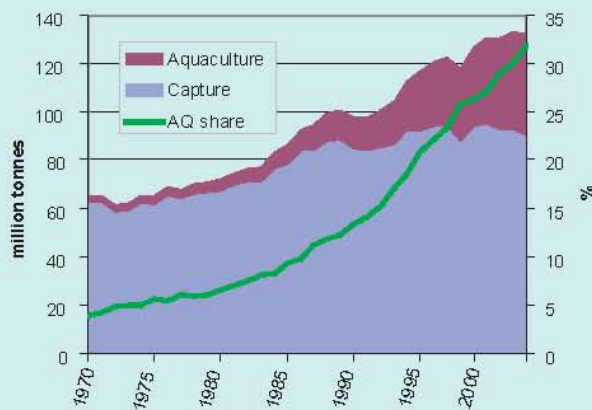


Towards improving global information on aquaculture



Cover photograph:

A local fish market in Phnom Penh, Cambodia. Courtesy of Felix Marttin, FAO.

Towards improving global information on aquaculture

FAO
FISHERIES
TECHNICAL
PAPER

480

by
FAO Fisheries Department

The designations employed and the presentation of material in this information product do not imply the expression of any opinion whatsoever on the part of the Food and Agriculture Organization of the United Nations concerning the legal or development status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

ISBN 92-5-104995-5

All rights reserved. Reproduction and dissemination of material in this information product for educational or other non-commercial purposes are authorized without any prior written permission from the copyright holders provided the source is fully acknowledged. Reproduction of material in this information product for resale or other commercial purposes is prohibited without written permission of the copyright holders. Applications for such permission should be addressed to:

Chief

Publishing Management Service

Information Division

FAO

Viale delle Terme di Caracalla, 00100 Rome, Italy

or by e-mail to:

copyright@fao.org

© FAO 2005

Preparation of this document

The COFI Sub-Committee on Aquaculture (COFI-AQ), during its First Session in April 2002, identified data collection and reporting (to improve knowledge and management of the sector) as a key priority area for future work. The Sub-Committee considered information needs for aquaculture at the global level and recommended that FAO develop an approach (strategy) for improving reporting on aquaculture status and trends similar to that developed for capture fisheries, with special attention to the quality of the information on which it is based.

Following up with this recommendation, the FAO convened, in January 2004, an Expert Consultation on Improving Information on Status and Trends of Aquaculture, which reviewed and approved, with amendments, a draft strategy for aquaculture prepared by FAO.

This document represents background documentation and reviews prepared for the Expert Consultation, the final draft of the strategy which incorporates the recommendations and suggestions of the Consultation and those of the Working Group of Experts on the FAO Aquaculture Questionnaire, "FISHSTAT AQ", which immediately followed the Expert Consultation.

The document has been prepared by the FAO Fisheries Department with the major contribution of Mr Ziad Shehadeh, former Senior Fishery Resources Officer at the Fisheries Department, Mr Rohana Subasinghe (Inland Water Resources and Aquaculture Service), Mr Alan Lowther (Fishery Information, Data and Statistics Unit), and Mr Raymon VanAnrooy (Development Planning Service), with page layout assistance from Mr Juan Carlos Trabucco.

Abstract

In order to work towards improving information on global status and trends for aquaculture, the FAO Fisheries Department convened two meetings of international aquaculture experts in January 2004. The first Expert Consultation on Improving Information on Status and Trends of Aquaculture was held from 20 to 23 January. The 16 technical experts included participants from five continents and a mix of government aquaculture officials, academic researchers, and representatives of producers associations and regional aquaculture organizations. The Expert Consultation approved a draft Strategy and Outline Plan for Improving Information on Status and Trends of Aquaculture.

Following this Expert Consultation, the Working Group of Experts on the FAO Aquaculture Questionnaire “FISHSTAT AQ” met from 24 to 26 January to suggest improvements to the data collection form used by FAO in its annual inquiry to member countries for aquaculture statistics. They were asked to deliberate improvements, while keeping in mind the relevant recommendations of the preceding Expert Consultation. Many of the same experts participated in this Working Group as well as additional participants representing national providers of data to FAO and two survey research specialists in questionnaire design.

These meetings are seen as the beginning of the already existing parallel process for status and trends reporting for capture fisheries. The outcome there was the adoption of the Strategy for Improving Information on Status and Trends of Capture Fisheries, which was formally agreed on and accepted by the FAO Committee on Fisheries (COFI) in February 2003. The process for aquaculture status and trends was envisioned to produce a similar strategy document for the aquaculture sector.

The draft strategy for aquaculture, the reports of the two meetings and background documents prepared for the meetings are contained in this volume. These background documents include an overview of current FAO procedures for collecting and reporting aquaculture statistics, a summary of the issues confronting attempts to improve data collection and reporting and a collection of regional reviews in which countries have described their systems and strategies for the collection of aquaculture status and trends information.

FAO Fisheries Department.

Towards improving global information on aquaculture.

FAO Fisheries Technical Paper. No. 480. Rome, FAO. 2005. 172p.

Contents

Preparation of this document	iii
Abstract	iv
Draft strategy and outline plan for improving information on status and trends of aquaculture	1
Report of the Expert Consultation on Improving Information on Status and Trends of Aquaculture	15
Report of the Meeting of the Working Group of Experts on the FAO Aquaculture Questionnaire “FISHSTAT AQ”	41
Supporting documents prepared for the Expert Consultation on Improving Status and Trends Reporting on Aquaculture	61
Current FAO procedures for monitoring and reporting production and status of aquaculture	63
General issues in relation to status and trends reporting on aquaculture	81
Asia regional synthesis: information for status and trends reporting on aquaculture	107
Latin America regional synthesis: information for status and trends reporting on aquaculture	139
Summary and excerpts from the Africa regional synthesis: information for status and trends reporting on aquaculture	161
Europe and Near East regional synthesis: information for status and trends reporting on aquaculture	165

Draft strategy and outline plan for improving information on status and trends of aquaculture

This document presents a strategy for improving information on aquaculture status and trends based on that developed for capture fisheries through an FAO Technical Consultation convened in March 2002 and approved by the FAO Council in 2003. The basic structure and guiding principles of the fisheries strategy are retained and selected revisions made in contents as necessary to meet the specific needs of aquaculture. The draft strategy for aquaculture was reviewed and approved with amendments by the FAO Expert Consultation on Improving Information on Status and Trends of Aquaculture in January 2004. The present document represents the final draft of the strategy for aquaculture, which incorporates amendments suggested by the Expert Consultation.

1 INTRODUCTION AND RATIONALE

The need for aquaculture data and information collection is embedded in the Code of Conduct for Responsible Fisheries, and some data needs are further elaborated in the associated FAO Technical Guidelines. The Code recognizes that reliable and timely data are required for the competent authorities of national governments to effectively discharge their general responsibility in the promotion of sustainable aquaculture practices that are well integrated into rural, agricultural and coastal development.

The collection, analysis and presentation of reliable evidence of current achievements at the local and national levels are the basis for monitoring the structure, production and performance of the aquaculture sector, and for analysing trends over time. These practices also contribute to the calculation of indicators that provide evidence of meaningful and sustainable impact of good policies.

In recent years the demand for reliable data and information and for reporting on aquaculture has greatly increased, driven not only by the need to formulate and monitor sound policies and development plans, but also by new information and reporting requirements of international agreements and initiatives, and by the increasing public demand for transparency and accountability.

Changing perspectives in fisheries and aquaculture management are also changing the requirements for information. Now, managers must take a wider range of issues into account in decision-making, including consideration of aquaculture within the full scope of the environment; approaching sustainability through application of the Precautionary Principle, as embodied in the CCRF; and considering information from and between all sectors to ensure transparency and the likelihood that compliance can be understood, accepted and implemented.

