculture statistics for Asia and the Pacific, how this has changed over the last 20 years, and indicate how these statistics can be improved in the future.

### CATCH AND AQUACULTURE STATISTICS

The quality of national fishery statistics can be assessed by comparison with information from other sources, i.e., fishery projects and by checking for internal consistency amongst the national statistics from different sources, i.e., between production and trade statistics. The Fishery Information, Data and Statistics Service (FIDI) of the Food and Agriculture organization (FAO) constructs supply utilization accounts in order to calculate the per capita fish consumption and these often show discrepancies which can be used to identify erroneous production or trade statistics. Such checking, of course, required that both production and trade statistics are reported but this is often not the case.

In cases where data are not reported or are considered unreliable, FIDI makes estimates using the best available information which, in the worst situation, can be a repeated value from an earlier year. Such estimated values are identified as such with footnotes "F" or "R", in the FAO Yearbooks of Fishery Statistics. Thus, the proportion of the total production which is accounted for by estimated data, provides a general indicator of the quality of the statistical data. It must be stressed that this is not a definitive measure of the quality of the statistics. Undoubtedly, some reported statistics which are adopted by FIDI are erroneous, but it is a useful indicator of the general quality of the data in comparison with other areas. For catch and aquaculture statistics, some analysis of the proportions based on estimates is also presented in this paper.

#### Reliable Catch Statistics

Catch statistics collated by FIDI and published in the *FAO Yearbook of Fishery Statistics: Catches and Landings* include aquaculture production and thus, represent total production from the wild and farmed stocks in terms of weight. Value data are not at present collated by FIDI. The statistics included in the analyses discussed in this paper include all aquatic organisms with the exception of mammals, crocodiles, pearls, sponges, corals, and plants.

In 1991, out of a total world catch of 96.9 million tons, the estimated catches accounted for 6.7 million tons, or about 7% of the total. Prior to 1988, the proportion estimated represented about 4%, but since then it has increased. A higher-than-average estimated proportion may be expected for the last data year due to late reporting by some countries and this will subsequently be reduced.

For Asian inland waters, data show a marked increase in production with the proportion estimated, remaining roughly constant at a relatively low level. The situation for the marine major fishing areas in the region, including catches by non-Asian and Pacific countries, is not different from the world average levels. The proportion of the catch which is based on estimates is very low in area 77 in all but one year, and is reasonably high in area 61. In recent years, a high proportion of the catch in the Eastern Indian Ocean has been estimated, and this is mainly due to problems encountered by FAO with Malaysia statistics since 1987.

The proportions of the average catch for the period 1987-91 reported and estimated for the Asian and Pacific countries considered, had production of at least 1000 tons. Only four countries failed to submit any statistics or submitted statistics judged to be unreliable for the five-year period, and these were not the largest producers. The countries with the largest quantities estimated were the Democratic People's Republic of Korea, 1.71 million tons average estimate of annual catch for the years 1987-1991; Viet Nam about 820,000 tons; other Asia, 520,000 tons; and Malaysia, about 520,000 tons. If statistical systems were upgraded in these four countries so that statistics for the top 15 countries were all based on reported data, the total quantity estimated for the Asia and Pacific countries which is 3.76 million tons, would be reduced by 95%. The top 15 countries account for 98% of the total catch of the Asian and Pacific countries.

#### Reliable Aquaculture Statistics

Aquaculture production statistics in terms of weight and value have been collected by FIDI since 1984. As for the catch statistics, FIDI estimates are used in cases where data are missing or are considered unreliable.

Prior to 1990, the quantity of global aquaculture production, based on estimates, was between 8% and 15% of the total production. However, this fell in the following two years, and for 1991, the estimates accounted for 7% or 1.2 million tons. A recent improvement is not apparent in terms of value, where the estimated proportion has shown an increasing tendency. In 1991, for example, 14% or US\$ 4,000 million, of the total production value was estimated.

Overall aquaculture production in Asia and the Pacific has been growing since 1984 and it is therefore, important that effective statistical collection systems are established by all the major producing countries. Most aquaculture production occurs in inland waters as well as in marine waters of the Northwest Pacific.

The reported quantity and value statistics for inland aquaculture improved markedly in 1990 and 1991, due to improved reporting by India and a resumption of reporting by Indonesia following an absence of reports for 1988 and 1989. Viet Nam has not reported inland water aquaculture statistics in any year.



There has been a dearth of reported statistics for Western Indian Ocean, although India provided aquaculture production statistics for shrimp, the major species in the area, for 1991. Reporting of statistics, however, seems to be reasonably complete for the Eastern Indian Ocean. On the other hand, the proportion of aquaculture production in the Northwest Pacific, which is only estimated, is similar to the world average in terms of quantity but is higher for recent years in terms of value. A marked deterioration in the reporting of statistics for 1991 is evident for the West Central Pacific and this is mainly due to lack of reported data for Thailand for that year.

The proportions of the average quantity and value of aquaculture output for the period 1987-1991, reported and estimated for the Asian and Pacific countries, had production in excess of 100 tons. In contrast with the situation for catch statistics, only Sri Lanka failed to report statistics for all five years. In terms of value, the largest estimates, expressed as average values during the period 1987-1991, were made for China which was about US\$ 860 million; India, about US\$ 580 million; Viet Nam, about US\$ 320 million; and the Democratic People's Republic of Korea, about US\$ 300 million. If statistical systems were upgraded in these four countries, so that statistics for the top 10 countries are based on reported data, the estimates of the value of aquaculture production for the Asian and Pacific countries would be reduced by 99%. The total value of aquaculture production in Asian and Pacific countries is US\$ 19.31 billion and the top 10 countries account for 97% of this value.

#### Detail of Catch Statistics

FIDI, in the process of making estimates for missing data or of data which are considered unreliable, always take into consideration the quality of catch and aquaculture statistics. Every time FIDI makes estimates, many problems are encountered. Among the problems is the lack of detail in the statistics provided, particularly in relation to the description of species caught, although this is not a serious problem for aquaculture statistics.

Catch statistics reported to FAO should ideally refer to individual species but in some situations this is not possible, and hence data are only reported for groups of species. The names of the aggregated species groups used for reporting to FAO are generally denoted by the suffix



"nei" - not elsewhere identified and range in grouping scale from the extremely unspecific, i.e., marine fishes nei to the genus level such as *Sardinellas nei*. Whereas grouping at the later end of the scale may not be too serious. Highly aggregated groupings can seriously limit the usefulness of statistics, particularly when the quantities are large. Although grouping may be inevitable in some fisheries where species are not separated for landing and where sampling of the landings to determine species composition, is not feasible. Another serious shortcoming of very broad groupings is that the statistics are very difficult to validate.

The total catch for Asian and Pacific countries during the period 1970-1991 comprised catches identified to individual species and catches of aggregate groups of species, species items denoted as nei. It is clear that for the Asian and Pacific countries, a very large proportion, almost 50% of the total catch consists of species groups. This proportion shows little sign of decreasing and in absolute terms catches of such groups have increased as the total has increased. Most seriously, the quantities of the two broadest groupings, marine fishes nei and freshwater fishes nei, have been increasing in the Asia and Pacific region, although quantities for the rest of the world are at a much lower level and have remained fairly constant.

The relative importance of the nei groups in the Asia and Pacific region accounted for more than 100,000 tons in 1991. The very large proportions classified as marine fishes nei and freshwater fishes nei must be reduced if the quality of statistics is to be improved.

## STATISTICAL ENHANCEMENT ACTIVITIES

### Methodological and Operational Issues

Almost all fishery statistical assistance and training provided by FAO has been related to the collection and processing of catch and effort data from artisanal and industrial fisheries. It is important to take into consideration the current and anticipated needs for basic fishery statistical data. The following three issues should be considered when providing assistance and training for the improvement of the national fishery information systems in the region:

- a) Basic methodological and operational concepts in the collection and processing of data on catch and fishing effort
- b) Computer aspects related to the collection and processing of basic data
- c) Training requirements and upgrading of national skills in the sector of applied fishery statistics and computing.

From the methodological and operational viewpoint, almost all of the statistical systems that have been implemented in conjunction with FAO during the recent years deal with basic simple data, i.e., catch, effort, and prices. Census approaches are only used in specific sectors of the fishing industry where regular recording of all fishing activities is in place. Examples of census-based data collection schemes are log books of industrial fishery and observer programs. Thus, it is important to consider the methodological and operational aspects, in the design and implementation of medium or large-scale fishery surveys that are sample-based.

Whether data are collected by means of survey or census, it is important to make use of any available mechanism for checking the accuracy of the recording system. It should be noted that independent commercial data are sometimes available from markets or processors.

Although sample-based surveys differ from country to country, in terms of species, fishing gear, fishing methods, types of water bodies, it has nevertheless been possible to identify common elements in the formulation of three major types of sampling scheme. The classification of statistical surveys into sampling scheme types has direct methodological and operational implications. Increased effectiveness of a system within a specific statistical scheme type is always desirable but improvements cannot go beyond certain limits that are characteristic of a sampling scheme in place. Significant and drastic improvements in the accuracy and completeness of the collected data is achieved only when a statistical survey passes from a statistical sampling scheme of low performance onto the next higher sampling scheme. A brief description of the most basic sampling schemes is outlined with respect to their order of effectiveness.

### *Census on Fishing Efforts from all Beaches*

In the first type of data collection approach, fishing effort is completely enumerated from all landing sites, including beaches for the entire survey period, usually a calendar month. Depending on the precision required for data on fishing effort, records on fishing operations are regularly collected from all fishing units that have been active during the fishing period. This sampling scheme is the most accurate among sample-based surveys since it is making the least assumptions about the uniformity of fishing activities. However, it is also the most costly in terms of human resources since it requires a regular statistical coverage of all sites where landings occur. Usually, this approach requires close cooperation between the fishery administrations and other national institutions specializing in data collection and capable of mobilizing sufficient number of recorders for the collection of data on fishing effort.

### *Sampling Fishing Effort from All Beaches*

In this type of sample-based surveys, fishing effort is completely enumerated from landing sites including beaches, but only during a limited period of randomly selected sample days. Thus, collection of data on fishing effort is based on census in space, since all beaches are covered and sampling in time since only a limited number of days is involved. In this manner, the fishing effort over the entire period, i.e., month is estimated by first determining the mean daily effort on a by-gear basis and then raising to a monthly total by applying a time-raising factor. Also, in this approach, no frame surveys are required since the fishing effort is censused in space and then directly estimated on the basis of the number of sample days during a month. This approach is less accurate than the first since it makes several assumptions regarding the uniformity of fishing effort over the sampling period, but it is less costly because landing sites need be covered only during a limited period.

### *Sampling Fishing Effort from Selected Beaches*

In this type of sample-based surveys, both fishing effort and catch are sampled in space and time, and frame survey data are used in the estimation process. Only a limited number of selected beaches participate in the

samples and only for a limited period of sample days. In this manner, the fishing effort over the entire period, i.e., a month, and for all beaches is estimated by first determining the main daily effort on a by-gear basis and then raising to a monthly total by applying two raising factors: one referring to time and the second to gear units. In this approach, as opposed to the previous two statistical sampling schemes, frame surveys are required since the fishing effort must be estimated for all beaches by assuming that the activity level of boats and gears in the samples is not significantly different from that of the beaches not covered in the survey. Thus, this third type of sampling scheme is the most vulnerable in terms of bias and inaccuracies, in estimating total catch and effort but it is also the most economical in terms of staff resources.

#### *Computing Aspects*

The principle of an integrated "statistics-computing" approach has resulted from the gradual expansion of low-cost microcomputers which have become an inseparable component in the design and implementation of fishery statistical programs. Computers are now an essential part of survey design, decentralized storage and processing of primary data such as effort, landings, prices, and centrally performed analytical, and reporting and publishing functions. The introduction of this new technology changed significantly the essential qualifications and experience requirements on the part of both survey designers and national experts and users, thus, significantly affecting the training and skill upgrading requirements.

Primary fishery data, i.e., raw data obtained directly from beaches during catch and effort, and frame surveys are best organized and processed by means of well-defined databases and computer procedures that make maximum use of database concepts and techniques. This approach constitutes the cornerstone of medium- and large-scale statistical programs since it offers a number of major advantages such as flexibility, validation of data input, automatic estimation of fishing effort and catch, and report production.

Electronic spreadsheets and other types of applications software are best suited for secondary fishery data which are actually primary data that have already been processed.

Secondary data are usually of low volume and are used for a variety of purposes such as preparation of technical documents and summary reports, tabulations and graphical presentations.

#### *Implementation Aspects*

The self-sustaining nature of a statistical system has always been and continues to be a principal issue during the survey design and implementation. In this respect, experience shows that the results obtained were sometimes below expectation either because of methodological drawbacks, i.e., there is high degree of complexity and/or lack of adequate training of national experts, or because of operational constraints, i.e., lack of sufficient national staff and/or operational funds. The introduction of computers increased the computational capability of national administrations for the editing and storage of the collected information. On the other hand, it also increased the training needs since technical expertise in statistical aspects had to be supplemented with similar skills relating to computer-based concepts and techniques.

Past experience has shown that fishery statistical surveys are best implemented within the context of a Fishery Statistical Programme with the objective of integrating various specific surveys and studies into a single fishery information system. In almost all cases, this is a lengthy and costly process that should be undertaken in a stepwise manner involving the following major activities:

- a) Identification of long-term staff requirements for data collection, supervision and storage/processing of basic fishery data and the dissemination of fishery information and statistics to national, regional and international users
- b) Identification of short-term staff requirements for the implementation of pilot fishery surveys, later to be expanded at national level
- c) Identification of computing needs and operational means, i.e., transportation, recording materials for the pilot surveys
- d) Training of national staff at various levels, i.e., data collectors, supervisors, computer operators, statisticians, researchers in basic aspects of applied fishery statistics and computing



- e) Implementation of pilot surveys with built-in data processing functions
- f) Evaluation of pilot surveys and revision, where and when appropriate, of their methodological, operational and computational functions
- g) Stepwise expansion of pilot surveys to other fishery sectors and regions. Training of new staff and acquisition of additional computing and operational resources.

For medium- and large-scale fisheries, the implementation of such a modular approach would require from three to five years, depending on the variety, size and complexity of the artisanal fisheries. It should be noted that there are no international standards for the implementation of fishery surveys for artisanal fisheries and even within the same country, certain fishery sectors may justify the application of different survey approaches in both methodological and operational terms.

#### CONCLUSIONS

Using the proportion of the total production which is based on estimated values, due to the absence of reasonably reliable reported statistics as an indicator of the quality of the statistics, accepting that this is but one such indicator and taking into account the large proportion of catches unspecified by species, the following points can be made:

- a) Catch statistics for Asian and Pacific countries, in terms of quantities caught, are reasonably well reported by comparison with the world average. Catch quantity statistics could be improved most effectively by upgrading the collection systems in the major fishing countries for which reporting is currently incomplete or considered unreliable by FIDI, e.g., Democratic People's Republic of Korea, Viet Nam, Other Asia and Malaysia, so that statistics for the top 15 countries which account for 98% of the catch, are all based on reported data.