Though aquaculture has been practiced for centuries in some countries, management of the sector is a fairly new concern. In fact, aquaculture was recognized only recently (March 2001) as an independent economic activity by the United Nations Statistical

Commission. Accordingly, the collection of statistical data and other information on aquaculture separately from fisheries data is a recent endeavor at the national regional and global levels and lags well behind systems for agriculture and capture fisheries.

However, the growing interest in aquaculture and the implications of its expansion, together with strategic concerns for sustainable development and trade, and for social and economic development, have created a need for a better array of numerical data of reliable quality and for other information that measures and describes trends of the sector. In many countries, the sector is developing rapidly, or is expected to do so, adding to the need for close and regular monitoring.

Information on the status and trends of aquaculture is also either needed for, or consistent with, international instruments with relevance to aquaculture, including:

- *Code of Conduct for Responsible Fisheries* which calls for use of the best scientific evidence available, bilateral and multilateral cooperation in research and data collection (Article 6.4), regional mechanisms for cooperation to compile and exchange data (including information on socio-economic factors, Article 7.4), and publication and dissemination of results (Article 12);
- *The Declaration and Plan of Action of the FAO Kyoto Conference on the Sustainable Contribution of Fisheries to Food Security* which calls for monitoring and assessing production of fishery products, supply and demand, and their effects on food security, employment, income and trade; promoting standardized methods for study of social, cultural and economic attributes of fisheries and aquaculture, and developing verifiable indicators of the importance of these attributes and their compatibility with management objectives;
- *Commission for Sustainable Development*, as called for by UNCED in Chapter 40 of Agenda 21, which requires states to report on sustainability indicators, which are likely to be partially based on fisheries and aquaculture status and trends information;
- International Conventions and Agreements, such as the *Convention on Trade in Endangered Species (CITES)* (1973) and the *Convention on Biological Diversity* (1992), which call for the collection and exchange of information on the status of biota; *Agreement on Sanitary and Phytosanitary Measures (SPS Agreement)* which calls for international reporting on incidence and risk of selected aquatic diseases; World Trade Organization (*WTO Agreement on Technical Barriers to Trade (TBT)*) which may call for eco-labelling for sustainability and safety purposes; and
- International Programmes, including the (a) *United Nations Environmental Programme (UNEP)*, (b) specific projects sponsored by the *Global Environmental Facility*, and (c) *Inter-Agency Committee on Sustainable Development*, which call for, or need, fisheries and aquaculture information.

FAO is a provider of global assessments and analyses to the world community. The challenge is to respond to the increasing and more diversified demand for these services, while adapting to Members' changing needs. The communications revolution has created an ever more quality-conscious external environment, requiring greater attention to the improvement of information products. As the quality of FAO's information is closely correlated to the capacity of member countries to provide reliable and complete data, there is a need to support and/or improve their capacity for data collection and analysis.

Promoting sustainable aquaculture at the national level requires improved status and trends information. Article 9 (Aquaculture Development) of the Code of Conduct for Responsible Fisheries (Articles 9.2.4. and 9.1.3) requests states to enhance their capabilities of data collection and dissemination, and in the application of such data to rational use of resources and aquaculture development planning.

Since 1984, FAO has made considerable progress in establishing a global database on aquaculture statistics, but much more needs to be done to improve knowledge of

the sector and to adapt to current demands for management information. Aquaculture statistics of many countries presently do not meet the information demands of management for sustainability, and there are a number of technical constraints in the compilation of regional and global aquaculture statistics related to standardization, completeness and reliability of data reported by some countries, and by institutional problems at the national and global levels. The need to resolve these constraints is made more urgent by the increasing demand for information at all levels by a variety of data users.

The Working Party on Status and Trends of Fisheries of the FAO Advisory Committee on Fisheries Research (ACFR:STF), on the request of the ACFR, prepared a draft International Plan of Action (IPOA) for improving the Fishery Department's data collection and assessments of status and trends of capture fisheries, which was presented to the twenty fourth session of the Committee on Fisheries (COFI) in March 2001. The IPOA was subsequently reviewed and amended to a Strategy by a Technical Consultation convened in March 2002, on the request of COFI. The Strategy and related project profile for Improving Collection and Processing of Data and Information on the Status and Trends of Capture Fisheries were adopted by COFI during its Twenty-fifth Session, February 2003.

The COFI Sub-Committee on Aquaculture (COFI-AQ), during its First Session in April 2002, identified data collection and reporting (to improve knowledge and management of the sector) as a key priority area for future work. The Sub-Committee considered information needs for aquaculture at the global level and recommended that FAO develop an approach (strategy) for improving reporting on aquaculture status and trends similar to that developed for capture fisheries, with special attention to the quality of the information on which it is based.

In follow-up to this recommendation, the FAO convened, in January 2004, an Expert Consultation on Improving Information on Status and Trends of Aquaculture, which reviewed and approved, with amendments, a draft strategy for aquaculture prepared by FAO. This document represents the final draft of the strategy which incorporates the recommendations and suggestions of the Consultation and those of the Working Group of Experts on the FAO Aquaculture Questionnaire, "FISHSTAT AQ", which immediately followed the Expert Consultation.

2 NATURE AND SCOPE

2.1 Nature of the Strategy

This Strategy has been elaborated within the framework of the Code of Conduct for Responsible Fisheries (the Code), as envisaged by Article 2 (e), and as it relates to national and regional mechanisms for cooperation to compile and exchange data (Article 7.4.7 and Article 9.2.4), and the publication and dissemination of results, as it relates to aquaculture (Article 12.3, 12.4). It is also within the remits of the Strategic Framework for FAO 2000-2015 (Chapter II. Corporate Strategies, Section E - Improving Decision-making through the Provision of Information and Assessments and Fostering of Knowledge Management for Food and Agriculture).

The provisions of Article 3 of the Code apply to the interpretation and application of this document and its relationship with other instruments. All concerned Members and non-members of FAO and aquaculture entities are encouraged to support its implementation.

This Strategy applies to the assembly and dissemination of information on the status and trends of aquaculture. Data collection needs for monitoring the status and trends of aquaculture are established by existing obligations of states to report fisheries statistics to FAO under Article XI of the FAO Constitution. The Strategy proposes to significantly improve data collection and related research and provide impetus for

fulfilling those that already exist. This impetus should include additional support from relevant international organizations, whether governmental or non-governmental, and financial institutions (development partner agencies) for capacity building in developing countries.

In this Strategy, the reference to states includes the European Community in matters within its competence.

2.2 Scope of the Strategy

The Strategy is global in scope and is designed to cover all aquaculture in fresh, brackish and marine waters, including all commercial and subsistence aquaculture. It addresses issues concerning national capacity for the collection, processing, analysis and dissemination of data and information; quality, completeness and scope of data and information; timeliness of data and information collection and dissemination; national and international institutional frameworks for coordination of data and information collection; and participation and transparency in the preparation of global status and trends reports.

The main focus of the Strategy is on information concerning the primary food-producing sector (as opposed to supporting industries) and its contribution to national food security, including socio-economic information.

3 OBJECTIVE

The overall objective of the Strategy is to provide a framework for the improvement of knowledge and understanding of aquaculture status and trends as a basis for policy-making and management, and for sector development that is compatible with good stewardship of resources and the environment.

The Strategy will be implemented through arrangements between states, directly or through their participation of regional fishery organizations, and FAO. These arrangements should be established at various geographic scales, ranging from local, to national, to regional, and they should be linked to form a global system under the auspices of FAO. Wherever, and whenever, possible, existing organizations should be used as the basis of the arrangements.