- b) Aquaculture production statistics for Asian and Pacific countries, in terms of quantity and value, are also reasonably well reported for most areas with the exception of the West Central Pacific where there has been a serious deterioration in data quality in recent years. Value data for aquaculture production in the Northwest Pacific have also deteriorated in recent years. There have, however, been notable improvements in some countries, e.g., India. In terms of value, the largest estimates were made for China, India, Viet Nam and the Democratic People's Republic of Korea. If statistics for the top 10 countries could all be based on reported data, the estimated component of the value of aquaculture production for the Asian and Pacific countries would be reduced by 99%.
- c) The single most serious problem concerning fishery statistics reported to FAO for Asia and the Pacific is the lack of detail concerning the species composition of the catches. Some countries may have more detailed information than is being provided to FAO at present, in which case national reporting offices are strongly requested to provide more specific data. In many cases, however, the problem can only be resolved by improving data collection schemes, e.g., by introducing sampling programs.

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**FISH AND FISHERY PRODUCTS  
INTERNATIONAL TRADE AND PRODUCTION STATISTICS  
IN THE ASIA AND PACIFIC REGION  
AND DEVELOPMENTS IN COMMODITY CLASSIFICATION**

by  
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**INTRODUCTION**

The collection, processing and dissemination of foreign trade statistics is generally accorded high priority by governments in their national statistical programs. Statistics on commodity movements across the borders are collected by complete enumeration and the data are generally considered more reliable than those, for example, of a country's production of the same commodity based on sample surveys of the firms. Foreign trade statistical systems have characteristics which are highly desirable in other data collection systems, since these are continuously maintained, the data is timely, the systems for storage and processing are technologically advanced, and the determination of the statistics either on a monthly, quarterly and annual basis, is generally adequate.

The fact that trade statistical systems are established primarily to respond to administrative and financial needs have, however, a major shortcoming. Figures collected are frequently used for objectives entirely different from those for which the systems were primarily designed. Different sets of users would benefit from even small variations to the classification in use or from the dissemination of data at a less aggregated level of detail. Some users' requirements could be easily accommodated into the system for little additional cost, thus, increasing the efficiency of the trade enquiry. This could be done easily provided adequate communication channels were established between the two sets of agents, those in charge of collecting data and major groups of data users.

This paper highlights some developments of common international trade classifications and on fish and fishery products therein, their shortcomings for tropical fishery systems, and proposes some improvements on a regional basis for the Asian and Pacific countries. The paper also intends to facilitate the achievement of a higher degree of harmonization of regional trade statistics thus, eventually facilitating regional economic integration.

#### FISHERY TRADE IN ASIA AND PACIFIC REGION

The Asian economies have continued to expand at a relatively high rate during the last decade. Economic activity in many Asian countries was stimulated by market-oriented policy reforms and a stable macro-economic environment as well as by policies which emphasized the export sector. However, for the region as a whole, fast growing incomes and the related demand for fishery products have been followed by a parallel increase in domestic production during the 1980s so that fishery imports have been fairly stable or even declining in several cases.

Trade of fish and fishery products has an important role in most Asian and Pacific countries. This is due to the traditional importance of fish in most Asian diets and in those of the island countries of the Pacific, which is in turn based on the availability of aquatic resources. The region taken as a whole, is a net importer of fish and fishery products. In 1991, the last year for which complete data have been compiled by FAO, the region's imports exceeded exports by US\$ 3.8 billion. Fishery exports amounted to US\$ 13.3 billion in value, nearly a threefold increase compared to that of 1982 and 4.6 million tons of products in their final weight in volume, as compared to 2.5 million tons in 1982. Imports, at US\$ 17.1 billion and 6.4 million tons of products, also increased more than three times in value and 2.6 times in volume compared to ten years before. There are however, significant sub-regional and national differences in Asia and Pacific. The balance of fishery trade is positive for the Association of Southeast Asian Nations (ASEAN) regional grouping, with Thailand, Indonesia, the Philippines and Malaysia having exports which exceed imports, and the Republic of Korea, Australia, New Zealand, China, Viet Nam, and Myanmar. The balance of fishery trade is negative in Japan where the demand for fish, still the traditional major source of animal protein food despite the growing importance of meat, is no longer met by national production. In all countries of the South

Asian Association for Regional Cooperation (SAARC), the fishery sector contributes to foreign exchange earnings with fishery imports either negligible or nil, as is the case of India, Bangladesh, Pakistan and the Maldives. In most developing economies of Oceania, fisheries are a net earner of foreign exchange and has taken over all the volume of fishery imports balancing that of exports.

Regional exports and imports are both very diversified in terms of species and commodities. The products traded range from shrimps and prawns to tunas, live fish for food or culture and ornamental purposes, frozen and preserved cephalopods, pastes and fermented products, canned mackerel, pilchard and tuna, frozen whole fish, filleted and minced, shark fins dried, sea cucumbers and dried jellyfish. The unit value of the commodities exported by sub-regional groupings of developing countries is higher than that of the imported ones, with high priced fish and shellfish varieties being mostly produced for export. There are prospects of further growth of fishery exports in both quantity and value for the developing countries of the region and significant foreign currency earnings are expected to continue, although some adjustment in net earnings will occur if fish imports are to increasingly satisfy national demands with most marine and inland stocks fished up to their sustainable level.

There is growing awareness that greater integration in the world economy and trade liberalization contribute to accelerate economic development and to improve people's standards of living. With the conclusion in December 1993 of the Uruguay Round which was launched in September 1986 to bring about further liberalization of world trade, agriculture commodities trade will be integrated more fully into the General Agreement on Tariffs and Trade (GATT).

The setting up of the Asian Free Trade Association (AFTA) by ASEAN in the fall of 1991, provides for the establishment of a regional customs union among Brunei, Indonesia, Malaysia, the Philippines, Singapore, and Thailand which would gradually lead to the creation of a single Asian market. The application of common tariffs to some agricultural products is also being considered. The major institutional changes of the former USSR and the assumption of independence of the individual republics, has opened the possibility for closer economic cooperation between the six Asian republics of the former USSR and the rest of the region while the collapse of the CMEA trade links may bring increased opportunities of trade to the Asia region.

Although the increase in the number of regional arrangements has heightened concern about the possible weakening of the multilateral trading system and the splitting of the world into major economic blocs, more or less self-contained, these agreements offer the opportunity for increasing intra-regional trade.

All the above indicates how desirable it is for the Asia and Pacific region to harmonize statistical reporting of their foreign trade including that of fishery products.

#### INTERNATIONAL FOREIGN TRADE CLASSIFICATIONS

The advantages of using a common trade classification have long been recognized. These are, to facilitate international trade by standardizing documentation, to facilitate the collection, comparison and analysis of statistics on international trade, and to facilitate the transmission of data.

More recently, the importance of accurate and comparable data for the purpose of international trade negotiations has also received wider recognition. There are two major international trade classifications used to report and disseminate national foreign trade statistics worldwide, namely, the Standard International Trade Classifications (SITC) of the United Nations, and the Harmonized Commodity Description and Coding System, based on the Tariff Nomenclature of the Customs Cooperation Council, formerly, the Brussels Tariff Nomenclature (BTN). Based on SITC and BTN, an International Standard Statistical Classification of Fishery Commodities (ISSCFC) has also been developed by FAO for compiling at a finer level of species and commodities dis-aggregation, annual production and trade statistics of fishery commodities in its Fishery Yearbook.

#### Standard International Trade Classification (SITC)

The foundation of the UN trade classification lies in the *Minimum List of Commodities for International Trade Statistics* established in 1938 by the League of Nations Committee of Statistical Experts for achieving greater comparability of foreign trade statistics. The Minimum List, revised to take into account both changes in the structure of international trade and the need of countries, intergovernmental bodies and international agencies for greater comparability of trade data, resulted in the establishment of the SITC in 1950. The classification



responded to the continuing and growing need for regular information on international trade in a comparable form by international agencies, the need to revise obsolete national trade classifications and the need to ease national reporting to international agencies and avoid wasteful duplication work.

SITC originally included 570 items (five-digit level), arranged into 150 groups (three-digit level), assembled in turn into 52 divisions (two-digit level). The divisions were consolidated into 10 sections (one digit), each one representing broad economic categories. Countries were encouraged to either expand or contract SITC to meet their national needs. The expansion was to be done using suffix decimal codes in addition to the five-digit SITC codes.

Edible fish, shellfish and other aquatic invertebrates were to be found in Section 0. FOOD, Division 03. FISH AND FISH PREPARATIONS, while Division 08. FEEDING STUFF FOR ANIMALS, referred to fish meal as part of item 081-04 MEAT MEAL (INCLUDING TANKAGE) AND FISH MEAL. Section 4. ANIMAL AND VEGETABLE OILS AND FATS, included item 411.01. OILS FROM FISH AND MARINE MAMMALS, and various inedible products of aquatic origin were to be found in other sections and divisions. SITC has been revised at some 10 year intervals following increases in the volume of world trade and changes in commodity patterns.

The United Nations Statistical Office produced the third revision of SITC in 1988, taking account the need for continuity with the second revision and several other criteria including the nature of the merchandise, its processing stage and the importance of the commodity in terms of world trade.

While in previous revisions the number of items allocated to fishery commodities had remained virtually unaltered, in SITC Rev 3 fishery commodities of Division 03 were accorded 42 five-digit items mainly reflecting emerging trends in fishery trade due to technological developments, namely the increase in trade of live, fresh, chilled, refrigerated and frozen products in contrast to the prevalence of preserved fishery products in previous decades.

Since the introduction of SITC, many countries used it as a basis to compile trade by commodity data or to develop their customs nomenclature. Trade statistics reported according to SITC are still the basis for world economic



analyses of trade which require that commodities are aggregated by class of usage, e.g., food.

Although the Rev 3 was recommended for reporting trade for 1988, there are still many countries lagging behind with this recommendation and reporting trade according to the more aggregated SITC 2.

#### **Customs Cooperation Council Tariff Nomenclature (BTN/CCCN) and Harmonized System (HS)**

Since the establishment of the Customs Cooperation Council (CCC) in 1950, in many European and other countries the nomenclature for the classification of goods in customs tariffs has been BTN which was introduced in 1955. The Nomenclature, whose original and primary purpose was the levying of duties on imported goods, has undergone revisions on a regular basis. The 1972 BTN, under the pressure of users who found its subdivisions insufficient for their needs, evolved into the CCCN and CCC undertook to develop and complete a Harmonized Commodity Description and Coding System or HS in cooperation with other international agencies concerned with statistical and other aspects of trade. The CCCN four-digit categories expanded into the 5016 six-digit headings of HS, was implemented starting with the 1988 trade statistics. Also the list of fishery commodities was accorded a commensurate increase. Following the widespread adoption of HS or its use as a guide for developing national systems, most series of international trade statistics are not comparable before and after 1988. Very general headings conveying little information to the economic analyst have however, been reduced, e.g., "Crustaceans and molluscs, prepared or preserved" imported by Asia and Pacific countries has dropped from 43,000 t in 1987 to 2150 t in 1988 upon the reporting according to the headings of the Harmonized System, and trade statistics have been allocated more precisely to the appropriate heading.

#### **The FAO International Standard Statistical Classification of Fishery Commodities (ISSCFC)**

In order to meet the special requirements of fishery data users, attention has been devoted by FAO since its beginning to the statistical information needs of the tertiary phase of the fishing industry. Admittedly, this part of the statistical information has not been developed to the extent envisaged when the foundations of the system were being laid, mainly because most regional commissions

which cooperate closely with FAO on fishery statistics through a coordinating mechanism, do not collect and publish fishery commodity statistics. There are also inherent difficulties, at national level, in the collection of reliable fishery products data particularly in those countries where processing units are small-scale and less easily surveyable than large factories.

In order to classify properly national production and trade details and to increase the usefulness of the statistics for commodity analysis it was a necessary for finer level of species and commodities dis-aggregation than that of SITC. The latter has however, been the basis of the FAO classification and close correlation has been maintained also with BTN and later HS. In establishing ISSCFC, FAO has taken special care to link the fishery commodity classification to the International Standard Statistical Classification of Aquatic Animals and Plants (ISSCAAP) used to collate world catch and aquaculture statistics and widely recognized as the world authority to report on commercial fishery.

The statistics of fishery commodities production and trade collated by FAO have been concerned with seven major groups of fairly homogeneous products, which originally corresponded to SITC "items" and BTN "headings." For purposes of world-wide comparability, these broad groupings have been maintained in the structure of the FAO Fishery Yearbook tabulations.

The FAO fishery commodity classification encompasses all edible fish and shellfish commodities included in Division 03 of SITC, the fish oils and fish meals. Although provision exists for other fishery products, edible and inedible, to be found elsewhere in SITC, trade statistics for those products are not collected on a regular basis. The standardization of trade questionnaires to meet SITC groups, and the bigger difficulty in assembling national statistics on those products, and consequently the unsatisfactory world-wide production and trade coverage, little by little has sanctioned the exclusion of inedible dead fish, crustaceans and molluscs used as crude and raw fertilizer, in position 562.99 of the SITC Rev 3, and a great variety of inedible products and preparations derived from fish and shellfish and other aquatic invertebrates and included elsewhere in the SITC structure, namely:

- in position 211.9 - fish skins
- in position 291.15 - corals, shells from molluscs, bones from cuttlefish
- in position 291.96 - inedible products of fish, crustaceans, molluscs and aquatic invertebrates, including: fertile fish eggs for hatching; fish eggs, inedible for use as bait; heads, stomach, maws, guts, viscera and other offal; scales and fins; whole animals inedible
- in position 291.97 - natural sponges
- in position 667.1 - pearls (natural and cultured)
- in position 098.5 - soups, broths, chowders
- in position 098.99 - protein concentrates, extracts, juices
- in position 012.92 - frog's legs

Another major exclusion consolidated by FAO but requiring attention are trade statistics of aquatic plants intended to cover the marine algae - seaweeds, the freshwater algae and water weeds, e.g., water cress, water chestnuts and water hyacinth, in position 292.97, and products thereof, e.g., agar-agar.

For the above products in certain instances, there are already separate categories providing for their exclusive, separate identification in the international classifications. However, in most other cases, they would be identifiable as individual statistical categories only in the national import and/or export of those countries where the international trade in these products are sufficiently important to justify their separate identification. Many of the above products are of regional interest to countries in Asia and Pacific and their exclusion from standard data compilations means that the contribution of the fishery sector to the national economy is understated.

#### Development in International Trade Classifications

When these were established, both the UN and CCC classifications were rapidly adopted by most countries, which have seen to it that classifications included species important in their regions, and fishery products and processing methods significant in their industry. As a result, Atlantic Ocean species are better identified in common trade classifications than those occurring in other oceans.

Over the last three decades, the use of the classifications has also spread among developing countries. This development was paralleled by the development of trade as a means of economic growth in developing countries and by improved communication among countries. Despite the expansion of the number of fishery items in SITC Rev 3, many species of regional interest to Asia and Pacific are not yet separately identified in the classification at five-digit level, while reporting beyond the fifth digit is left to national initiatives according to the countries' reporting needs.

Although HS is now in use in many Asia and Pacific countries, the 1992 version of HS is being revised for implementation in 1996. This offers the opportunity for homogeneous groups of users to exert some vigilance and pressure on the responsible national institutions for the inclusion of specifications of regional importance in common foreign trade classifications.