FAO efforts to assemble and disseminate comprehensive information on the global status and trends of aquaculture (through its annual statistical yearbooks, periodic *FAO Fisheries Circulars* and the FAO Fisheries Global Information System (FIGIS)) are hindered by a number of institutional and technical constraints at the national, regional and global levels. The Strategy seeks to provide a framework for addressing these key constraints.

Consistent with Article 5 of the Code, the capacity of developing countries will be duly taken into account in implementing the Strategy. The Strategy will seek to enhance the capacity of states whose data collection systems are in a critical condition, so that they can improve sector management at the national level and fulfil existing commitments to collect aquaculture statistics, thus allowing them to more fully participate in the Strategy.

4 GUIDING PRINCIPLES

The arrangements for implementation of this Strategy should be based on the six guiding principles highlighted in the paragraphs that follow.

4.1 Sustainability of information systems

Arrangements for assembling and disseminating information on the status and trends of aquaculture should be viable in the long term. As a consequence: (a) adequate funding should be provided at the national, regional and global levels, taking into account the

resources available to countries, regional aquaculture/fishery organizations/mechanisms and FAO; and (b) the programme should consider the particular needs of developing countries which may require large investments in training and capacity building, to facilitate the formulation of appropriate national programmes or strategies.

4.2 Best scientific evidence

Arrangements for assembling and disseminating information on the status and trends of aquaculture should contribute to the best scientific evidence available. Protocols for assuring the quality of scientific information should be applied wherever and whenever practicable and appropriate. Such protocols should take account of the need to consider knowledge of participants in the sector, as well as traditional knowledge.

4.3 Participation and cooperation

Arrangements for assembling and disseminating information on the status and trends of aquaculture should adopt mechanisms for inclusion of all relevant participants in the preparation, analysis and presentation of aquaculture information. Relevant participants may include, *inter alia*, government experts, producers, industry representatives and non-governmental organizations. States should, in accordance with international law, cooperate with other states in developing and maintaining such aquaculture information, as appropriate, either directly, or through appropriate intergovernmental organizations, including regional fishery organizations/mechanisms. States should provide feedback on the status and trends of aquaculture to all relevant participants.

4.4 Objectivity and transparency

Arrangements for assembling and disseminating information on the status and trends of aquaculture should contribute to providing the best scientific evidence available (paragraph 26), and to transparency, in support of Article 6.13 of the Code of Conduct, while respecting any confidentiality requirements. Uncertainty associated with status and trends information should be expressed.

4.5 Timeliness

Arrangements for assembling and disseminating information on the status and trends of aquaculture should result in information being provided in a timely manner. Specific tools should be adopted or developed to ensure this outcome.

4.6 Flexibility

Arrangements for assembling and disseminating information on the status and trends of aquaculture should be flexible enough to permit adjustments as necessary to ensure that they effectively support aquaculture policy-making and management through the provision of appropriate information.

5 REQUIRED ACTIONS

5.1 Capacity-building in developing countries

States, relevant intergovernmental and non-governmental organizations, and financial institutions, should address developing country needs for financial and technical assistance, technology transfer, training and scientific cooperation, in order to build capacity to implement cost-effective and sustainable aquaculture data collection, data processing, analysis and reporting, and exchange information. Capacity building is critical to fulfil national needs, the needs of regional aquaculture/fishery organizations, existing obligations for reporting aquaculture data to FAO, and to ensure that developing countries can more fully participate in, and benefit from, the Strategy.

States, particularly major aquaculture producers, should incorporate the collection of aquaculture statistics as an integral part of the policy-making and sector management process, both at the local and central levels.

States should, with support from development partner agencies and assistance from FAO, where necessary, enhance their capacities to collect data (including the capacity to determine data needs of target users, identify the data to be collected, and clearly define the expected output), to ensure that the coverage of aquaculture information is as complete as possible and encompasses all sectors.

States should improve national inter-agency communications and coordination to make best use of all data collection schemes to obtain aquaculture data and reduce costs, particularly with regard to socio-economic data on small scale and subsistence aquaculture, employment and similar information that is often collected by government agencies unrelated to fisheries or aquaculture. The establishment of working groups comprising aquaculture and other statisticians should be promoted.

States should cooperate through their regional fishery organizations and regional programmes, with the cooperation of FAO if necessary, to develop and adopt effective and pragmatic standards and systems for collection of aquaculture statistical data, which should be compatible with FAO systems in order to enable reliable compilation of data on aquaculture at the regional and global levels.

5.2 Global methodologies and standards

5.2.1 Addressing gaps and constraints in the FAO statistical database on aquaculture

States, particularly major aquaculture producers, with assistance from FAO and relevant regional aquaculture/fishery organizations/mechanisms, should place special emphasis on the periodic collection of information on structural aquaculture statistics to enable the design of appropriate frame surveys, in the interest of more reliable and representative statistics, and for calculating resource use indicators as needed.

States should make greater efforts to specify aquaculture production by species and not aggregate them into species groups. In some instances, preparation of local taxonomic field guides for enumerators might help improve species details in aquaculture statistics.

States should seek to reduce delays in the collection, processing, analysis and reporting of statistical data by adopting information technology tools and investing in computers. Prolonged delays reduce data benefits in the decision-making process and may lead to poor decisions (due to dated information) and attendant loss of confidence and support for statistical systems.

FAO, in cooperation with states, regional fishery/aquaculture organizations/mechanisms and development partner agencies, should develop a standard software package for the compilation, processing and analysis of aquaculture statistics, and promote its adoption and application at the national and regional levels to ensure timely delivery of information to users. FAO should further expedite the processing and reporting of global aquaculture statistics by developing and adopting electronic tools and procedures for the collection of statistics from states.

FAO should review and revise the FAO aquaculture questionnaires as necessary to meet information needs and should improve the accompanying instructions. FAO should also seek to improve harmonization of priority terms and definitions where confusion may result in submission of incorrect information by states.

5.2.2 Data collection systems for aquaculture in rural development

States, relevant intergovernmental and non-governmental organizations, and financial institutions should recognize that many small-scale and subsistence aquaculture holdings, particularly in developing countries, are not well monitored and awareness

needs to be raised on the importance of monitoring these activities. They are probably under-estimated and therefore under-represented in current aquaculture status and trends information. Consequently they are not adequately considered in the development of plans and policies for aquaculture, particularly for improving rural food security and livelihoods.

States should participate in and support the development of cost-effective methods for acquiring and validating data on small-scale and subsistence aquaculture, including rapid appraisal methodologies and other approaches for data-poor situations and participatory processes that closely associate the farmers and their organizations to the data collection schemes. Where possible and appropriate, these surveys should be integrated with agricultural surveys and surveys of small-scale fisheries.

FAO, with support from member states and development partner agencies, should address the special data collection and assessment needs for small-scale and subsistence aquaculture, including the use of meetings of experts to develop innovative approaches and guidelines.

5.2.3 Expanding the scope of information on status and trends of aquaculture

States should approach the implementation of the Code of Conduct, in particular as this relates to Article 9 (Aquaculture Development), and other articles applicable to aquaculture [e.g. Article 7.4.4 and 7.4.5 (Data Gathering and Management Advice) and Article 12.9 (Fisheries Research)], by considering ways to expand the scope of status and trends reporting to meet the responsibilities recommended therein.

States, directly or through participation in regional fisheries organizations, should consider broadening the collection of information on the status and trends of aquaculture to support further development of aquaculture management, by incorporating, *inter alia*, socio-economic, environmental and resource use considerations.

FAO should seek to include the following data in its annual questionnaire (FISHSTAT AQ): (a) Volume of production by species by method of culture, (b) aquatic environment and area, (c) production in volume, (d) production in value, (e) area under culture, (f) volume of water, (g) hatchery production released to the wild, (h) hatchery production put in controlled environment, (i) number of farms/hatcheries, (j) employment in full time equivalent, (k) production by intensity level, (l) environmental indicators, (m) input of fry/juveniles from the wild.

FAO, with support of Members, and with full participation of regional organizations should further address the issue of indicators of sustainable aquaculture development (ecological, social, economic and institutional), including cost-effective methods for their derivation, to facilitate management of aquaculture, resources and the environment.

Any increase in the scope of collected statistics, to be practicable, must be considered in the context of national needs and priorities, data collection costs and national capacity, as well as the trade-off between the scope of coverage and data accuracy.

5.3 Improving institutional mechanisms and procedures for aquaculture statistics and status and trends reporting

5.3.1 Coordination and scientific advice

FAO, with support of its Members, either directly or through regional aquaculture/ fishery organizations/mechanisms and arrangements, should consider establishing an inter-regional Coordinating Working Party on Aquaculture Statistics (CWP-AS) with the same terms of reference as the Coordinating Working Party on Fishery Statistics (CWP-FS), i.e. to (a) keep under continuous review the requirements for aquaculture statistics for research, policy-making and management, (b) agree on standard concepts, definitions, classifications and methodologies for the collection and collation of

aquaculture statistics, and (c) make proposals for the coordination and stream-lining of aquaculture statistical activities amongst relevant intergovernmental organizations.

5.3.2 Participation

FAO should consider establishing an appropriate participatory mechanism for the involvement of national experts, centres of excellence and regional aquaculture/fishery organizations/mechanisms in the preparation and analysis of information on status and trends in aquaculture. Relevant participants may include, *inter alia*, government experts, producers, industry representatives and non-governmental organizations. The mechanism would provide greater transparency, consensus building at the national, regional and global levels.

5.3.3 Oversight

FAO, with support from its Members, either directly or through regional fishery organizations, should also consider establishing a process for scientific oversight of the global reviews of aquaculture status and trends, including those prepared for the biennial State of World Fisheries and Aquaculture (SOFIA).

5.3.4 FIGIS participation, structuring and capacity building

States should support, both directly or through participation in regional fisheries organizations, the development of Fisheries Global Information System (FIGIS) by:

- providing national user requirements for outputs from and inputs to the system;
- participating in national, regional and international processes to define the protocols for information exchange, quality assurance or quality rating, and transparency provisions to be specified in partnership agreements;
- contributing timely information to FIGIS;
- facilitating a systematic synthesis of information on aquaculture status and trends from national to regional and global levels;
- participating in complementary information and communication technology initiatives aimed at improving the generation and dissemination of research-based knowledge relevant to sustainable development;
- providing FIGIS with the best scientific information available where the assurance of information quality could be established by review processes at the national or regional level;
- supporting FAO and other FIGIS partners, as appropriate, in the organization of and participation in pilot projects and workshops, to further develop and implement FIGIS, to develop training materials, and to conduct training; and
- FAO's continued development of FIGIS, using modern information and communication technology, as a partnership between FAO, regional fisheries organizations and national organizations, and other organizations that can make a positive contribution to the system.

5.3.5 Criteria and methods for ensuring information quality and security

States should participate in the development and application of criteria and methods to ensure information quality and security for the purposes of best scientific evidence, in accordance with internationally agreed standards and practices, through mechanisms for data verification, and in a manner consistent with applicable confidentiality requirements.

FAO, with support of, and participation by Members should facilitate the development of practical guidelines for quality assurance, transparency and security of aquaculture information.

5.3.6 Arrangements for the provision and exchange of information

States, directly or through their participation in regional fisheries organizations, should seek and agree on arrangements to facilitate the provision and exchange of information on the status and trends of aquaculture with FAO, as appropriate. These arrangements should address the roles and entitlements of the partners, including in relation to information quality, transparency and confidentiality.

Working groups composed of aquaculture experts and set up by countries or regional fishery organizations that meet to assess the status and trends of aquaculture and which conduct their work according to terms of reference which specify the scope of their activities, are an important mechanism for enhancing the quality and transparency of scientific information. They can also provide important opportunities for capacity building.

States, directly or through participation in regional fishery organizations, in their respective jurisdictions and regional programmes, should formalize arrangements for working groups to analyse aquaculture data and information towards the evaluation of their status and trends. The periodicity of these working group meetings would depend on available human and financial resources and the characteristics of the aquaculture sector.

States should seek to make use of all national information systems by improving coordination and sharing of information among government agencies and integration of information collection where possible (e.g. with agricultural and artisanal fisheries surveys, agriculture census, etc.).

States and development partner agencies should work with FAO to ensure the participation of fishery experts from around the world in working groups, particularly where these working groups contribute to capacity building in developing countries. The TCDC and other FAO programmes could be used for this purpose.

5.3.7 Sustaining data collection, information on the status and trends of aquaculture

States should monitor their systems for data collection, analysis and reporting to ensure the sustainability of these systems to meet the needs of aquaculture policy-making and management and the agreed requirements of regional fishery organizations and FAO, and take corrective actions as appropriate.

FAO and development partner agencies should assist states identify minimum data requirements and frequency of collection to meet management and reporting needs, and to elaborate cost-effective methods, tools and institutional arrangements for this purpose.

6 PROMOTION AND IMPLEMENTATION MECHANISMS

6.1 General call for improving information on the status and trends of aquaculture

States, regional aquaculture/fishery organizations and international institutions should develop and implement mechanisms for the improvement of aquaculture information, the application of research to enhance the availability of best scientific evidence, and the adoption of a continuing process for the enrichment of aquaculture status and trends information to support sustainable development and management at local, regional and global levels.

6.2. The role of states

States should evaluate the actions they need to take to improve information on the status and trends of aquaculture, address these needs on a priority basis, and report on the improvements they make, as part of their biennial report to FAO on the Code of Conduct.

States should allocate adequate resources in order to ensure sustainable and timely collection, processing and dissemination of information needed to enable rational management of national resources and responsible aquaculture development. Sound national information systems are the basis of a sound global information system.

6.3 The role of regional fishery organizations

Regional fishery organizations/mechanisms, within the limits defined by their conventions and to the extent mandated by their members, should participate in the implementation of this Strategy, by providing support to their members, participating in global programmes and decisions on the development and adoption of standards and guidelines for information on the status and trends aquaculture.

6.4 The role of FAO

FAO will, to the extent directed by its Conference, and as part of its Regular and Field Programme activities, support states and regional aquaculture/fishery organizations in the implementation of this Strategy.

FAO will, to the extent directed by its Conference, support member states' implementation of this Strategy, through in-country technical assistance projects using Regular Programme funds and by use of extra-budgetary funds made available to the Organization for this purpose. For more sustainable management of aquaculture development and conservation of resources and the environment, FAO should prepare a specific programme for establishing effective and sustainable systems for data collection, processing and analysis in developing countries, including in particular the least developed among them. A draft project outline prepared by the consultation for this purpose is given in Annex 1.

FAO will report biennially, through COFI-AQ and COFI on the state of progress in the implementation of the Strategy.

6.5 Role of development partner agencies and non-governmental organizations

International and national development partner agencies should give priority to the provision of financial and technical assistance to developing countries, in particular the least-developed among them and small-island developing states, and countries whose data collection systems are in a critical condition, for capacity building and information system development, as necessary for implementation of this Strategy.

Non-governmental organizations (national, regional and international) concerned with aquaculture, fish-farmers and the aquatic environment and research into these, should encourage implementation of the Strategy through appropriate support, information methods development and capacity building and participation.