Over the years, continued international cooperation of concerned parties has ensured that correspondence was established between individual codes of SITC and BTN/CCN first and then HS later. In the years to come, there will be even closer cooperation at international levels since the UN Statistical Commission recently decided to use HS as the basis for the collection of trade data. UN's COMTRADE database is now also maintained in terms of the Harmonized System. It is intended to incorporate into commercial commodity description and coding systems, HS classification and also to promote a close correlation between imports and exports trade statistics.

A computerized commodity database is also being developed on CD-ROM by the CCC. Upon completion of the work, the quality of the trade data will also improve as it will be easier for customs officials to classify trade commodities. The database will be an important tool for statisticians as well.

Problems of statistical nature based on international trade classifications are being addressed in several specialized fora where international agencies including FAO, participate, e.g., the Task Force on International Trade Classifications. Increasing attention is being paid internationally to the possibility of certifying fishery species and commodities quality and origin similar to the established practice for certain agriculture products. Already some aquaculture products, e.g., salmon and oyster,



can be certified for quality. In 1992, a rule of the Council of the European Union has introduced the concept of Certified Geographical Origin for certain species. The spread of such practice and the parallel requirement of a systematic surveillance plan by authorized institutions will make the reference to a national list of fishery species and products an essential requirement.

#### FAO Fishery Commodity Statistical Database

At present, the FAO/ISSCFC includes some 450 individual combinations of commodities by species and/or species groups. The classification is very flexible and allows expansion for accommodating the inclusion of new commodities and codes to follow the evolution of the fishery processing and trading sectors and monitoring the emergence of fishery products so far, of national relevance in foreign trade. Since all national descriptions and codes are stored in the database, the reclassification of entries according to new codes being introduced does not pose problems.

However, unless the reporting of countries where there is an important fishing industry is done with comparable standards of commodities identification, world-wide and region-wise statistical aggregations are of little significance. For instance, in Asia and Pacific countries' exports, freshwater species are all grouped together; individual species of fish belonging to the populous ISSCAAP group 33, e.g., redfishes, basses, congers, etc., are identified by a handful of countries, and the majority of fresh and chilled and frozen products exported are still to be found in items such as "Marine fish not elsewhere identified."

FAO collates fishery commodities production on the basis of standardized but country-tailored questionnaires to report processed fishery products, the FISHSTAT FC. The source of trade statistics are published data, machine readable products and other sources, e.g., statistical trade questionnaires for the whole agriculture sector, FAO project reports. However, its fishery trade record may differ from those stored in the UN COMTRADE. National practices may depart from the internationally agreed practice of including in imports, the direct landings by foreign fishing vessels into national ports and the purchases "over the side" occurring at sea; and in exports, the direct landings of the national flag fishing vessels in foreign ports and the sales

"over the side" occurring at sea. When the amount of direct landings abroad and/or transactions over-the-side are known, FAO adjusts official trade statistics to conform with the internationally recommended practice.

In the absence of officially reported trade statistics for any one year, FAO estimates the annual national fishery statistics. The method followed is the compilation of imports and exports by commodity utilizing the data reported by major trading partners. This task has become less laborious due to greater availability to FAO of fishery trade data on tapes.

For instance, in the fishery commodities of the FAO Yearbook of 1991, 14 Asia and Pacific countries did not provide information on time for inclusion in the database and five did not make available trade in any form. Statistics of processed commodities officially submitted to FAO are very scanty, and failing to have alternative industry sources available, they are generally estimated on the basis of domestic export statistics.

The FAO fishery commodities database has been computerized starting with production and trade data of 1976. At that time, limitations in the hardware and in resources did not permit to establish database with countries of origin of imports and destination of exports. The information therefore, which used to be provided for major fishery trading countries in the Yearbook was discontinued.

The present VAX 4000 is used for data input and simple retrieval, and a main frame computer for more complex analytical tabulations and the production of the Yearbook. The latter is however, also disseminated in machine readable form either as a standard tape or diskettes for personal computers (PCs).

Work is in progress in FAO for allowing outside users, direct access to the fishery, forestry and agricultural databases. In preparation for such developments and in order to facilitate direct data retrieval for users not familiar with commodity classification structure, FAO is introducing a rearrangement to its commodity descriptions. Each fishery commodity will be identified by the preservation process, the aquatic animal part used in the process, and when applicable, by other descriptions such as flavors, other qualifiers of grade, type.



Based on international and national trade classifications in use, the most frequently recurring terms have been identified and can be used in combination with any species. However, in order to reduce to a manageable size the classification, it is essential to identify the actual combinations of each commercial fish and shellfish species with any of the elements included above found in the national trade classifications.

#### RECOMMENDATIONS

Countries should be encouraged to produce, through cooperation between industry and government statisticians, a national list of the commercially most important inland and marine aquatic organisms and products thereof, and a system of coding. Such classifications should provide for the systematic inclusion of all aquatic animals and plants and avoid imprecise terminology for describing the processing, thus, increasing its value as a means to monitor trends and avoid loss of important information.

Sub-regional groupings of countries where trade cooperation agreements exist should consider the harmonization of codes beyond the fifth digit of the SITC or the sixth digit of the HS to report statistics of products by species of regional interest. These lists should be based on those agreed first at national joint industry or government committees.

Countries should collect and report statistics of production, imports and exports of fishery commodities using the same classification.

International agencies should consider in their fishery statistical data compilations, the inclusion of fishery products, e.g., aquatic plants which are important export items in Asia and Pacific in order to provide a more accurate and detailed description of the contribution of fishery to the economy and to increase the efficiency of statistical reports in monitoring trends by species.

Proceedings of the Regional Workshop  
on Fishery Information and Statistics  
in Asia (Vol. II)

**PROPOSED FORMAT FOR THE  
CATCH-EFFORT STATISTICS FOR  
THE SOUTH CHINA SEA AREA**

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**INTRODUCTION**

The Catch and Effort Statistics for the South China Sea Area is now being compiled and published as a separate bulletin by the Marine Fishery Resources Development and Management Department of the Southeast Asian Fisheries Development Center (SEAFDEC/MFRDMD). This bulletin was previously part of the Fishery Statistical Bulletin for the South China Sea Area, compiled and published by SEAFDEC Training Department.

Three categories of statistics are included in the Bulletin, namely, Annual Catch-Effort Statistics, Monthly Catch-Effort Statistics and Specific Data on Catch-Effort. Compilation of the Bulletin will be based on returns from the participating countries which will be provided with questionnaires. Concerned authorities in the participating countries will be requested to accomplish the questionnaires properly and have these returned to SEAFDEC/MFRDMD. Together with the questionnaires, is the Notes on the Completion of the Questionnaire, for the guidance of the concerned authorities.

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2. Classification and Code Number of Species
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#### EXPLANATORY NOTES

##### 1. *General Notes*

###### 1.1 Data collection

The data compiled in this Bulletin are, in principle, based on the returns from the authority concerned in each country, to a questionnaire prepared by SEAPDEC/MFRDMD.

###### 1.2 Time Reference

Data in this Bulletin refer to the year 199\_

###### 1.3 Standard Symbols and Unit of Catch

The following standard symbols are used throughout the tables in this Bulletin:

- ... = not available
- = magnitude zero or not applicable

Catch quantity is shown in metric tons. However, there are some exceptions in section "III. Specific Data on Catch-Effort."

##### 2. *Notes on Statistics*

###### 2.1 Category of Statistics

- 1) Annual Catch-effort Statistics --- Annual catch and effort data broken down into fishing gear and boat size category are described.

- 2) Monthly Catch-effort Statistics --- Monthly catch and effort data broken down into fishing gear and boat size category are described.
- 3) Specific Data on Catch-Effort --- Data which can not be applied for the above two categories, are described.

## 2.2 Classification and coverage of Fishing Gears

Five major types of fishing gear are selected for the compilation of the annual and monthly statistics on marine catch by fishing gear, namely, Otter trawl, Pair Trawl, One Boat Purse Seine, Drift Gill Net and Long line. Please describe the particular or specific name of fishing gear, if available, in the questionnaire. Please refer to the following table which shows slight modification on regional classification of fishing gear. The other kinds of fishing gear, especially hand line, pole-and-line and gill net are defined for the statistics, however, descriptions of such information will be suggested.

## 2.3 Classification of Fishing Boats

Fishing boats are classified into classes by their tonnage (GRT Class) which comprise five broad categories, i.e., 10 (GRT<10), 10 - 20 (10 $\mu$ GRT<20), 20 - 50 (20 $\mu$ GRT<50), 50 - 100 (50 $\mu$ GRT<100), and over 100 (100<GRT) tons.

## 2.4 Coverage of Fishing Efforts

The units of fishing effort are classified for each GRT class boat size.

- 1) Number of fishing units
- 2) Number of trips
- 3) Number of days
- 4) Number of hauls
- 5) Number of hours (operating hours are from start shooting until start of hauling, in the case of trawling, and excluding searching hours for fish schools in the case of purse seining.
- 6) Number of hooks (Long line only)

If other fishing efforts can be defined, describe the data in detail.



## 2.5 Others

Countries and sub-areas for the statistics, classification and code number of species, and list of marine species with codes of SEAFDEC and the International Standard Statistical Classification of Aquatic Animals and Plants (ISSCAAP) of FAO, are shown in the Annexes.

*Annexes*

## 1. Countries and Sub-areas for the Statistics

Countries and sub-areas to be used in catch-effort statistics are as follows:

- 1) Brunei
- 2) Taiwan
- 3) Hong Kong
- 4) Indonesia
  - 4)-1 West Coast of Sumatra
  - 4)-2 South Coast of Java
  - 4)-3 Malacca Straits
  - 4)-4 East Coast of Sumatra
  - 4)-5 North Coast of Java
  - 4)-6 Bali and Nusa Tenggara
  - 4)-7 Kalimantan
  - 4)-8 Sulawesi
  - 4)-9 Maluku and Irian Jaya
- 5) Kampuchea
- 6) Malaysia
  - 6)-1 West Coast of Peninsular Malaysia
  - 6)-2 East Coast of Peninsular Malaysia
  - 6)-3 Sabah
  - 6)-4 Sarawak
- 7) Philippines
  - 7)-1 Luzon
  - 7)-2 Visayas
  - 7)-3 Mindanao
- 8) Singapore
- 9) Thailand
- 10) Viet Nam

In Specific Data on Catch-effort, some particular areas which are defined in the remarks are applied.

## 2. Classification and Code Number of Species

### 1) Catch by Species

The catch should be broken down by species or group of species. The standard statistical classification of marine species was amended based on the recommendation during the Seventh Regional Workshop on Fishery Statistics (1989). The revision took into account the comments of the participating countries during the workshop.

### 2) Species code Number

The species code number, previously assigned by SEAFDEC for the Fishery Statistical Bulletin, was changed from a "three-digit number" to "four-digit number." The four-digit number will be added to the list to allow for further sub-division of the species groups, when required.

### 3) Definition of Species Code Number

The first two digits show the group number taken from ISSCAAP (FAO Yearbook). This group number should not be changed, even if the ISSCAAP grouping has been changed. The last two digits show the particular species within a group, starting from 01.

### 4) Names of Family

In all cases, the family names of species have been taken from a single reference (Greenwood, P.H., D.E. Rosen, S.H. Weitzman and G.S. Myers. 1966. Phyletic studies of teleostan fishes, with a provisional classification of living forms. Bull. Amer. Mus. Nat. Hist., 131(4): 339 - 456.), to allow clear selection, with out taxonomical confusion, of teleostan fishes.

### 5) English and Scientific Name

As the English names for species vary quite considerably, the species codes have been based on the scientific name of the species.

Table 1. Regional classification of fishing gear

Major group	Sub-group	Examples for particular name
1. Surrounding net	1.1 With purse line (a) One boat purse seine	Anchovy purse seine Sardine purse seine Tuna purse seine, etc. (Light luring purse seine, Payao luring purse seine)
	(b) Two boat purse seine 1.2 Without purse line	Chinese purse seine Surrounding net, etc.
2. Seine net	2.1 Beach seine	Beach seine
	2.2 Boat seine	Danish seine, etc.
3. Trawl	3.1 Otter trawl	Bottom trawl Shrimp trawl
	3.2 Otter trawl with boom	Double rigger otter trawl Baby trawl
	3.3 Pair trawl	Pair trawl
	3.4 Beam trawl	Beam trawl Double rigger beam trawl, etc.
4. Gill net	4.1 Drift gill net	Spanish mackerel gill net Bonito gill net Trammel net
	4.2 Set gill net	Bottom gill net
	4.3 Encircling gill net	Encircling gill net
5. Lift net	-	Stick held dip net Stick held lift net Stick held cast net, etc.
6. Trap	-	Fyke net Stake trap, etc.
7. Hook-and-line	-	Pole-and-line Handline Longline, etc.
8. Push net	-	Portable push net Engine boat push net, etc.
9. Shellfish and seaweed collecting gear	-	-
10. Others	-	-

CATCH-EFFORT STATISTICAL BULLETIN

FOR THE SOUTH CHINA SEA AREA

I. Category of Statistics

1. Annual Catch-effort Statistics
2. Monthly Catch-effort Statistics
3. Specific Data on Catch-effort

II. Data Collection System

MFRDMD/SEAFDEC prepares and sends the Questionnaire to the authority concerned in each country. AND THEN, MFRDMD compiles the Catch-effort Statistical Bulletin based upon the returns from each country.

III. Questionnaire

1. Questionnaire
2. Notes on Completion of Questionnaire

## 3. Specific Data on Catch-effort

Country & sub-area	Fishing gear	Gear	Gear	Gear	Gear	Gear
		A	B	C	D	E
Brunei		.....	.....	.....	.....	.....
Taiwan		.....	.....	.....	.....	.....
Hong Kong		.....	.....	.....	.....	.....
Indonesia		.....	.....	.....	.....	.....
West Sumatra		.....	.....	.....	.....	.....
South Java		.....	.....	.....	.....	.....
Malacca Strait, Sumatra		.....	.....	.....	.....	.....
East Sumatra		.....	.....	.....	.....	.....
North Java		.....	.....	.....	.....	.....
Bali, Nusa Tenggara		.....	.....	.....	.....	.....
Kalimantan		.....	.....	.....	.....	.....
Sulawesi		.....	.....	.....	.....	.....
Maluku and Irian Jaya		.....	.....	.....	.....	.....
Kampuchea		.....	.....	.....	.....	.....
Malaysia		.....	.....	.....	.....	.....
West coast		.....	.....	.....	.....	.....
East coast		.....	.....	.....	.....	.....
Sabah		.....	.....	.....	.....	.....
Sarawak		.....	.....	.....	.....	.....
Philippines		.....	.....	.....	.....	.....
Luzon		.....	.....	.....	.....	.....
Visayas		.....	.....	.....	.....	.....
Mindanao		.....	.....	.....	.....	.....
Singapore		.....	.....	.....	.....	.....
Thailand		.....	.....	.....	.....	.....
Gulf of Thailand		.....	.....	.....	.....	.....
Indian Ocean		.....	.....	.....	.....	.....
Viet Nam		.....	.....	.....	.....	.....

Abbreviations: U, number of Fishing units; T, number of trips; D, number of days; A, number of hauls; H, number of hours; C, catch of major species; each abbreviation shows an availability. When classified data by size of management were not available, abbreviation shows in the small letter.