Annex 1

DRAFT PROJECT OUTLINE: IMPROVING COLLECTION AND PROCESSING OF DATA AND INFORMATION ON THE STATUS AND TRENDS OF AQUACULTURE

1 BACKGROUND

The novelty of aquaculture as a recorded economic activity and the lack of easy access to adequate objective information has often resulted in its exclusion from development planning and the management of resources, and hampered investment in the sector. In some instances, it has led to societal and environmental problems, failure to provide development support, loss of market opportunities, and conflicts with other traditional sectors.

The growing importance of aquaculture, its rapid expansion, increasing interactions with other sectors and competition for natural resources calls for closer attention to the collection of data and information for sustainable management. Data and information on aquaculture in many countries are often of such poor quality that it is difficult to draw reliable conclusions from them. Therefore, it is necessary to improve statistical and other data collection and status and trends reporting systems throughout the world in order to empower policy makers and managers in each country.

The overall objective of the Draft Strategy is to provide a framework for such improvement to facilitate aquaculture policy making and management for development in the context of good stewardship of natural resources and the environment. The required actions are listed in Part V. The Project Outline is based on the required actions, and its outputs are contributions to solve the problems.

2 DRAFT PROJECT OUTLINE

The Project addresses the improvement of collection, processing and use of data and information on the status and trends of capture fisheries. It is part of the FishCode Programme “Assistance to Developing Countries for the Implementation of the Code of Conduct for Responsible Fisheries”, the overall objective of which is to increase economic, social and nutritional benefits obtained from fisheries and aquaculture, through the adoption of responsible management and resource conservation policies and practices. The suggested project duration is five years.

It is a pre-requisite that the data and information to be improved are those that have been identified by countries as a necessary basis for advice generation and effective policy-making and fisheries management.

The immediate objectives of the Project are as follows.

- **Objective 1:** Improved collection and processing of data and information on aquaculture (freshwater, brackishwater and marine) to provide a reliable basis for sustainable development, economic analyses and management.
- **Objective 2:** Aquaculture data collection and processing according to the latest global standards executed by competent staff.

Project activities will be delivered through the implementation of two overlapping components.

2.1 Component 1: Development of inventories, methodologies and operational guidelines

This component (about 3 years) covers the creation of methodological descriptions of aquaculture statistical and data collection systems used by all countries and regional aquaculture/fisheries organizations/mechanisms. The exercise is intended to obtain a complete picture of all systems in use so as to identify gaps in monitoring and, crucially, to assess the quality of the systems used. It will also identify the improvements and training required in developing countries that are to be addressed under Component 2. The inventory will cover data systems on all aspects of aquaculture, including data on aquaculture holdings, employment, consumption, processing and trade and all economic and sociological aspects. Component 1 will also address methodological needs at the global level.

Component 1 activities will be normative and global in nature, involving desk studies, questionnaires and expert consultations as well as data collection and verification missions by consultants over a three-year period. It is foreseen that FAO Regular Programme staff will be deeply involved in overseeing these activities, which should lead to a number of publications, computer programs and training materials.

Elements of Component 1

Inventory preparation:

- assessment of locally available capabilities;
- preparation of methodological descriptions of existing national and regional statistical and data collection systems for aquaculture;
- identification of gaps in monitoring;
- assessment of the need for indicators at the national and regional levels;
- preparation of a glossary of terms and definitions used in the collection of statistics and data on aquaculture;
- review of available criteria for quality assessment and assurance; and
- elaboration of weighting factors for the quality of statistical data.

Assessment of training needs:

- identification of (i) training needs and (ii) training materials; and
- preparation of training material specific to aquaculture and to specific production systems as necessary.

Development of global methodologies and standards:

- development of software programmes to facilitate collection and processing of national aquaculture statistics;
- preparation of a standardized global glossary of terms and definitions for statistical purposes;
- development of protocols for the provision and exchange of information, including protocols for inputs into FIGIS;
- development/adaptation of rapid appraisal methods for use in data-poor situations, with focus on semi-commercial and subsistence aquaculture;
- development of low-cost (Web-based) information systems for national, regional and global information systems;
- expansion of the scope of information on status and trends of aquaculture, including socio-economic and sustainability aspects;
- elaboration of indicators focusing on practical applications at national and regional levels, including consideration of data requirements and practical solutions for indicators on sustainability aspects;

- elaboration of guidelines for creating appropriate linkage between information needs and management (policy, planning and management), including procedures or the use of data for management purposes; and
- developing methods and criteria for ensuring and assessing information quality and security.

Establishment of institutional arrangements:

- establishment of an inter-regional mechanism for coordination of and scientific advice on aquaculture statistics;
- establishment of mechanisms for cooperation in the preparation of status and trends reports on aquaculture and of protocols for the provision and exchange of information; and
- establishment of a process for oversight of status and trends reports.

2.2 Component 2: Field training and implementation

Component 2 (4 years) aims at substantial improvement in collection and processing of aquaculture statistics and other data and information on aquaculture for selected developing countries. The main purpose is to obtain better data for policy-making and aquaculture management at national level, and at regional level in cases of transboundary concerns. Improvements in reporting to FAO and other agencies would be an important secondary benefit.

Component 2 covers capacity building at all levels, and implementation of improved or new statistical and other data collection and processing systems in a number of selected countries. There is also a need for improved interaction between aquaculture statisticians, sector analysts and socio-economists, as well as for new interactions with experts of other sectors, particularly in the agriculture and fisheries sectors. The Project should facilitate this interaction.

Beneficiary states will be selected from developing countries with substantial aquaculture sectors that have a potential of becoming an example for other countries in similar situations. Training will initially be based on existing material (guidelines, manuals, computer programs), but gradually this lecture material may be modified, building on knowledge gained through the execution of Component 1. The basic approach will be first to train regional teams of trainers by language group, and then to provide Project support at national and/or sub-regional level for courses to larger numbers of national staff.

Elements of Component 2

Improvement of national and regional data collection systems for aquaculture with special focus on small-scale aquaculture and the environment:

- support to national and regional data collection and information systems, including guidelines to assist planning and implementation of such systems, and to establish appropriate linkages between management and information gathering and utilization;
- assistance to improve inter-agency communications and co-ordination for more cost-effective and compatible data gathering and information systems;
- capacity-building (technical assistance, training and systems development) in developing countries, including the collection of statistics on subsistence and semi-commercial aquaculture;
- national and regional capacity building for inputting to the Fisheries Global Information System (FIGIS); and
- expansion of the scope of information on status and trends of aquaculture to cover socio-economic and sustainability data, through improved information sharing and coordination at the national level, development of rapid assessment methods

for data-poor situations, integration with agricultural and artisanal fisheries household surveys, and other appropriate means.

Improvement of arrangements for the provision and exchange of information at regional and global levels:

- support to and active participation in the Fisheries Global Information System (FIGIS);
- mobilization of support to regional aquaculture information systems;
- organization of and participation in working groups in assessing the status and trends of aquaculture;
- assistance for improving communication and coordination among agencies involved in the collection of aquaculture and related statistics and data, at the national and regional level, to make best use of available data and capacity; and
- continued improvement/strengthening of FAO's aquaculture information dissemination system, including on-line systems and publications (e.g. FIGIS, NASO, *FAO Fisheries Circular* 886, etc.).

2.3 Institutional arrangements

FAO will work primarily with national administrations in implementing the Project, in particular the departments and institutes responsible for aquaculture statistics and information and for the maintenance of registries important for aquaculture policymaking and management. Where appropriate, FAO will seek partnerships with regional organizations in connection with setting up an institutional framework for global status and trends reporting, and as a means of facilitating prompt and efficient implementation of the Project, particularly in situations where more states are involved.