I. Annual Catch-effort Statistics 199\_

1. Catch and Fishing Effort by Type of Fishing Gear

1.1 Otter Trawl [Hong Kong, Malaysia, Singapore and Thailand]

Country and sub-area	Total	Malaysia				Singapore	Thailand	
		West coast P	East coast P	East coast P	Gulf of Thai.		Indian Ocean	
Unit of fishing effort		Total	50.77%	14.57%	1,700	84	5,766	769
Mo. of units	72,898	67,048						
Mo. of trips	1,950,514	1,562,116						
Mo. of days	3,266,907	1,912,079						
Mo. of hauls	10,959,537							
Mo. of hours	33,928,351							
Total catch	1,451,610							
Catch of major species and code No.	Total	Malaysia				Singapore	Thailand	
		Total	West coast P	East coast P	Sabah		Total	Gulf of Thai.   Indian Ocean
Lizard fishes	3303							
Groupers	3305							
Red snappers	3307							
Threadfin breams	3310							
Pony fishes	3311							
Drums and croakers	3313							
Goatfishes	3314							
Big-eye snappers	3316							
Jack, cavalla, trevallies	3406							
Selar scads	3407							
Sardines	3501							
Indian mackerels	3701							
Indo-Pacific mackerel	3702							
Mairtails	3703							
Miscellaneous fishes	3901							
Trash fishes	3902							
Tiger prawn	4501							
Panaeid prawns	4502							
Other prawns	4503							
Cuttlefishes	5701							
Squids	5702							
Octopuses	5703							
OTHEREIS								
TOTAL	1,451,610							



3.	37. Mackerels	RAG	1. Indian mackerel	3701	Scombridae - <i>Rastrelliger kanagurta</i> (including <i>Rastrelliger faughni</i> )
		RAB	2. Indo-Pacific mackerel	3702	Scombridae - <i>Rastrelliger brachysoma</i>
		CUT	3. Hairtails	3703	Trichiuridae
38. Sharks & rays	SKH	1. Sharks	3801	Carcharhinidae, Sphyrnidae, Orectolobidae, etc.	
	BAI	2. Rays	3802	Trygonidae, Sphyrnidae, Myliobatidae, etc.	
39. Miscellaneous	MZZ	1. Miscellaneous	3901	Mixed species	
	MZZ	2. Trash fish	3902	Mixed species	
4.	42. Crabs	CRS	1. Swimming crabs	4201	Portunidae - <i>Portunus</i> spp.
		MUD	2. Mangrove crab	4202	Portunidae - <i>Scylla serrata</i>
43. Lobsters	SLV	1. Spiny lobsters	4301	Palinuridae - <i>Panulirus</i> spp.	
	SST	2. Slipper lobster	4302	Scyllaridae - <i>Thelus orientalis</i>	
45. Shrimps, prawns, etc.	GIT	1. Tiger prawn	4501	Penaenidae - <i>Penaeus monodon</i>	
	PEN MET	2. Penaeid prawns	4502	Penaenidae - <i>Penaeus</i> spp. <i>Metapenaeus</i> spp.	
		3. Other prawns	4503	Penaenidae - <i>Parapenaeopsis</i> spp. - Other family (genus) name will be added	
47. Miscellaneous marine crustaceans	CRU	1. Miscellaneous	4701	Mixed species	
5.	53. Oysters	OYX	1. Flat oysters	5301	Ostreidae - <i>Ostrea</i> spp.
		OYC	2. Cupped oysters	5302	Ostreidae - <i>Crassostrea</i> spp.
54. Mussels	MSX	1. Sea mussels	5401	Mytilidae ( <i>Mytilus</i> spp., <i>Modiolus</i> spp., <i>Perna</i> spp., <i>Glaucome</i> spp.)	
55. Scallops, pectens, etc.	SCX	1. Scallops	5501	Pectinidae	
56. Cockles, clams	BLS BLC	1. Blood cockle	5601	Arcidae - <i>Anadara</i> spp. <i>Anadara granosa</i>	
	MAT	2. Clams and cone shell	5602	Macridae - Other family name will be added	

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## CATCH AND EFFORT STATISTICS FOR THE JAPANESE SQUID DRIFT NET FISHERY

by

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### INTRODUCTION

The Japanese Drift Net fishery for flying squid, *Ommastrephes bartrami*, commenced in 1978 in the Northwestern Pacific. In response to its rapid growth, the Government of Japan introduced a limited-entry licensing system for this fishery in 1981, under which various regulations were implemented. The regulations established a seven-month fishing period from June to December, and a fishing area between latitudes 20° N and 46° N, and between the northern boundary which changes monthly. This is in order to minimize the by-catch of salmonids while keeping the squid catch.

A typical vessel deploys about 1,000 "tans" of drift nets for each operation. A "tan" is a unit of the Drift Net, having a length and depth of 30 - 50 m and 7 - 10 m, respectively. The net material is nylon monofilament with a mesh size ranging from 110 to 135 mm. The most commonly used mesh size is 110 - 120 mm.

The licensed vessel is obligated to report their operations data in a fishing log book sheet prepared by the Fisheries Agency, not later than one month after returning to its mother port. The catch and effort statistics are made from the analyses of the collected fishing log books.

#### DOCUMENTATION

The number of licensed vessels decreased year by year from over 500 in 1981 to less than 300 in 1992, the final year of the study conducted by the Fisheries Agency of Japan. The total number of tans deployed per year has been kept stable at about 35 million during the late 1980s. But this too has decreased to less than 20 million in 1992. The annual flying squid catch also fluctuated between 120,000 and 216,000 tons, resulting in annual average catch rates of 3.8- 7.9 t/day or 4.2 - 8.6 kg/tan.

#### CATCH AND EFFORT STATISTICS

The Catch and Effort Statistics for the Japanese Squid Drift Net Fishery in the Northern Pacific in 1991, was prepared by the Fisheries Agency, Ministry of Agriculture, Forestry and Fisheries, Tokyo, Japan, and submitted to the Annual Meeting of International North Pacific Fisheries Commission, Seattle, U.S.A., 1992 October. The paper will be published by the International North Pacific Fisheries Commission.

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## CURRENT STATUS OF THE IPTP DATABASE

by

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### INTRODUCTION

The Indo-Pacific Tuna Management and Development Programme (IPTP) was established in 1982. Its major objective is the compilation and dissemination of statistics on tuna and tuna-like fish catches from the Indian Ocean (FAO Areas 51 and 57) and the Western Central Pacific off Southeast Asia (in FAO Area 71).

By mid-1983, data on tuna catch from 16 countries were manually compiled and the first IPTP data summary was published. Problems related to the selected computer system however, delayed the implementation of the database until the second half of 1984. The publication of three manuals for historical and statistical data collection and computer operation on tuna database management, recommended in the 1984 Expert Consultation, served to improve the methodology and format of the data collection and submission.

This paper presents the present status of the IPTP database and identifies major problems in the collection of data.

### DATABASE STRUCTURE

IPTP maintains five major databases as shown in Table 1. In addition, data are available from sampling schemes either funded by IPTP directly or implemented by national fishery authorities or research institutes.

Table 1. Major IPTP databases and types of data collected

Database	Data collected
CATCH	Annual nominal catch of tuna and tuna-like fish by country, FAO fishing area, species and gear.
FISHING BOATS	Annual number of boats targeting on tunas or with significant tuna by-catch by country, gear and type of boat
CATCH AND EFFORT	Catch and effort data by species, gear and fishing ground (5°x5°) by fleet or national catches
LENGTH-FREQUENCY	Length-frequency data by species, gear, fishing ground and month raised to fleet or national catch
TUNA TRANSSHIPMENT	Data on every transshipment made at the port of reference by foreign vessels.

No attempt is made to achieve consistency in the classification of fishing craft, other than to homogenize measurement units where this is possible. All the information is stored in computer files and IPTP has recently substantially improved its computer facilities and has established a computer network for safe maintenance of the database.

### DATA SOURCES

Tuna catch statistics have to date been compiled from flag state reporting through liaison officers nominated by each country providing the data. During the Tripartite Review Meeting held in Rome, in June 1992, IPTP was given the mandate to: "... Complement these data where possible by

*data from alternative sources, including transshipment sites, using all data sets available to cross-check for and rectify inconsistencies and errors. ...*" This new activity allows IPTP to verify the data submitted by each country and to estimate the tuna catch when reports are not submitted on time or do not provide the level of detail or accuracy required. Prior to any modification of the database, the liaison officers concerned are consulted. Finally, any modification is fully documented in the IPTP files.

The forms sent to the liaison officers for flag state reporting includes all the possible necessary data including information on the manner in which these data were generated. Instructions are printed on each form on the manner in which the data should be compiled and the codes being used. Other data sources used for comparison or to provide raising factors include those from the sampling schemes mentioned above as well as data from the scientific literature including national reports submitted during the various IPTP Expert Consultations and other technical meetings.

At present, tuna catch information is available for 41 countries. Data also exists for non-flag state sources for some years and, in certain cases, for some of the catch.

#### PROBLEMS AND CONSTRAINTS

IPTP has embarked on a detailed review of the time series in its database. This has shown major inconsistencies in many national data sets as typified by the changes in the manner in which catches were categorized by species and by gear. In many cases also, national statistical systems do not report on tunas at the species level. Other problems identified include non-correction for nominal catch, non-calendar year reporting time frames and non-localization of catches.

#### Catch Statistics

This is the most important database and is reported by most of the countries in the area covered by IPTP. The data are required by FAO fishing area, by tuna and tuna-like species and by major fishing gear.



### *Nominal Catch*

The data are requested in the form of Nominal Catch. Nominal catch weights are landings corrected for losses: in weight from fish which die due to fishing activities but are not caught; discards, e.g., unwanted by-catch species; damaged or undersized fish, fish used for food or bait by crew, processing; and for weight gains due to such factors as water absorption, ice accretion. The correction factors are in most of the cases, very difficult to obtain. In fact most of the data submitted to IPTP are likely to reflect landings rather than nominal catches. There are no studies dealing with the estimate of any of the above mentioned catch raising factors for any of the fleets operating in the area covered by IPTP.

In the new IPTP forms, the type of data reported for each fishery should be specified together with information on the proper correction factors to apply to each fishery. This allows the revision of time series.

### *Time Frame*

IPTP data are maintained on a calendar year basis. In a number of countries, however, fishery statistics are compiled by financial year, e.g., July-June in Australia or by fishing season, e.g., Taiwanese gill netting from July to June or the country follows a different calendar than the "Julian", e.g., the Persian or "Farsi" calendar is used in Iran. At best, this requires re-processing of data. In certain cases, only estimates were possible to bring the time frame to the calendar year with a resultant loss of accuracy. Liaison officers in the countries concerned have been requested to compile the data by calendar year and to review the time series.

### *Species Breakdown*

The number of species reported depend on the species categories used in the national fishery statistics. In many cases, the national statistics do not record tuna or tuna-like species separately as these may be grouped only as "tunas", "seerfish" and "billfish." During the review mentioned above, several problems were discussed relating to the mis-identification of the tuna species. These include absence of records of species known to be caught in a given country or species compositions which appear unrealistic,

e.g., no yellow fin catches reported from India, kawakawa catches exceeding skipjack in Comoros; drastic changes or re-allocations in one particular species catch for some years of the series, e.g., skipjack catches in Australia and seerfish catches in Malaysia; inclusion of several species under one species listing, e.g., *Thunnus* spp. and billfish grouped as yellow fin catches in Indonesia; and incorrect English name designation for non-Indian Ocean distributed species, e.g., long tail tuna called northern blue fin tuna in Australia and Papua New Guinea, blue marlin called white marlin by the Taiwanese long liners, kawakawa called eastern little tuna in Indonesia.

Where available, data from sampling schemes will be used to generate raising factors for estimating catches by species. In certain cases, species breakdowns are available from the literature for certain years and these can be used to split groupings or to correct mis-identification if there have been no major changes in the fishing patterns.

#### *Gear Categories*

There are cases in which the catch by gear reported in the national statistics do not reflect the gears used in the country, e.g., troll lines, major gear in Indonesia are not listed in the statistics. On the other hand, in some statistical systems, an excessive number of gears are reported, i.e., the Japanese gear categories up to 1984 were for offshore, distant water, mother boat and coastal fishery for each gear which complicates the database excessively and makes reporting difficult.

In some artisanal fishery, some gears catching tunas are mistakenly identified as other gears which do not catch tunas in this area, i.e., trawl for troll lines and seines for purse seines or catch tunas very occasionally, i.e., lift nets, beach seines, trap nets.

As stated above, the list of gears by which IPTP data are reported is being reduced to a smaller number of generic gears. This will reduce the number of gear mis-identification, the others being in general fairly evident. Reallocation of catches from the unclassified (UNCL) category to specific gears is more difficult however, and requires substantial local knowledge of boat or gear types.

*Non-reporting*

Non-reporting is known to occur in three situations, namely, vessels flying flags of convenience, "joint venture" operations between coastal countries and distant water fishing nations which are reported partly and Taiwan long liners of less than 100 GT which are not required to report to their national authorities.

Coverage of vessels flying flags of convenience can only be ensured at this stage by comprehensive transshipment information provided by coastal countries. An IPTP form has been designed for this purpose. Completion of the forms should also permit the constitution of a registry of tuna fishing vessels active in the zones covered. From these forms, estimates of catches could be made even in the absence of a complete coverage of transshipment data. Vessels which tranship at sea or return to ports outside the Indian Ocean are not sampled.

Joint venture situations should be governed by the flag under which the vessels are registered, but this does not appear to be systematically the case. Transshipment data could be used but care must be taken to avoid double reporting. Landings from the small Taiwanese long lines which operate in the Indian Ocean originating from Bali, Jakarta, Penang, Colombo, and Oman, while some may possibly also operate from Bombay and Karachi, could also be covered through transshipment data. Here again, care must be taken to avoid double reporting.

Transshipment information is required by the flag state to correct estimated log book catch data and by IPTP to compile distant water fishing national catch not covered by flag state reporting. At this time, Mauritius is the only country which has reported transshipment information on a regular basis since 1980. Transshipment data are required for foreign tuna fishing boats operating from the port of reference. Several alternative boat identification codes are suggested to avoid multiple entries due to boat re-flagging or changes of name.

These statistics are particularly important for distant water fishing national vessels operating under flags of convenience or under joint venture arrangements and for vessels such as the small Taiwanese long liners which do not report catches to their national statistical systems. The collaboration of all the participating countries is urged to help IPTP in the collection of the tuna catch coming from these fleets through the transshipment statistics.

other two FAO Area limits are, however, in conflict with Indonesian fishing grounds and provisional divisions. The  $113^{\circ}28'E$  meridian is not related with any Indonesian provincial border. Parallel  $11^{\circ}30'S$  straddles the Indonesian Exclusive Economic Zone (EEZ) and the Indonesian long line fishing ground in the Timor sea, which creates serious problems in the allocation of the catch to the correct FAO statistical divisions, considering all the factors that affect fisheries data collection. Thus, for the fishing grounds and state or provincial boundaries in Australia and Indonesia, two possibilities for a more practical division of this zone are being suggested.

One suggestion is to extend the boundary westward to make it coincide with the Java Timur and Java Tengah regional border off  $110^{\circ}45'E$ . Indonesian statistics are reported by region and the artisanal catch could therefore be easily allocated to the different FAO Areas. The Indonesian tuna long line fishing ground would, however, still be straddled.

Another alternative would include the Bali-Nusa Tenggara - Timor province in Area 57, extending the actual eastern limit, the  $129^{\circ}E$  meridian up to the parallel that marks the Java Timur - Java Tengah provincial border ( $7^{\circ}10'S$ ). This includes the long line fishing grounds in the Timor Sea together with the artisanal fishery operating off the Bali - Nusa Tenggara - Timor province.

The possibility of changing the eastern boundary of Area 57 off South Australia was also suggested at the "Workshop on Stock Assessment on Yellow Fin Tuna in the Indian Ocean" (IPTP, 1992). With the shift of the  $150^{\circ}E$  boundary to  $140^{\circ}E$ , only the South and Western Australia states would be included in Area 57. This suggestion is based on environmental conditions and catch distribution affecting the yellow fin stock off Southern Australia and the different southern blue fin tuna fishery from Victoria and South Australia.

#### *FAO Fishing Area 71: Western Central Pacific*

IPTP compiles data on tuna catches from Indonesia, Malaysia, the Philippines, and Thailand in the Southeast Asian region of Area 71. These four countries caught 780,000 t of tunas and tuna-like fish in 1991 in Area 71, the equivalent catch of the whole Indian Ocean. No distant water fishing nations are reporting on their catch in Area

71, other than those under the fisheries agreements with the South Pacific Forum countries.

#### Fishing Boat Statistics

These statistics are usually poor and irregularly reported by most countries. Data on types of boat and size class are required by major tuna fishery or by fishery with a significant tuna by-catch. The information requested includes number of boats actually operating from the country during a particular year. These statistics are needed to assess trends in effort when no other information is available and also to estimate catches by fishery type, using average catch rates in general, by sampling schemes.

The national classification is believed to reflect special features of each fishery but in many cases the inconsistency of the class and size categories used and the inclusion of non-tuna catching boats make these statistics difficult to use. In most of the artisanal fishery, the catch is better reported than the number of boats. This seems to be contrary to the nominal estimation procedure in artisanal fishery where catch estimates are frequently derived from average catch rates raised by a boat census when statistics are not based on total enumeration of landings or on log book declarations.

#### Catch and Effort Statistics

Catch and effort data are required for the whole fleet or a representative sample of the fleet by the smallest area or time strata, i.e., at least by month and 5°x5° square. These statistics are needed for stock assessment and for interpretation of tagging data.

In artisanal fishery, the collection of catch and effort is particularly complicated. One of the major difficulties is the choice of meaningful effort units specially in artisanal multiple-gear fishery and in rapidly evolving fishery situations. Boat statistics are extremely important in cases where catch and effort statistics are difficult to obtain.

While this issue is not discernible from the database, the expansion of tuna fishery from coastal to offshore waters in some countries, e.g., Philippines which has tuna fishing vessels in the Indonesian and Papua New Guinea



waters, means that the assumption that the catch was adjacent to the port of landing is no longer valid. The only solution to this is through log book reporting or through sub-sampling with interviews of the vessel crew.

### Length-frequency Statistics

Length-frequency information is requested by species and gear in the smallest practical area or time strata. Sampling should be concentrated on the major tuna and tuna-like species caught by the reporting country, although length-frequencies from the other species are also of interest.

However, some sampling programs used were not continuous along the sampling period or sampled insufficient numbers of fish. The design of an effective sampling program is therefore, very important to obtain reliable data.

### IMPLEMENTATION OF THE IPTP DATABASE

While the national statistics may not compile the tuna catch information in the detail required for basic management analysis, IPTP has provided technical assistance to national agencies to enable them to improve the statistical system and financial support in establishing tuna sampling programs.

### IPTP Technical Assistance to National Statistics

In its last phase, IPTP had provided technical assistance to the fishery statistical systems in Iran, Reunion and Seychelles. In addition, support has been provided to the *Association Thoniere* of the *Commission de l'Ocean Indien* in the design of a statistical system for the Comores.

As tuna fishery generally form only a portion of the marine fishery sector, the establishment of a statistical system for these fisheries alone is not justified. This may imply the design of a statistical system covering all the marine fisheries of the country, with an obvious progress in the quality of the fishery statistics.



### **IPTP Tuna Sampling Programs**

IPTP has designed and implemented sampling programs in six member countries, namely, Indonesia, Philippines, Sri Lanka, Malaysia (Kuala Terengganu and Penang), Pakistan, and Thailand. These have in the past, been used mainly for biological and descriptive studies. With the change in approach on the type of data kept by IPTP, sampling schemes become the preferred tool to generate raising factors from grouped national catch figures to the species and gear levels in cases where national catch statistics are reliable and timely. If this is not the case, data from the sampling schemes can be used to estimate catches, but this is only if there is at least a reliable count of fishing craft by categories. Finally, the sampling scheme in Penang, for example, is specifically designed to provide information on activities which are not covered by flag state reporting.

The implementation of the IPTP sampling scheme has been recently constrained by budgetary shortage. IPTP's policy is directed to establish and monitor sampling programs during the reasonable time span and then to transfer them to the national authorities. This has happened in the Philippines, Sri Lanka, Malaysia, and Thailand and should be made as a guiding principle in order to ensure continuity of the statistical output.

### **REGIONAL TAGGING DATABASE**

IPTP has assisted in the implementation of tuna tagging projects in four member countries, namely, Indonesia, Maldives, Malaysia and the Philippines. The results obtained by these experiments have been reviewed by Lewis (1992) and by Yesaki and Waheed (1992). Only the Maldivian tagging program has achieved completely successful results mainly due to the appropriate tagging methodology, i.e., using pole and line boats, and the cooperation of the Maldivian fishermen who returned all most of the tags recaptured and good catch and effort data for the fishery under study.

In the Workshop on Stock Assessment of Yellow Fin Tuna in the Indian Ocean held in Colombo, 7-12 October 1991, a strong recommendation was made that IPTP should maintain a database of all Indian Ocean tagging data and that all countries and organizations conducting tagging experiments should supply a complete copy of these data to IPTP. The meeting also recommended that IPTP should act as a channel

through which countries and organizations conducting tagging experiments within the Indian Ocean can publicize their activities in order to maximize tag returns and further, that IPTP should continue to act as an inter-regional coordinator to ensure smooth transfer of relevant tagging information with organizations in other oceans, notably with the South Pacific Ocean.

To date, only Maldives have conformed to these recommendations, despite the fact that two organizations, JAMARC and the *Association Thoniere*, have conducted tagging experiments in the Indian Ocean.

#### INDIAN OCEAN TUNA COMMISSION

The Agreement for the Establishing of the Indian Ocean Tuna Commission (IOTC) was approved during the Twenty-seventh Session of the FAO Conference, Rome, 6-25 November 1993. This Agreement will enter into force upon the accession of ten parties. Following the conclusion of hosting arrangement and the appointment of personnel, the activities currently undertaken by IPTP will be taken over by IOTC.

IOTC will cover FAO Statistical Areas 51 and 57 exclusively. The Twenty-fourth Session of the Indo-Pacific Commission, Bangkok, 23 November - 4 December 1993, recommended that the IPTP and the Southeast Asian Fisheries Development Center (SEAFDEC) discuss the arrangements relative to the transfer of responsibilities for the collection of tuna statistics for the Southeast Asian region, to the latter organization. The Commission also recommended that the proposed Working Party on Fishery Statistics and Economics and the Working Party on Marine Fisheries would be responsible for the analysis of fishery statistics and the elaboration of scientific advice for tuna management in the region.

#### CONCLUSIONS

The ongoing review of the IPTP database is the first comprehensive and detailed review made by IPTP. Through this review, IPTP is still finding major historical inconsistencies never corrected by the reporting countries.

The approach now adopted should provide far more accurate data than those which have been made available in the past. However, a far more active role is required from the liaison officers. The tendency in the past has been to obtain data from the national fishery statistical system. It is now necessary to know how these data were generated in order to apply the appropriate raising factors. Information will thus be needed from research institutes and possibly from the industry. Finally, transshipment and vessel characteristics data will be needed from harbor and customs authorities.

Liaison officers should report national data in a manner consistent with previous years. When the national fishery statistical systems are modified in a manner affecting species composition or gears reported in the catch statistics, liaison officers should report these changes and review the historical series in order to compile a homogeneous series.

Special effort should be placed in obtaining correction factors in the reported catch figures to estimate the total nominal tuna catch. IPTP stresses the necessity of the inclusion of nominal catches rather than landings for a good coverage of the tuna catch in the Indo-Pacific Region. The reports should be submitted by calendar year.

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**THE USE OF ECONOMIC SURVEY INFORMATION  
IN AUSTRALIAN FISHERY MANAGEMENT**

by  
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**INTRODUCTION**

The value of catch effort information depends on how effectively it is being used for fishery management purposes and its goal which has generally been defined in relation to the prevention of biological over-exploitation of the fish stocks. However, the management of fisheries is concerned with the management of fishermen and how they use the fishery resources rather than the stock itself. In order to understand these relationships and to manage the resources, it is essential that the appropriate economic information is available and is used in conjunction with biological information.

The economic information required to effectively manage fisheries is relatively wide and this includes, data on the number and type of fishermen using the resource, data on costs and earnings of those fishermen and the returns associated with the different types of fishing activity and gear types and configurations, and data on markets supplied by the fishermen with fish and the characteristics of the demand to be met by the fishermen.

The Australian Bureau of Agricultural and Resource Economics (ABARE) undertakes the collection of a range of economic statistics for fishery management purposes, the most important of which are the data from economic surveys of the industry. These surveys are undertaken on a fishery base, using sample surveys based on multi-stage stratification, using boat characteristics and fishing performance differences established from licensing and catch-effort log books.

### STATISTICAL INFORMATION

Information collected are used in assessing the success of fishery management programs in order to achieve a sustainable and profitable fishing industry. Economic surveys are the most reliable means of assessing the latter and are used in conjunction with biological stock assessments, in determining the former.

The information is also used in assessing the impact of policy and other changes on the efficiency of the industry. For example, the impact of fuel price changes on the fishing industry can be assessed. Moreover, information is also used in evaluating the likely impact of different management options on the fishing industry. It is in the interest of all those involved in the management of fisheries to ensure that the most efficient overall management regime is adopted.

### BIO-ECONOMIC MODELS

Bio-economic models of fishery management are developed to bring together all the pertinent information affecting the performance of boats in a fishery in a systematic way. Cost and returns information collected from economic surveys are combined with information on biological relationships to model the aggregate performance of the fishery industry. The information is used to estimate the initial fish stock levels at the beginning of the season, nature mortality, catch ability, growth and size composition throughout the season.

The physical and economic characteristics of the fleet are also incorporated in the model to identify the costs of fishing associated with the level of effort or catch and revenue from fishing which is determined from the biological component of the model and from information on prices.

The third component of the model is the management program which tends to influence the level of catch either directly through catch limits, such as the imposition of quotas or through restricting the number and types of vessels and gear which may be used. Such programs also influence the cost and revenue from fishing.

The model is then used to determine the set of factors that maximizes a given variable such as fleet profit, subject to the biological, economic and management constraints. This is achieved through the use of a computer program based on non-linear programming.

These models have been successfully used in a range of fishery management work such as identifying the optimum level restructuring of the fishing fleet, the most effective way of implementing restrictions on catches, and identifying the impact of different types of management programs on the fishing industry. The models have been pivotal in addressing the key question for fishery management, of what would be the effect of fishery management changes on operators in the fishing industry. If operators can be shown the likely impact of the changes in management, on their profitability, they are more likely to accept these changes.

Economic survey information is also used for a range of other decisions including the establishment of fishery management development and research priorities. Research priorities are increasingly set on the expected net benefit principle. To apply the benefit cost analysis techniques, it is necessary to have a robust information on which such analysis could be based.



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**SURVEY ON COSTS AND EARNING STATISTICS  
ON SEMI-INTENSIVE AND INTENSIVE  
SHRIMP CULTURE IN THAILAND**

by  
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**INTRODUCTION**

During the past few years, shrimp culture in Thailand had expanded rapidly in terms of number of operators and area of farms. This is due to the fact that the operators had attained high rate of return. However, from the ecologists' point of view, the expansion of shrimp culture has caused problems of encroaching the coastal forest and deteriorating the environment. A couple of years ago, shrimp culture operators were faced with over-supply of shrimps, thus reflecting a drop in prices. In order to study the situation of the shrimp culture in Thailand, the National Statistical Office (NSO) in collaboration with the Department of Fisheries, undertook the 1990 Costs and Earning of Semi-intensive and Intensive Shrimp Culture Survey. Results of the survey are now being used as guide in formulating and implementing shrimp culture development projects in Thailand.

**THE SURVEY**

The objective of the survey was to collect data on the components of farm expenses and farm income including rearing activities. The survey, conducted in 1990, covered semi-intensive and intensive shrimp farms which had been in operation at least one year prior to the enumeration day in 24 coastal provinces of the central and southern parts of Thailand.

The following definitions were used in the survey:

Intensive shrimp culture - refers to shrimp culture which employs a stocking density of at least 150,000 shrimp fry per hectare or 15 shrimp fry per sq m, feeding three to five times a day, and using 3 - 6 paddle wheels or air jet per hectare during the third and fourth month of culture. On the other hand, semi-intensive shrimp culture refers to shrimp culture which uses a stocking rate of less than 150,000 shrimp fry and feeding occasionally.

Costs of shrimp culture are classified into two types, fixed cost refers to expenses which are incurred whether the farm is in operation or not, while variable cost refers to expenses during farm operation. Fixed cost consists of cash fixed cost, such as land tax, rental of land, and interest. Non-cash fixed cost includes depreciation of shrimp ponds and farm equipment which are calculated using the straight line method, and opportunity cost of land owned calculated using local land rental rate.

Variable cost are either cash variable cost such as expenses for shrimp fry, feed, lime, fertilizer, pesticide, fuel, lubricant, electricity, wages and salary; or non-cash which includes opportunity cost of family labor calculated by using local wage and salary rate.

Total cost refers to the sum of the fixed and variable costs while earning refers to profit or loss from farm operations.

#### SURVEY METHODOLOGY

The sample design was based on a stratified two-stage sampling. Groups of coastal provinces were treated as the stratum. Enumeration districts were the first-stage sampling units, while the semi-intensive and intensive shrimp farms were the second-stage sampling units.

The interview method was applied to the survey. During the survey period, 110 enumerators, all NSO staff were sent out to interview the operators of 2558 sample farms consisting of 1190 semi-intensive shrimp farms and 1368 intensive culture farms. The report of the survey was published in Thai language and released in July 1992.

### SURVEY RESULTS

The result of the survey is summarized below:

#### *Costs*

Results revealed that the average total cost of semi-intensive shrimp culture in the whole country was 76,282 Baht per hectare or 130 Baht per kilogram of shrimp. With regard to cost components, expenses for shrimp feed was highest about 28,444 Baht per hectare comprising 36.9%. This was followed by opportunity cost of land owned, labor cost and cost of shrimp fry which was 9331 Baht, about 12.2%; 9044 Baht, about 11.8%; and 8950 Baht, about 11.7%, respectively.

For the intensive shrimp culture, the average total cost was 641,231 Baht per hectare or 120 Baht per kilogram of shrimp. Of these, almost one half of the total cost was for shrimp feeds. This was followed by the cost of shrimp fry, depreciation and fuel, and electricity expenses which accounted for 59,979 Baht (9.3%), 58,606 Baht (9.1%), and 49,956 Baht (7.8%), respectively.