Considering the magnitude of the problem, the Project should be seen as a driving force that may pass its programme on to other organizations and projects for execution of training and other activities. Close coordination is also envisaged with other elements of the FishCode Programme and other aquaculture/fisheries projects executed by FAO (e.g. FIGIS, National Aquaculture Sector Overviews (NASO), etc.) or other agencies.

2.4 Government inputs

All Member states of FAO will be expected to complete questionnaires issued by the Project on behalf of FAO.

Beneficiary states will be expected to provide various commitments ranging from support to Project staff to the provision of personnel to assist in carrying out studies, the collection of information and data required for studies, office accommodation, transportation and other logistical support, etc.

Report of the Expert Consultation on Improving Information on Status and Trends of Aquaculture

1 BACKGROUND AND RATIONALE

During the past few decades, aquaculture has expanded, diversified, intensified and advanced technologically. It is anticipated that its growth and contribution to national economic and societal goals will increase in the future as enabling environments for investment and sustainable development are established. Aquaculture growth is likely to be driven by a static supply from capture fisheries, rising fish prices and diversification of species, especially those with established regional or global markets. A greater diversity of value-added products, market development and the increasing application of science and technology will also stimulate this trend.¹

Ideally, the expansion of aquaculture should not occur faster than the acquisition of the information required for its rational management. The rapid growth of the sector raises concerns about the implications of expansion and the risk of unsustainable development. This underlines the need for an information base to ensure informed policy and development planning. Unmanaged development has resulted in societal and environmental problems, loss of market opportunities, failure to provide development support and conflicts with other traditional sectors. The recent emergence of aquaculture as a significant, recorded economic activity and the lack of easy access to adequate objective information on its social, economic and environmental characteristics have often resulted in its exclusion from development planning and the management of resources. It has also hampered investment in the sector.

The need for collection of reliable aquaculture data and information collection is embedded in the Code of Conduct for Responsible Fisheries (CCRF)², and some data needs are further elaborated in the associated FAO Technical Guidelines³. The Code recognizes that reliable and timely data are a requirement so that the competent authorities of national governments can effectively discharge their general responsibility in the promotion of sustainable aquaculture practices and integration into rural, agricultural and coastal development.

In recent years the demand for reliable data and information and for reporting on aquaculture has greatly increased, driven not only by the need to formulate and monitor sound policies and development plans, but also by new information

¹ NACA/FAO. 2001. Aquaculture in the Third Millennium. Subasinghe, R. P., Bueno, P.B., Phillips, M.J., Hough, C., McGladdery, S.E., & Arthur, J.R. (Eds.) Technical Proceedings of the Conference on Aquaculture in the Third Millennium, Bangkok, Thailand. 20-25 February 2000. NACA, Bangkok and FAO, Rome. 471p.

² FAO. 1995. Code of Conduct for Responsible Fisheries. Rome, FAO, 41 p. <http://www.fao.org/fi/agreem/codecond/ficonde.asp>

³ FAO Fisheries Department. 1997. Aquaculture Development. FAO Technical Guidelines for Responsible Fisheries No.5. Rome, FAO, 40 p. <http://www.fao.org/docrep/003/w4493e/w4493e00.htm>

and reporting requirements of international agreements and initiatives⁴, and by the increasing public demand for transparency and accountability. Changing perspectives in management are affecting the information requirements for information, such as the need to take a wider range of issues (besides production volume and value) into account in decision-making and to consider aquaculture development within the full scope of the environment and management of natural resources. These are essential to exercise appropriate precaution as the best approach to sustainability.

FAO plays a unique role in aquaculture statistics and the preparation of information on the global status and trends of the aquaculture sector, facilitating cooperation in the collation at the global level of national and regional data, and the production of global assessments of the state of aquaculture and development trends based on these. The quality of regional and international data ultimately depends on prevailing national statistical standards in reporting. The usefulness of the national statistics which constitute the regional and international data bases depends on their accuracy and completeness. It is clear that countries need to collect aquaculture statistics for their own national interest, for policy-making, planning and management. The provision of statistics to FAO (and regional fishery bodies) is a secondary concern.

Though aquaculture has a long history, active management of the sector is an emerging trend and the collection of statistical data and other information on aquaculture is a recent endeavour in many parts of the world. Equally, the FAO aquaculture statistics database system is a relatively recent activity, initiated only in 1984. Published FAO statistics are currently limited to production quantities and values by species and environment.

There is considerable variation in the quality of the data submitted to FAO by Member States, and some of the data (e.g. hatchery output, structural data) is not published because of quality problems. Though FAO has made considerable progress in improving its database, the latter is still in the developmental stage, lagging behind statistical systems for fisheries and agriculture. However, the growing importance of aquaculture requires closer attention to some aspects of data collection and their accurate reporting and analysis, as well as the purpose and scope of collected data.

With these concerns in mind, the FAO Advisory Committee on Fisheries Research (ACFR), through its Working Party on Status and Trends in Fisheries (WP/STRF) recommended that the FAO global system of status and trends reporting be improved in support of more effective policy-making and management, and better monitoring of environmental and ecosystem impacts, in the context of an international plan of action to be drafted for this purpose⁵. Such a strategy has been developed for capture fisheries and was adopted by the FAO Committee on Fisheries in its meeting in March 2003. Aquaculture was excluded from the strategy because of perceived differences in its information requirements, and recognition that the aquaculture sector requires a dedicated initiative.

More recently, The COFI Sub-Committee on Aquaculture⁶, during its first session in April 2002 and the second session in August 2003, designated information needs for aquaculture as a priority area for attention at the global level and recommended that FAO develop an approach for improving reporting on aquaculture status and trends

⁴ E.g. Code of Conduct for Responsible Fisheries, Kyoto Declaration and Plan of Action, International Convention on Biological Diversity; WTO Agreement of Sanitary and Phytosanitary Measures and OIE International Aquatic Animal Health Code; Convention on International Trade in Endangered Species; etc.

⁵ Report of the Technical Consultation on Improving Information on the Status and Trends of Capture Fisheries. Rome, Italy, 25-28 March 2002. FAO Fisheries Report No. 680 Rome. 2002.

⁶ Reports of the first and second sessions of the COFI Sub-Committee on Aquaculture. FAO Fisheries Reports 674 and 716.

similar to that developed for capture fisheries, with special attention to the quality of the information on which it is based. This consultation is in follow up to that recommendation.

2 OBJECTIVE AND SCOPE

The Fisheries Department organized this consultation with the purpose of seeking advice and guidance for improving global status and trends reporting on aquaculture.

To provide guidance, the Consultation was requested to consider a number of interlinked institutional and technical issues. The Consultation was asked to evaluate the current information base and its adequacy for monitoring of trends in the light of changing management perspectives. It was also requested to examine the procedures for global reporting and address the broader issues of quality assurance and participation in the collation and analysis of information in order to ensure transparency and consensus. During the process, the Consultation took into consideration:

- the current content and constraints in the collection of aquaculture statistics and
- availability of non-statistical information systems;
- national data collection capacities and resources, as well as the trade-off between the scope of coverage and data accuracy; and
- recent recommendations from FAO meetings on these matters.

The overall objective of the Consultation was to prepare a sustainable strategy and a plan for the improvement of status and trends reporting on aquaculture at the international level. In doing so, the Consultation:

- reviewed available information on completeness, scope and procedures for preparation of FAO status and trends reports on aquaculture (i.e. information collection and collation, quality control, analysis and dissemination), as well as the nature and quality of the information on which it is based, and the timeliness of reporting;
- reviewed regional and global institutional arrangements and mechanisms for advising on information needs for policy and management, agreeing on standards and methodologies for collecting information, and coordinating statistical activities among regional bodies;
- considered changing information requirements for sector management and suggested minimum content and related data and information needs at the national level and for global reporting, within the practical limits of national resources and capacities, to enable a more holistic, multi-faceted approach to aquaculture analysis and management;
- identified areas for improvement and suggested practical measures and mechanisms for achieving improvements in targeted areas; and
- drafted an international strategy and plan to serve as a framework for implementing these improvements.

3 DOCUMENTATION FOR THE CONSULTATION

The deliberations of the Consultation were supported by documents prepared by FAO, which provide background information on key topics; e.g. current status of information for monitoring and reporting status and trends of aquaculture at the national level in selected countries, current FAO procedures for monitoring and reporting global status and trends of aquaculture, key issues in establishing an adequate information base for global reporting on aquaculture, and other relevant FAO publications.

A document outlining a draft strategy (EC:STA2004/5 – See list of documents in Annex 2) and a brief plan for improving global reporting of status and trend of aquaculture, adapted from the strategy prepared earlier for capture fisheries was made available to the Consultation, which served as a starting point for discussions.

4 ORGANIZATION OF THE CONSULTATION

The consultation was held in English. All materials prepared before and during the meeting, as well as the discussion held, were in English. The Consultation was conducted in plenary sessions. Key background information was presented in summary form by FAO staff prior to discussions. The report of the consultation was prepared by the secretariat and reviewed and adopted by the participants.

5 PARTICIPATION

The Consultation was attended by selected experts representing both information “providers” (involved in the collection of statistical and non-statistical information) and information “users” (policy-makers, planners/managers). Participants were invited to attend in their personal capacities as technical experts in their fields and to achieve a balance of regional representation. List of participants of the Consultation is given in Annex 3.

6 PROGRAMME, VENUE AND DATE

The Consultation was held at FAO Headquarters in Rome, Italy, from 20–23 January 2004. The agenda and timetable for the Consultation (EC:STA/2004/1) are given in Annex 1.

7 OPENING OF THE CONSULTATION

Mr. Ichiro Nomura, Assistant Director General of FAO (Fisheries Department) opened the Consultation by addressing the participants. In his opening address, Mr Nomura expressed the gratitude of FAO to the experts for attending the Consultation and welcomed them to Rome. Mr Nomura emphasized the importance of regular, reliable, and quality information for sustainable development and management of the aquaculture sector and invited the experts to discuss and advise FAO on how to improve information on status and trends of aquaculture.

8 APPOINTMENT OF A CHAIR PERSON

Mr Svein Munkejord was appointed as the Chairperson to the Consultation.

9 ADOPTION OF THE AGENDA AND ARRANGEMENTS FOR THE CONSULTATION

The Agenda (EC:STA/2004/1) shown in Annex 1 was adopted by the Consultation. The documents which were provided to the Consultation are listed in Annex 3. The Secretariat informed the process used for producing the Consultation documents.

10 CURRENT STATUS AND MAIN ISSUES OF NATIONAL MONITORING AND REPORTING OF AQUACULTURE STATUS AND TRENDS

The Secretariat presented the regional syntheses of procedures and issues in relation to national monitoring reporting on aquaculture (EC:STA/2004/2) which covered the regional reviews of aquaculture status and trends. The consultation was informed of the countries reviewed, the methodology used and the results obtained.

In all countries reviewed there was a separate treatment of aquaculture and fisheries. The definitions used by the countries were generally similar to those used by FAO. Administrative structures for aquaculture development management and monitoring varied between the regions. There were varying degrees of linkage between monitoring and planning and management. Annual reports on aquaculture status and trends were prepared, but only in some regions. There are wide variations between countries and regions in terms of the information that was collected for the structural statistics.

Key problems constraining collection of high quality data related to: fears of taxation results in underreporting, in other cases planned production targets may lead to over-reporting in some countries, limited infrastructural/logistical support, poor access to farms and also inadequate legal frameworks are also common problems. Non-statistical supporting information was not collected regularly or used widely.

National priorities for information included market intelligence, basic production data, environmental and socio-economic information. Priorities also included the dissemination of information in a form that could be used more effectively. In most countries there were on-going efforts to improve the information systems (including user-producer consultation and IT related aspects such as electronic reporting, internet based systems/databasing as well as some training).

Purpose of data collection

It is important to emphasize the importance of understanding which data is collected and for what purpose. In particular there is the need to ensure that the information is useful in management. Data collection should be a part of the management process. This is important throughout the information chain from farmers to national level (although there will be differing information needs between these levels).

Making information useful and relevant

The differing interests in information collection are an issue – this is particularly the case where farmers are expected to generate information that is not directly useful to them. It is important to have a dialogue with farmers in order to generate and develop information systems that are actually useful to their information needs. The involvement of producers groups is an essential feature of ensuring accurate and timely information.

Lack of ownership over the production of information inevitably means that farmers are less likely to be concerned with providing accurate information. In some circumstances the farmers/producers feel the requirement to provide information is a burden. If data providers have a clear understanding of the use of the information that they provide, this encourages their commitment to the generation of information.

Definitions and their standardization

The consultation emphasized the importance of definitions for aquaculture (e.g. separation of aquaculture and capture fisheries, inclusion or not of reptiles and amphibians, inclusion of ornamental species) and the types of aquaculture (intensive/extensive etc.), since it is important in the development of strategic and economic plans as well as legal frameworks. This is a long standing issue for FAO and the conclusion has been to separate fisheries and aquaculture questionnaires. Countries are encouraged to inform FAO when they submit information that contains definitions that do not correspond to FAO standardized terms (i.e. inform if data submitted include or exclude aquarium species, reptiles, amphibians, tuna fattening etc.). The current FAO definitions of brackishwater and marine environments create difficulties since these definitions may vary between countries. Combining these two environments might remove confusion from reporting. This is of particular importance in the reporting of shrimp aquaculture.

Separation of fisheries and aquaculture can be problematic especially where the two activities are integrated (e.g. enhancement of waters bodies using hatchery produced stocks). Globalization will increasingly require more standardized definitions in order to resolve disputes over trade.

Fattening of wild-caught fish is a rapidly expanding industry. FAO has been in dialogue with statistical agencies regarding the aquaculture component of tuna fattening. FAO recommended that only the weight increase in captivity should be reported as

aquaculture production. However, there is a lack of awareness of this protocol that has resulted in countries reporting the entire production under aquaculture or under capture fisheries and not distinguishing between the aquaculture and capture fisheries elements. The consultation was urged to consider this issue of definition further. This raises a practical issue of assessing the weight of the fish at stocking, since weighing the live fish is extremely difficult. The reporting of fattened tuna as aquaculture production may be intentional since it relates to fisheries management issues, such as quota controls.

Legal and institutional frameworks

Legal frameworks may be a constraint if they change too frequently or do not adequately cover aquaculture. When marine and freshwater aquaculture are covered by different authorities this may result in miss-information. Linked to this is the issue of government continuity/commitment to statistical collection. Many countries lack baseline information and this constrains long term trend reporting (an additional issue is that collection of information may not be continuous).

Incentives are an important aspect of the national information system, especially where the system is based on voluntary reporting. If there is no legal requirement to report then the information is unlikely to be delivered. There is a challenge to develop ways to get timely and accurate information relating to small-scale farming operations.

Licensing and registration of farms is an important aspect of developing efficient sampling schemes. The number, location and type of farms are useful information and legal frameworks to ensure collection of such information should be developed. Licensing and registration of farms are becoming increasingly important for export targeted products, since this supports traceability of products. Thus, there may be opportunities to link these developments to statistical data collection systems.