Comparing the two methods of shrimp culture, the average cost for intensive shrimp culture was seven times higher than the cost of semi-intensive culture. As for the cost components, the proportion of shrimp feed expense for intensive shrimp culture (48.6%) was higher than that of the semi-intensive shrimp culture (36.9%).

Furthermore, labor cost of the semi-intensive shrimp culture (11.8%) was higher than that of the intensive culture (7.3%). This is due to the higher proportion in opportunity cost of family labor constituting 9.3% of the total cost or 78.7% of the total labor cost, whereas for the intensive shrimp culture, the opportunity cost was 3.5% of the total cost or 47.9% of the labor cost.

There was a remarkable high figure for opportunity cost of land owned in the semi-intensive shrimp culture compared with the intensive shrimp culture. The reason for this could be that the semi-intensive shrimp culture farm size is larger than the intensive shrimp culture farms.

### *Earnings*

The shrimp farmers harvested their products at an average of 1674 kg per crop. These are sold at 131 Baht per kg at farm gate. Deducting the total cost from the total sale, the net profit for semi-intensive shrimp culture was 999 Baht per ha or 1 Baht per kg.

Owing to more production from an intensive shrimp farm as well as higher sale price, the net profit of an intensive farm was 175,156 Baht per ha. This is 174 times higher than the profit from a semi-intensive shrimp farm.

Figures from the earning analysis showed that the rate of return of semi-intensive shrimp culture per hectare was quite small, only 1.3%. On the other hand, the rate of return for operating an intensive shrimp culture was 27.3%.

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**THE SOCIO-ECONOMIC STATUS OF SMALL-SCALE  
FISHERFOLK COMMUNITIES IN SRI LANKA**

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**INTRODUCTION**

Since 1977, the economy of Sri Lanka has undergone a series of radical changes. The period prior to 1977 saw the state playing the main role in economic activity. A regulated economy with a heavy accent on social welfare and income redistribution characterized the policy thrust of the period. The final result was a slow growth and a stagnant economy, the actual growth rate was only 3.2%. The post 1977 period witnessed an almost total reversal of the pre-1977 policies. The stimulation of the market mechanism and a shift from direct control to liberalize and reliance of the price control, are the main features of the post-1977 period. The economic reform was aimed at accelerating the process of economic growth, improving the utilization of production capacities and opportunities for employment, stimulating savings and investments, and improving the balance of payments over the medium term.

The objectives were to be achieved through a comprehensive package which included the unification of the exchange rate and adoption of flexible exchange rate policies, liberalization and dismantling of import and exchange controls, reduction or removal of administrative and price controls, relaxation of monopolistic controls exercised by the state enterprise, and the encouragement of private sector competition, introduction of liberal tax incentives for private sector investment and savings, and reform in subsidy policies.

According to the country's Department of Census and Statistics and the Central Bank, the increase of Gross Domestic Product (GDP) growth rate from 3.2% to about 6%, the increase of foreign exchange earnings from SLRs. 12,311 million to 110,057 million, and the reduction of unemployment rate from about 21% to about 14%, during these two periods, are some of the economic indicators that clearly show positive results from these reforms.

Although the contribution of fishery sector to the GDP of the country during this period was quite marginal, 2.7% in 1992, the fishery sector is still important in the economy of the country in terms of employment, foreign exchange earnings, and supply of animal-based protein.

According to the fishery frame survey conducted in 1989 by the Ministry of Fisheries and Aquatic Resources (MFAR), there was around 120,000 persons engaged in fishing or fishing-related occupations. This is about 2% of the total employed population in Sri Lanka.

On the other hand, according to the Department of Customs, in 1992, the total foreign exchange earnings from the fishery sector accounted for SLRs 1291 million. This is about 1.2% of the total foreign exchange earnings.

Fish has always been a major contribution to the protein intake of the population of the country. According to the Food Balance sheet published by the Department of Census and Statistics in 1992, fish contributed around 65% of the animal-based protein consumed by the population.

#### THE SURVEY

At the request of MFAR, the Bay of Bengal Programme (BOBP) of the Food and Agriculture Organization (FAO), agreed to formulate and execute a project to design and implement a non-subsidized Credit Scheme for Small-Scale Fisherfolk. One of the important activities of the project was to obtain the socio-economic data relating to fisherfolk communities through a comprehensive survey. Since MFAR also indicated that there was an urgent need for this type of information for fishery planning, development, and management in Sri Lanka, both MFAR and BOBP worked together and planned the survey. The twin objectives of the survey were to obtain socio-economic information that would help in the formulation of the new credit scheme, and also to supplement the existing socio-economic information base of MFAR relating to the fisherfolk communities of Sri Lanka.



The survey was conducted in areas selected for BOBP's Fisherfolk Credit Project, namely, the fishery districts of Puttalam, Chilaw, Galle, and Matara. These areas were selected for the Credit Project as they were considered to be generally representative of the fishery situation in the country, particularly in terms of fishing craft and methods, physical infrastructure, and the economic and social conditions prevailing in the fisherfolk communities. In addition, these areas also accounted for 30-35% of the country's total production of marine fish during the past five years. The survey commenced in mid-1989 and the field work was completed in November 1989.

#### SURVEY METHODOLOGY

The survey covered about 25% of the fishery households, which was effected by selecting a sample of fishing villages in the districts chosen. The selection of the samples was done in consultation with the Planning and Programming Division of MFAR. A total of 5276 (32%) of the 16,269 households were covered in the survey. Out of the 19,726 active fishermen in the four areas, 5768 (29%) were covered by the survey. Of the 80,149 fisherfolk population, 25,704 (32%) was covered by the survey.

Information were gathered through a comprehensive questionnaire which covered all aspects of small-scale fisheries. The survey was originally planned to concentrate on information of relevance to the Credit Project, but it was subsequently expanded and adjusted to accommodate the data requirements of MFAR, particularly those relating to welfare and community development-oriented aspects.

Collection of data from the field was done by the Fisheries Inspectors of MFAR assigned to the project areas. A total of 32 Fisheries Inspectors participated in the field enumeration which covered 89 villages. Each enumerator was assigned 30 - 40 households. The required information was obtained during the enumerators' visit of the villages through personal interviews as well as observation. To ensure reliability and accuracy of the data collected, the enumerators were given adequate training on the questionnaire and also on the interview and data collection techniques.

Data processing was done electronically using computers. This was preceded by a post-coding exercise conducted by a team of selected fisheries officers. The post-coding operation was useful in spotting erroneously or inaccurately filled questionnaires.

### SURVEY RESULTS

An average fishing family is of the same size as or probably larger than the rural family, which has an average of 4.9 members per family. The population growth rate in the fishery sector is estimated to be higher than the national average which was about 2% in the late 1980s. About 70% of the households were engaged exclusively in fishing activities. There were little evidence of employment and income diversification, although the coastal fishery resources were being over-exploited.

The literacy rate of the fishing sector was around 87%, the same as the national average and 75% of the people had attended school up to at least grade V. Despite the generally high literacy rate and educational level, 55% of the working population, 15 years and above, was unemployed and significantly, the female unemployment rate was 90%.

Credit subsidies have had only a marginal impact on the purchase of fishing craft and engines by the fisherfolk. Less than 30% of the craft and engines were purchased with subsidies. About 61% of the households surveyed did not use any loans. Institutional loans only reached about 7% of the fishing households. Most fishing households reported that fear of their inability to repay, was among the key reasons for not availing of any loan.

About 68% of the fishing households had no savings. For those households that had savings, the money saved was used primarily for fishing activities and other emergency needs. About one-third of the households lived in improvised homes. About 48% of households had access to protected common wells for their water supply. However, in Puttalam District, 52% of the households had to depend on unprotected water sources. About 64% of the households had no toilet.

At least 25 different skills were available in the population surveyed. The skills were suited to self employment and at least nine of the skills were traditionally those preserved for the womenfolk.

Obtaining financial assistance appeared to be the most important constraint in initiating self-employment skills. The families wanted to avail of small-scale micro-credit loans of less than SLRs 10,000. But another 36% of the families would require medium-scale loans, ranging from SLRs 10,000 to SLRs 50,000.

The detailed report on the Socioeconomic Status of Small-Scale Fisherfolk Communities in Four Fishery Districts of Sri Lanka, 1989/90, was published by BOBP and MFAR.

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**AQUACULTURE STATISTICS:  
STATUS AND PROBLEMS**

by

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**HISTORY OF AQUACULTURE STATISTICS**

Although several Asian countries started to collect and publish national statistical data on cultured and captured aquatic organisms separately long since, e.g., Japan in 1940 and Thailand in 1969, and the series of Fishery Statistical Bulletin for the South China Sea Area published by the Southeast Asian Fisheries Development Center (SEAFDEC) which contains data on culture fisheries of ten Southeast Asian countries from 1977 onwards, on a global scale, there was still no systematic effort to collect aquaculture production data until the middle of 1980s. Asia's pioneering role in collecting and disseminating aquaculture statistics is obviously the result of the significant role of culture fisheries in the region, while the importance of aquaculture was much less in other parts of the world.

The first enquiries to determine global aquaculture production started with two *ad hoc* surveys carried out by the FAO Aquaculture Development and Coordination Program (ADCP) in 1976 and in 1982. Results of these efforts were published in 1979 (Pillay 1979) and 1982 (ADCP 1982). These analyses were based on production data submitted by various governments in response to questionnaires circulated by ADCP, which were cross-checked and completed with information obtained from various other published and unpublished sources. Another attempt restricted to the

Asia-Pacific region, was made in 1984/85 by the FAO Regional Office for Asia and the Pacific (FAO/RAPA) using basically the same method of data collection and verification. This latter survey covered the years between 1975 and 1985, its results were published in 1988 (Csavas 1988).

Systematic collection of aquaculture statistics by FAO's Fishery Information, Data and Statistics Service (FIDI) started only in 1985, using two additional formats (FISHSTAT AQ) circulated together with the annual statistical survey of world fishery activities. From the first returns, it became apparent that responding government agencies had problems in classifying certain types of production into culture or capture fishery due to lack of a clear definition and unambiguous instructions for completing the questionnaires. In 1987, the FAO definition of aquaculture was refined and the revised questionnaires were first applied in the collection of aquaculture production data for the year 1986. Results of these surveys were published by FAO in 1989 and updated in subsequent annual revisions. The latest of these contains data for the period 1985 - 1991 (FAO 1993a).

#### DEFINITIONS OF AQUACULTURE

The earliest definition of aquaculture used for statistical purposes was developed by SEAFDEC in the early 1970s. This definition already comprises all major elements that provide functional distinction between capture and culture fisheries (SEAFDEC 1978):

*Culture means an economic activity to rear the young of aquatic organisms such as fry, fingerlings, oyster seeds, etc., to commercial size. In principle, culture occupies a certain water area for its operation and is carried out with certain artificially built facilities such as ponds, fences, rafts, cages, pens, etc. The production of fry and fingerlings in hatcheries, and the collection of various shell seeds in natural waters with artificially built facilities are also included herein.*

*Unlike capture, aquatic organisms under culture operations belong to the property of a specific person or a group of specific persons who manage them until they grow to commercial size. Therefore, stocking of fry and fingerlings into public waters to increase the abundance of natural fishery resources is not regarded as culture, since such natural resources do not belong to any specific person after stocking.*



When initiating regular collection of aquaculture statistical data in 1985, FAO proposed a reformulated definition of aquaculture production in order to facilitate global comparability of data by enabling more precise separation of aquaculture production from that of capture fisheries. It was drafted on the basis of common usage of the term "culture" and followed closely the practical distinction between gathering and hunting and agriculture. In 1987, based on the experiences gained during the processing of the first returns of the aquaculture questionnaires, the original definition was refined through extensive discussions within the Fisheries Department of FAO and with other agencies involved. The revised definition which was in effect since 1988, reads as follows (FAO 1989):

*Aquaculture is the farming of aquatic organisms, including fish, molluscs, crustaceans and aquatic plants. Farming implies some form of intervention in the rearing process to enhance production, such as regular stocking, feeding, protection from predators, etc. Farming also implies individual or corporate ownership of the stock being cultivated. For statistical purposes, aquatic organisms which are harvested by an individual or corporate body which has owned them throughout their rearing period contribute to aquaculture while aquatic organisms which are exploited by the public as a common property resource, with or without appropriate licenses, are the harvest of fisheries.*

The FAO definition closely corresponds with that of SEAFDEC. The concepts of intervention by man and property ownership are accepted in both cases. The FAO definition is already implicitly accepted by the ICES and the European Community (EC) since both, as members of the Coordinating Working Party on Atlantic Fishery Statistics, accept the current FISHSTAT AQ questionnaires and receive copies of the returns which it generates.

Based on this definition, the intention of FAO is to produce and publish two distinct sets of fishery statistics, one for capture fishery and one for aquaculture. Currently, the annually published FAO Yearbooks of Fishery Statistics (FAO 1993b) contain aggregated data of total fishery production, including aquaculture and the annual revisions of FAO circulars on aquaculture production provide data on cultured commodities. In theory, subtracting aquaculture



data from total production should provide data on capture from wild stocks but, in practice, some discrepancies continue to persist. These are best shown by the negative figures that may appear after such subtractions.

#### PROBLEMS AND CONSTRAINTS

Obviously, it is impossible to develop a definition that satisfies everyone's ideas about aquaculture. However, some standardization is necessary if national data are to be aggregated in order to study regional and global trends separately for the aquaculture and capture fishery sub-sectors. While the revised FAO definition was generally well received and accepted by member governments, it became evident that its interpretation and application has caused some problems that were reported in detail in 1992 in the FAO Aquaculture Newsletter (New and Crispoldi-Hotta 1992) from which the first part of this working paper is derived. Most of the difficulties were related to the classification of fishery enhancement activities, culture-based fisheries, where hatchery-reared seed is released to the wild. Several countries continued to consider all the results of re-stocking activities in lakes and reservoirs, incorrectly, as aquaculture.

Judicious use of the ownership concept incorporated in the definition would classify most of the final results of fishery enhancement activities as capture fishery production, as is intended. The role of aquaculture in the enhancement process is the production of seed for stocking, the stock usually becomes an open-access resource and will be harvested as such after an appropriate growing period. The cultured seed volume released in open waters is to be reported separately on the FISHSTAT AQ forms as aquaculture production. Up to now, the seed volume released for fishery enhancement by member countries have not yet been published by FAO, as particular problems have been experienced with the returns from some Asian and Latin American respondents.

Another important problem seems to be caused by local differences in the concept of ownership. Financial rewards may accrue to the public as well as to the private sector. Thus, some governments regard fish harvested as the result of re-stocking programs to be owned publicly and report it as aquaculture production. Conversely, the too strict application of the ownership principle by accepting only production from privately owned enhanced stocks as aquaculture would exclude all the output of fishery

enhancement activities, which is not acceptable to those involved in salmon ranching, for example. In fact, salmon ranching activities contribute both to the capture fishery by extraction and to aquaculture production. The Fishery Statistics Unit of FAO attempts to appropriately correct the data returned but is unable to identify all instances of correct allotment to production category.

Some countries are reporting aquaculture production of certain species that are not included in their species list for total fishery production data. The question remains whether these have been reported in the total catch, though inaccurately identified, e.g., production of carps reported under "freshwater fishes" in the total production or whether they have been omitted from the total. For species that are both captured and cultured, subtraction of aquaculture from total catch figures may result in a zero or "negative" capture fishery production in some instances. This indicates the probability of a much more serious problem, that some countries may not include aquaculture production in their total catch returns as many omit inland capture fishery data too. This would result in artificially deflated figures for capture fishery especially inland capture fishery production.

Often, the cause of such discrepancies is that in some countries, the total catch statistics are produced by a different government authority from that responsible for returning the aquaculture questionnaires. In such cases, confusions, double counting and/or omission of some data can easily happen. Where possible, FAO attempts to verify data from conflicting sources through the use of information from trade associations or other similar organizations but these are not available in most of the developing countries.

The division of aquaculture into freshwater, brackishwater and mariculture which is used by both SEAFDEC and FAO, is also a source of confusion. These categories, based on the salinity of the culture water, are overlapping in practice and can lead to significant discrepancies in reporting. In many cases, aquaculture returns report data for certain species in a different category than that of the total catch returns. Dividing aquaculture simply into "inland" and "coastal" production has strong merits by simplifying reporting without losing important information.

### RECOMMENDATIONS

FAO's fishery statistics are the prime source of global information both for the capture and culture sub-sectors. It is therefore important that these provide accurate and consistent information essential for development planners and administrators. Clearly, no perfect solution could be found to the above mentioned problems, however, practical compromises could be developed and actions are therefore being considered by FAO's FIDI as follows:

First of all, two questionnaires are planned to be circulated annually, one for capture fisheries and one for aquaculture. The request for reporting total production data would be abandoned. The existing definition of aquaculture would be retained, to change it at this stage would cause more confusion. However, the instruction sheet appended to the questionnaires will explain that FAO recognizes that, opinions differ from country to country, especially on what forms the output of aquaculture and what is the product of capture fishery. The completion of the FISHSTAT forms may necessitate the allocation of some production data into a different category from those utilized when national statistical data are prepared. Nevertheless, for standardization purposes and to enable accurate trend analyses, FAO will request its Member States to group each activity according to the definition.

The instruction sheet will note that the definition is for statistical purposes only and does not imply any attempt to demarcate a border between aquaculture and fisheries from a technical point of view. It will also be stressed that the designation of production as aquaculture is not dependent on the source of stock as both wild caught and hatchery-reared seeds can be used either for aquaculture or for fishery enhancement. Furthermore, a number of improvements have been suggested to promote the clarity of the instruction sheets and to make it easier for the recipients to complete the aquaculture questionnaires.

Improvements in clarity would include renaming "freshwater culture" as "inland aquaculture" and combining "brackishwater culture" with "mariculture" to form a category called "coastal aquaculture." If the cultivation of the end-product takes place in brackishwater or seawater including production from off-shore facilities, coastal ponds and/or on-shore tanks supplied with brackishwater or full-strength seawater, its harvest would be regarded as coastal aquaculture production. The earlier stages of the

life cycle of some species may be spent in freshwater but, if harvested in brackishwater or seawater, production data should be recorded as coastal aquaculture and vice versa, for instance freshwater prawn seed is produced in brackishwater but the end-product is raised in freshwater, often far from the sea, should be regarded as inland aquaculture production.

Perhaps the most useful amendment to the instructions for completing the aquaculture questionnaires would be an appendix that clearly places the most common practices into either aquaculture or capture fishery for statistical purposes. This appendix would note that the production from hatcheries, ponds, cages, tanks, raceways, temporary barrages, permanent lakes and reservoirs where fish are harvested by their owners, anadromous fish returning to release sites, privately owned sport fishery, brush parks and fish aggregating devices, molluscs from owned and managed grow-out sites, the harvest of planted and suspended seaweed, integrated aquaculture, e.g., rice-fish culture, valliculture and private tidal pond culture (tambaks) should be recorded as aquaculture. Conversely, the harvest of fish and crustacea caught in open waters or in permanent lakes and reservoirs having open access whether enhanced or not, and of anadromous fish not caught by those who released the juveniles, together with fish caught by those who released the juveniles, together with fish caught around artificial reefs, molluscs subject to open harvest, enhanced marine fishery, the harvest from natural seaweed beds and the result of coastal lagoon management should be reported on the capture fishery questionnaires.

The problems of aquaculture statistics and the proposed solutions outlined above were put on the agenda of the 14th Session of the Asia and the Pacific Commission on Agricultural Statistics (APCAS); 8-13 June 1992, Beijing, People's Republic of China (FAO/FIDI 1992). The Commission discussed the proposals in some detail and after some clarifications, endorsed them. It was a general view that these and further improvements into the questionnaires and the instruction sheets will be significant steps forward in providing more accurate information on aquaculture production.

In order to improve the accuracy of regional and global fishery statistics, APCAS requested its member countries, currently reporting only aggregate figures on aquaculture production of certain commodities, to make efforts to disaggregate their data by major cultured species. Detailed



analyses are now hindered by countries reporting all of their finfish production under "freshwater fish," e.g., Bangladesh, Bhutan and Viet Nam; all freshwater fish under "cyprinidae," e.g., Democratic People's Republic of Korea and Laos; most freshwater fish under "cyprinidae," e.g., Pakistan; all carps under "cyprinidae," e.g., Philippines; all Chinese and Indian major carps under "cyprinidae," e.g., India; all Indian Major carps under "cyprinidae," e.g., Nepal; all crustaceans under "natantian decapods," e.g., Viet Nam; all marine shrimp under "*Penaeus* spp.," e.g., India; or all molluscs under "miscellaneous marine molluscs," e.g., Democratic People's Republic of Korea.

APCAS also emphasized that, in addition to production volumes, the collection and dissemination of data on production costs and market prices would also be needed. In fact, market prices are regularly published by SEAFDEC for the South China Sea countries and FAO also collects such data on the FISHSTAT AQ questionnaires, although the results have not yet been published except for the total value of aquaculture production in a given country. Obviously, there is a need to process and publish these price information to at least for those countries that are reporting reliable data. Apart from the early initiatives of FAO/ADCP in the frame of the AQUIS aquaculture information system, there were no systematic attempts to date to collect and disseminate production costs of various species and culture systems.

As the sustainability of aquaculture production is closely related to its intensity, FAO has to increase its efforts also in collecting, processing and publishing information on the culture area of various aquatic commodities. Most countries do have this information; SEAFDEC already publishes such data for the South China Sea area. Similarly, there is a need to improve our knowledge on the labor force involved in aquaculture production, for which data are collected and published only by SEAFDEC.

#### Timely Availability of Data

For the users of aquaculture statistics, i.e., the decision makers, administrators, researchers, commercial farmers, exporters and importers, a major source of frustration is the long delay needed to collect and publish production data. While some commercial production estimates are attempted to be published by the end of the current year, e.g., Rosenberry 1993, and a few national yearbooks

may be published in the following year, e.g., in Hong Kong or Malaysia, the time needed to publish national aquaculture statistics is generally two years. Publishing international data may take an even longer time: as of January 1994, for example, the latest edition of FAO's aquaculture production statistics (FAO Fisheries Circular No. 815 Revision 5), published in June 1993, contains data up to 1991. Similarly, SEAPDEC's latest Statistical Bulletin for the South China Sea Area, issued in January 1993, reports data for 1990.

Such a long time gap considerably reduces the benefits of aquaculture statistics in the decision-making process of administrators, managers and businessmen as recent changes in the production of various commodities are not reflected in the published data. Such outdated information may be especially misleading when production of a commodity approaches limits of sustainability as earlier exponential growth of production is expected to continue at a time when economical or ecological limits were already reached and actual production has leveled off.

There is an urgent need, therefore, to speed up the process of collecting, analyzing, compiling and disseminating international aquaculture statistics. Luckily, the means to achieve this are now within reach as the use of computers has spread all over the developing world of Asia, very few national institutions responsible for aquaculture statistics do not possess suitable Personal Computer (PC) capacities for electronic data processing.

#### **Achievements and Potentials of Computerization**

Processing of aquaculture statistical returns has been computerized long since both at FAO and SEAPDEC. In fact, the FAO aquaculture database is also available on 3.5" computer diskettes since June 1993. The program, called AQUASTAT-PC, runs on all common 386 PCs having a VGA screen and MS/DOS operating system. It requires only two megabytes of random access memory and about five megabytes of free space on the hard disk. Its installation takes not more than five minutes for computer-literate persons.

The time series of aquaculture production volume included in the program currently covers the period between 1984 and 1991. Data are organized by country, cultured species and culture environment, i.e., marine, inland or brackishwater. The current release (1993/A) is planned to be updated at least once a year.



Production data can be extracted from the database by country, species or culture environment. Extracted time series can be aggregated, ranked in terms of magnitude, averages or moving averages can be calculated. Statistical functions are also available, presently these involve the computation of relative linear trends, fluctuation indicators and the shape of the time series.

Printing and plotting functions of the program are rudimentary, good only for obtaining a quick idea about the extracted time series. However, data can be exported to LOTUS, using the LOTUS TRANSLATE utility, or to WORDPERFECT, using an ASCII file. Thus, a LOTUS spreadsheet can be created for further computations and for producing more sophisticated graphs. Moreover, tables may be inserted directly into the written text. The new revision of FAO's aquaculture statistics (FAO 1993a) shows good examples of such applications.

The AQUASTAT-PC offers a powerful tool for analyzing aquaculture statistics not like the previously published immense volumes of raw numbers. An additional advantage is that preparing an updated version of the program takes much less time than publishing a new issue of the annual statistics, in an optimal case, this can shorten the time gap within one whole year.

Further steps in the use of electronics may be computerized data collection and reporting through electronic mail. This would further reduce time requirement and increase accuracy. In order to fully utilize the potentials of computerization, the current wide diversity of computer hardware and software used by the responsible national agencies has to be reviewed and standardized. FIDI can assist member governments in such a process by advising on the most appropriate hardware specifications and software packages, by organizing training activities. Moreover, internationally compatible spreadsheets for data collection, processing and/or reporting may also be developed. Asia should again take the leading role in this respect by initiating a regionwide survey based on which suitable proposals could be developed.

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## ROLE PLAYED BY INFOFISH IN FISHERY INFORMATION

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### INTRODUCTION

INFOFISH was established as the FAO Project "Marketing Information and Advisory Services for Fish Products in Asia/Pacific Region" in 1981, hosted by Malaysia with headquarters in Kuala Lumpur. Initial funding was provided by the Government of Norway. Subsequently in March 1987, INFOFISH became an independent inter-Governmental Organization. It is now funded by the member countries' contributions and revenue from sales and services. There are ten members at present, namely, Bangladesh, India, Indonesia, D.P.R. Korea, Malaysia, Maldives, Papua New Guinea, Solomon Islands, Sri Lanka and Thailand. The Philippines is expected to join shortly. The organization's activities in the member countries are coordinated by the National Liaison Offices designated by the respective governments.

The Regional Marketing Information and Advisory Services for Fish Products were launched by FAO during the late seventies, starting with Latin America where the first of the four Regional Projects was established in 1977 as INFOPESCA based in Panama. Following INFOFISH, its African counterpart INFOPECHE was started in Cote d'Ivoire in 1985. INFOSAMAK based in Bahrain since 1986, is the final link of this network, serving the Arab world. Depending on the language in which these organizations operate the words Pesca in Spanish, Peche in French and Samak in Arabic all meaning Fish, are suffixed to INFO denoting information.

These networks link together with the GLOBEFISH data bank attached to FAO in Rome constitute the global fish marketing information network. Each component of the network is engaged in collection of market and trade data from their respective regions as well as neighboring developed countries and major markets.

#### PUBLICATIONS

Information collected by the Regional Services as well as specially assigned Market News Correspondents is compiled and analyzed at INFOFISH and disseminated through various means. Regular and occasional publications, apart from replies to marketing and technical enquiries, are the major tools used by INFOFISH in these activities:

##### **INFOFISH Trade News**

The INFOFISH Trade News (ITN) issued every two weeks contains market reports for the preceding fortnight, gathered from different parts of the world. Special emphasis is given to major suppliers and importers. Price references, in local currency and US dollar, together with indications on price trends and market prospects, are covered for all major seafood products and markets. Fresh/chilled, frozen and processed fish and shellfish including major commodities like shrimp, tuna, cephalopods, finfish and other marine products, are covered separately. Fact sheets, news bulletins and current statistics are regular features of the ITN. Trade and joint venture opportunities including offer and demand announcements are also published for trade promotion.

##### **INFOFISH International**

Originally INFOFISH Marketing digest, "INFOFISH International" or II, is published bimonthly by the Regional Services. Articles on fish harvesting and processing, aquaculture and marketing aspects, current issues, new equipments, industry notes, technical questions and answers, book reviews and such items of interest to industry and policy-makers, are published in II. While post-harvest aspects were highlighted initially, aquaculture and fishing technology are also extensively covered at present.

### European Price Report

Compiled by GLOBEFISH and reproduced and distributed by INFOFISH, this monthly publication covers fish prices prevailing in European markets, together with price trend indications and information on supply-demand situation.

### GLOBEFISH Highlights

This is a quarterly publication prepared by GLOBEFISH and distributed by INFOFISH. Periodic review of markets and price trends for marine products is provided in this publication. Major commodities such as shrimp, tuna, cephalopods, groundfish and fish meal are given particular emphasis.

### Warta Akuakultur

An aquaculture magazine published by INFOFISH in Indo-Malay language every three months, "Warta Akuakultur" focuses on tropical aquaculture. original articles catering to readers in Malaysia and Indonesia are featured, together with technical papers written in laymen's language.

### Irregular/Occasional Publications

A wide range of publications meant for fishery industry, policy-makers and technologists have been brought out by INFOFISH. These include proceedings of several international conferences organized by INFOFISH. Further, a series of technical handbooks deal with fish handling, processing, packaging, transportation and waste utilization as well as aquaculture.

On the marketing and investment side, commodity studies on shrimp, tuna and cephalopods have been taken up and results published as separate volumes. Together with these fishery export industry profiles of thirteen countries in Asia Pacific region were also issued recently. Such INFOFISH publications as well as a series of GLOBEFISH Research Programme Reports, are well accepted and sought after by the industry and others concerned.



### ADVISORY SERVICES

Apart from publications, the broad range of practical services provided by INFOFISH includes dissemination of information through its advisory services. The INFOFISH technical information center containing a large number of fishery publications including books and periodicals, other source materials as well as computerized rosters and database, are used in these services. Markets and marketing as well as technical topics including fishing, processing and aquaculture, are covered under advisory services. Training activities and consultancy work are also undertaken, either independently or in collaboration with FAO and other agencies concerned. These activities are carried out by the core sectors of INFOFISH comprising Trade Promotion, Market Information, Technical Advice and Specialized Services.

#### Trade Promotion and Market Information

In addition to publications on trade and markets, these services handle an estimated 2,000 trade enquiries every year. Enquiries from INFOFISH Member Countries account for about 35 per cent of the total. These are usually dealt with free of charge and on priority basis. Other enquiries especially from industrialized countries and involving time consuming research are charged based on the volume of work involved. INFOFISH Trade news Fax Service, aimed at those in urgent need of specific market information by facsimile on the same day of its publication, is a new service which started recently. Pages of the ITN and European Fish price Report are available by Fax to subscribers at an extra cost.

#### Technical Advisory Services

About 3,500 enquiries on subjects ranging from fish processing and quality control to aquaculture and the environment are handled by the Technical Advisory Services (TAS) on an average every year. Information on global suppliers and manufacturers of machinery and equipment for fish processing and aquaculture industries is compiled, stored and disseminated by TAS. Preparation of rosters on consultants and experts in these fields is another activity.



Specialized advise in areas such as plant design and layout, products and product development as well as important regulations and standard are provided by this services which also publishes a quarterly bulletin "The Fish Inspector" which is distributed globally.

#### *Fishing Technology Services*

Fishing Technology Services (FTS) started in 1992 with the support of FAO is the latest addition to INFOFISH Technical Advisory Services meant for helping the fishing sector in the region. A quarterly newsletter "Information Technology, Fishing Gear and Methods, Vessels and Equipment" issued by this service is well received by the industry. Preparation of regular articles on fishing technology, answering technical enquiries and collection and dissemination of related data are major activities carried out under FTS which is presently manned by FAO specialist.

#### **Specialized Services**

Short-term consultancies related to harvesting, processing and marketing of fish and fishery products are taken up under this activity. The specific needs of the industry, policy-makers and governments in these areas are met by this service, namely, global supply, market trends and prospects for the principal fishery commodities including shrimp, tuna, cephalopods and other fishery products; buyer-seller matching; handling, processing and quality assurance; product development, value addition and packaging; aquaculture; and environmental assessment.

#### **CONFERENCES**

Starting with "Tuna Bangkok" in 1985, a series of international conferences have been organized by INFOFISH as far. Since holding "Shrimp 88" in Bangkok and "Aquatech 90" in Kuala Lumpur, INFOFISH international conferences are being organized annually on topics of global interest. "Tuna 91 Bali," "Shrimp 92 Hongkong" and Tuna 93 Bangkok" held in recent years were internationally acclaimed. while providing useful and up-to-date information. These events also offer opportunities for industry leaders to meet, exchange ideas and strike deals.

### CONCLUSION

INFOFISH is now on its seventh year as an Inter-Governmental Organization serving the fishery industry in general. Over the years, INFOFISH has seen increasing acceptance of its expertise and role within the Asia-pacific region and in industrialized countries through regular meetings and consultations with industry in member countries and participation in international events. Despite being independent, INFOFISH continues close cooperation with FAO in areas like technical training and data exchange with the worldwide fish marketing information network.

Though INFOFISH was mostly concerned with post-harvest aspects of fishery in the initial stages, with the addition of aquaculture and fishing technology services in recent years the organization has evolved into an indispensable source of integrated fishery information within the region and beyond. With the expansion of its activities, INFOFISH is also in need of understanding and encouragement from all concerned for ensuring its sustainability. While continued patronage of its member countries is an important factor in this respect, other interested parties are also welcome to cooperate. New members from the region should be encouraged to join INFOFISH as a first step. Both developing countries and industrially advanced countries are expected to benefit from membership.

The industry can also take an active role in INFOFISH through corporate membership, presently being promoted. On the other hand, the international agencies, financial institutions and donor countries will find INFOFISH a purposeful organization for collaboration in promoting healthy growth of fishery and fish trade regionally and globally.

Recommendations on  
Fishery Statistics

Proceedings of the Regional Workshop  
on Fishery Information and Statistics  
in Asia (Vol. II)

### RECOMMENDATIONS ON FISHERY STATISTICS

The Workshop discussed the actions required to improve the collection and compilation of fishery statistics in Asia based on the problems and constraints identified by the participating countries.

After the discussion, the Workshop adopted the following recommendations in order to improve the collection and compilation of fishery statistics in Asia:

#### (1) National Level

Country	Recommendations
Australia	
Bangladesh	Existing fishery resources survey system (which is responsible for fishery statistics) in the Department of Fisheries should be strengthened
	Frame survey should be conducted
Brunei Darussalam	Suitable training of staff should be conducted for proper data collection and analysis
Cambodia	Fishery census should be carried out as soon as possible
	Staff should be trained to improve the statistical system
	Computer facilities should be provided for data processing
	International assistance is required to implement the aforementioned recommendations

People's Republic of  
China

Under the changing conditions, from planning economy to market economy, the administrative structure of agencies should be improved so that statistical agents and posts can be lawfully established at each level of the Department of Fisheries

Statisticians should be properly trained

Fishery information cooperation should be expanded internationally

India

Assistance for computer facilities is needed, for software as well as hardware, in order to develop the statistical network

Indonesia

A management fishery statistics and information system should be established in the Directorate-General of Fisheries or the whole nation

Japan

Laos

A management fishery statistics and information system should be established

Malaysia

A complete networking and computerization of data processing and analysis should be developed

Maldives

The whole statistical system should be reviewed

Fishery census should be conducted

Senior and junior staff should be trained

Assistance from international organizations is required for the above-mentioned recommendations

## Nepal

Statistical units must be stationed in the districts in order to collect various data of the districts

A National Coordinator for information and statistics should be appointed in each country in Asia

Technical cooperation should be promoted among the Asian Countries

A data collection system should be developed

## Pakistan

A proper fisheries data collection System should be established

## Philippines

Adequate budget should be provided in order to improve the fishery statistical system

A system should be developed on the generation of catch-effort statistics

Staff should be trained

The existing statistical system should be reviewed

A more sustainable data collection system should be developed

## Sri Lanka

Computerization of fishery data processing analysis with suitable computer facilities such as hardware and software should be carried out

Training in computer data processing should be implemented

Training facilities already available for fishery statistical staff, should be strengthened



- Thailand
- Training course on the use of computer-on-line system for data processing at central and provincial levels should be conducted
- Regional training course on the analysis of catch statistics should be conducted so that the analysis part can be included in the Statistics Yearbook of each country
- Taiwan
- Review process should be undertaken constantly by fishery statistics authority to ensure international standards
- Bilateral cooperation should be established as soon as possible
- Viet Nam
- The system of data collection and validation should be improved and modernized
- A centralized computerized information system should be established
- Masters and owners of all motorized fishing boats should be enforced to make notebook or logbook recording of their fishing activities
- Training of technical staff, provision of micro-computers and software technology at all levels, should be carried out
- Necessary training and organization of appropriate data analysis and communication systems should be implemented
- Cooperation and coordination with countries and organizations at regional and international levels should be established.

(2) Regional and International Levels

2.1 FAO in cooperation with SEAFDEC will work on the standardization of the classification used for collating fishery products, production and fish trade statistics for the region

2.2 In order to fully utilize the potentials of computerization, the current wide diversity of computer hardware and software used by the national agencies should be made compatible

Moreover, compatible standard procedures and formats should be developed for reporting fishery statistical data at regional level using electronic and magnetic media

FAO/RAPA should organize such a survey in cooperation with SEAFDEC

2.3 Participating countries should be strive to submit complete and accurate data, and to make use of the database package developed by FAO and SEAFDEC for faster reporting of data

(3) Catch-Effort Statistics

3.1 The format of the Catch-effort Statistics for the South China Sea Area, should be amended as proposed by SEAFDEC/MFRDMD

The revised format will include three categories of catch-effort statistics, namely, Annual Catch-effort Statistics, Monthly Catch-effort Statistics, and Specific Data on Catch-effort

(4) Fishery Statistical Bulletin for the South China Sea Area

4.1 The classification of fishery commodities on disposition of catch, fish processing and exports by fishing commodity should be revised as proposed by SEAFDEC/MFRD and supported by FAO

(5) Socio-economic Statistics

- 5.1 Noting the increasing importance of economic data for efficient fisheries management, the workshop encouraged countries to collect them and to make more appropriate analytical studies
- 5.2 The fisheries departments should collaborate closely with national agencies in conducting socio-economic surveys on fisheries
- 5.3 Different types of fisheries/aquaculture should be taken into account in the design of socio-economic surveys
- 5.4 Countries were urged to make efforts to disaggregate data on employment and other local information, by sex in their survey
- 5.5 Participating countries and FAO should consider the collection and publication, as soon as feasible, of data on catch value at the landing place

(6) Aquaculture Statistics

- 6.1 For resource management purposes, it would be more useful and more reliable to obtain and report separate statistics on capture fishery and culture production, rather than subtracting aquaculture data from total catch to obtain capture figure  
  
Until this change can be made and for greater clarity, the current FAO yearbook be labelled as "Fishery Production Statistics Including Aquaculture", rather than "Catches and Landings"
- 6.2 On the criteria on units of measure for aquaculture facilities, it was recommended that "hectares" should be used for ponds and pens while "cubic meters" for cages
- 6.3 Many participating countries endorsed the proposed amalgamation of "brackishwater" and "marine" aquaculture to "coastal aquaculture" to avoid confusion and simplify statistical work

- 6.4 Participating countries should make greater efforts to specify returns of aquaculture production by species and not to aggregate them into simple groups like "natantian decapods" or "cyprinidae", as the case may be
- 6.5 The instructions for completion of the FAO questionnaire should be improved by giving more guidance on the designation of type of fisheries, on type of production by environment, and to explain that "cultured ornamental fish" should be reported as "aquaculture," where feasible

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Proceedings of the Regional Workshop  
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- AADCP - ASEAN-EEC Aquaculture Development and  
Coordination Programme (Thailand)
- ABARE - Australian Bureau of Agricultural and Resource  
Economics
- AFS - Asian Fisheries Society (Philippines)
- AGNA - Aquaculture Genetics Network of Asia  
(Philippines)
- AGRIS - International Information System for the  
Agricultural Sciences and Technology (FAO, Rome)
- AIBA - Agricultural Information Bank for Asia  
(Philippines)
- AIT - Asian Institute of Technology (Thailand)
- APCAS - Asia and Pacific Commission on Agricultural  
Statistics (Thailand)
- ASD - Agriculture Statistics Division (Nepal)
- ASEAN - Association of Southeast Asian Nations
- ASFA - Aquatic Sciences and Fisheries Abstracts (FAO,  
Rome)
- ASFIS - Aquatic Sciences and Fisheries Information System  
(FAO, Rome)
- BAR - Bureau of Agricultural Research (Philippines)
- BAS - Bureau of Agricultural Statistics (Philippines)
- BFAR - Bureau of Fisheries and Aquatic Resources  
(Philippines)
- BFDA - Brackishwater Fish Farmers' Development Agency  
(India)
- BFDC - Bangladesh Fisheries Development Corporation

- BIOSIS - Biological Sciences Information System (U.K.)
- BOBP - Bay of Bengal Programme (India)
- BRAIS - Brackishwater Aquaculture Information System (Philippines)
- CABI - Commonwealth Agricultural Bureau International (U.K.)
- CARIS - Current Agriculture Information System (FAO, Rome)
- CBS - Central Bureau of Statistics (Nepal)
- CCABES - Current Contents: Agriculture, Biology and Environmental Sciences
- CICFRI - Central Inland Capture Fisheries Research Institute (India)
- CIDA - Canadian International Development Authority
- CMFRI - Central Marine Fisheries Research Institute (India)
- CFRI - Central Fisheries Research Institute
- CSD - Cadastrally-surveyed district (Nepal)
- DAD - Department of Agriculture Development (Nepal)
- DFAMS - Department of the Development of Food and Agriculture Development (Nepal)
- DFIS - Division of Fishery Information and Statistics (China)
- DGF - Directorate-General of Fisheries (Indonesia)
- EPCS - Economic Planning and Coordination Section (Maldives)
- ESCAP - Economic and Social Commission for Asia and the Pacific (Thailand)
- EEZ - Exclusive Economic Zone
- FAO - Food and Agriculture Organization (Rome, Italy)

- FAO/RAPA - FAO Regional Office for Asia and the Pacific (Thailand)
- FDD - Fisheries Development Division (Nepal)
- FFDA - Fish Farmers' Development Agency (India)
- FIDI - Fishery Information, Data and Statistics Service (FAO Fisheries Department)
- FIPIS - Fishery Project Information System (FAO, Rome)
- FLC - Fish Landing Center (Philippines)
- FRI - Fisheries Research Institute (Malaysia)
- FRSS - Fishery Resources Survey System
- FSP - Fisheries Sector Program (Philippines)
- IAMSLIC - International Association of Marine Science Libraries and Information Centers (U.S.A.)
- ICAR - Indian Council for Agricultural Research
- ICLARM - International Center for Living Aquatic Resources Management (Philippines)
- IDRC - International Development Research Centre of Canada
- IFRM - Integrated Fishery Resource Management
- INFIS - Indonesian Fisheries Information System
- INFOFISH - Intergovernmental Organization for Marketing Information and Advisory Services for Fishery Products in the Asia and Pacific Region (Malaysia)
- IOC - Indian Ocean Commission (Sri Lanka)
- IOTC - Indian Ocean Tuna Commission (FAO)
- IPFC - Indo-Pacific Fisheries Commission (Thailand)
- IPTP - Indo-Pacific Tuna Development and Management Programme (Sri Lanka)
- IT - Information Technology



LAN	- Local area network
LKIM	- Fisheries Development Board (Malaysia)
MAFF	- Ministry of Agriculture, Forestry and Fisheries (Japan)
MALFIS	- Malaysian Fisheries Information System
MCS	- Monitoring Control and Surveillance in Fishery Resource (Malaysia)
MFIS	- Management Fishery Information System (Indonesia)
MIFCO	- Maldives Industrial Fisheries Company
MOFA	- Ministry of Fisheries and Agriculture (Maldives)
MPEDA	- Marine Products Export Development Authority (India)
NACA	- Network of Aquaculture Centres in Asia-Pacific (Thailand)
NCSD	- Non-cadastral district (Nepal)
NFIS	- National Fishery Information System (Philippines)
NIC	- National Informatics Centre (India)
NIDBMS	- National Integrated Database Management System (Malaysia)
NOAMI	- National Oceanographic and Marine Institute (Bangladesh)
NSO	- National Statistics Office (Philippines, Thailand)
NSSO	- National Sample Survey Organization (India)
NTFS	- Network of Tropical Fisheries Scientists (Philippines)
PASFIS	- Philippine Aquatic Sciences and Fisheries Information System
PASO	- Provincial Agricultural Statistics Office (Philippines)

- PC - Personal computer
- PCAMRD - Philippine Council for Aquatic and Marine Research and Development
- PFDA - Philippine Fisheries Development Authority
- RC-IPD - Regional Centre for Information Preparation and Dissemination (Malaysia)
- SAFIS - Southeast Asian Fisheries Information Service (SEAFDEC)
- SCORRAD - Standing Committee on Resource Research and Development (IPFC)
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- SEAPOL - South-East Asian Programme in Ocean Law, Policy and Management (Thailand)
- SFIS - Selective Fisheries Information Service (ICLARM)
- SIFR - Strategy for International Fisheries Research (Canada)
- SPARSO - Space Research and Remote Sensing Organization (Bangladesh)
- TFB - Taiwan Fisheries Bureau
- THAIFIS - Thai Fisheries Information System

- UNCED - United Nations Conference on Environment and Development
- UNCLOS - United Nations Convention on the Law of the Sea
- UPV - University of the Philippines in the Visayas
- UTs - Union territories (India)
- WPFCC - Western Pacific Fisheries Consultative Committee (Philippines)

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