Expanding the scope of global data compilation

In current questionnaires there is typically a lack of information on structural and economic data (production information is reasonably good). Inclusion of economic and socio-economic data at national or regional level is valuable and should be encouraged. Market information is also increasingly useful for developing an appropriate policy (relating to development of aquaculture and subsidies).

Collection and use of non-statistical data/information

Non-statistical information that is useful in development and management of aquaculture includes:

- White papers on aquaculture prepared by line agencies
- Information from producer organizations and national institutions
- Market information
- Research and academic studies
- Legal frameworks and policy and planning documents
- Information on inputs related to aquaculture (such as feed ingredients, water usage, biomedication and pesticides)
- Socio-economic information
- Administrative data
- Environmental information

It was noted that although some information may not be collected regularly, this information could be used in status and trends reporting.

Using other information collection mechanisms to obtain basic/baseline information

The diversity of systems and environments and sheer scale of numbers of producers in Asia is a challenge to information systems. The use of a baseline system is to be encouraged (such as census information of some form of basic registration). More detailed information can be obtained from sample surveys.

To improve status and trends reporting, the consultation was asked to consider how distinct aquaculture (especially land based operations) is from agriculture since it shares many commonalities with agriculture. Synchronizing of aquaculture data collection with agriculture was urged. FAO is currently dealing with the issue of how aquaculture information can be included into Agriculture statistical processes (e.g. census information). It should be noted that agriculture production is often based on estimates of seeded areas or numbers of livestock present on the holding at the beginning of the season. Annual production is then estimated through sampling of production. This is particularly effective with annual plant crops.

Additional recommendations

It was noted that many countries lack a regular annual survey of aquaculture, and thus much of the information reported are estimates.

The issue of timeliness is also critical in terms of making the information produced as useful as possible (especially for trends reporting). Trends reported that are several years out of date may not be useful for predictive purposes.

Questionnaire development should be accompanied by explanatory notes. In particular, what are the data to be used for, and an explanation of the value of the data for the sector?

ARTFISH⁷ – could be adapted by FAO to assist in standardization of aquaculture data collection. The consultation requested that it could be informed of the potential for adapting ARTFISH as a tool for collecting aquaculture statistical information. FAO has commenced the process for developing ARTFISH for aquaculture and FAO expects that it will be ready for testing soon.

It was noted that it would be desirable to include fisheries and aquaculture products into global food consumption and trend models (and not just for globally traded commodities).

The difference in data requirements for macro-level analysis and micro-level analysis should be addressed. For macro level analysis, detailed data are not required but timeliness of data availability is essential, whereas detailed sets of data may be required for micro level analysis but will take longer to produce. It was recommended that information collected should be clearly divided into data that is needed as quickly as possible (but which may be based on gross estimates) versus that data which must be accurate but which may have a slower rate of change and therefore can be updated less often.

11 CURRENT FAO PROCEDURES FOR MONITORING AND REPORTING PRODUCTION AND STATUS OF AQUACULTURE

The document “Current FAO procedures for monitoring and reporting production and status of aquaculture: review and discussion” (EC/STA/2004/3) was presented by the secretariat.

In the presentation the following issues were brought forward: goals for data collection, methods, elements included in the FISHSTAT AQ and FISHSTAT NS AQ questionnaires, schedule for the collection and processing of the questionnaires,

⁷ Approaches, Rules, and Techniques for Fisheries Statistical Monitoring – software package developed by FAO for planning, entering and processing sample survey data and producing estimates of production.

processes of distribution and receipts of questionnaires, data quality control, weaknesses in current data procedures, data dissemination, publications used by FAO and collaboration with international and regional agencies and bodies in data collection and dissemination.

It was detailed that the less well known FISHSTAT NS AQ questionnaire is used to revise previous seven years data. At the end of the presentation some areas for improvement were suggested, including, the development and implementation of standardized methodologies for aquaculture data collections (e.g. ARTFISH system for aquaculture) and the intensification of FAO technical assistance in order to implement more projects improving aquaculture data collection. Among the points suggested for discussion by the consultation were the adequacy of current procedures and areas of weakness. The secretariat also suggested improvements on appropriateness of data items, frequency of collection, comments on publication and dissemination strategy, development and implementation of standardized definitions and methodologies, and the possibility of designing feedback mechanisms for data between parties.

Standardization of methodologies

Standardization of methodologies might seem the solution to a number of key difficulties for data processors and database developers. However, this could be problematic where the diversity in aquaculture systems (e.g. in terms of administrative structures and infrastructure) is large and standardization could lead to false- or under-reporting and/or under reporting.

The existence of different types of information systems in different countries and regions is a challenge for the development of a common approach. Procedures used for collection of data (direct to farm, use of enumerators, surveyors) vary among countries. Availability of a wide range of questionnaires limits standardization; therefore a more standardized form of survey might be useful.

Employment data

It was discussed to include aquaculture employment data in the FISHSTAT AQ questionnaire, instead of the use of a FISHSTAT FM questionnaire as is currently the case. The relative advantages and disadvantages of such a change were discussed. The fact that in many countries employment figures are only collected by the Ministry of labour which usually has limited linkage with the Departments or services responsible for Aquaculture Statistics was an argument in favour of leaving the situation as it is. The Secretariat mentioned that the National Aquaculture Sector Overviews (NASO), which FAO has started to compile, also covers employment data and might be a useful source of information in this respect.

It was noted that there are difficulties for database producers in determining whether to include traders of aquaculture products under aquaculture employment, and the issue of how to deal with part-time aquaculturists in statistics was raised. The secretariat mentioned that FAO has attempted to collect data on full-time, part-time and occasional aquaculture employment since the early 1990s. However, the rate of response from the member governments on this subject is low and it requires excessive estimation and time from FAO. It was noted that EUROSTAT had similar experiences and had also found it extremely difficult to obtain relevant data on this subject.

FISHSTAT AQ

Some suggestions were made to include more issues into the FISHSTAT AQ questionnaire form, such as numbers of hatcheries, hatchery production in million larvae, direct and indirect aquaculture jobs per hectare and per metric ton of product harvested.

EU DG Fisheries database on aquaculture legislation and FAOLEX

The consultation was made aware of the existence of a website accessible through the Internet with all EU regulations, directives and decisions related to aquaculture, processing and marketing⁸.

Moreover, the existence of a FAOLEX website with legislation of many countries (including fisheries sector relevant legislation) was mentioned as another source of relevant information. This website is directly accessible from the FAO website at: <http://faolex.fao.org/faolex/>.

Regional and international collaboration

The follow-up possibilities of the SIPAL (Sistema Informático para la Planificación de la Acuicultura en Latinoamérica y el Caribe) project, which was developed in the early 1990s, were discussed. It was noted that interest by member countries within the region is high, but funds to restart activities in this field in Latin America are lacking at present. FAO intends to assist the Latin American countries on some of the issues covered originally under SIPAL through FIGIS.

It was noted that advantage should be taken of the desire of many international and regional agencies and bodies to complement each other on data collection and dissemination. Further increase of collaboration between the various agencies involved in aquaculture statistics issues (e.g. with NACA, SEAFDEC, EUROSTAT) should be promoted. This would allow the agencies to jointly serve their member countries.

Food Balance Sheets

Questions were raised whether FAO could construct specific food balance sheets for aquaculture. It was noted that the lack of information on the origin of the fish, particularly in the foreign trade data (capture fisheries or aquaculture) used to prepare these sheets might be a major constraint to achieving this.

Quality assurance of data

The quality and checking procedures of aquaculture data inside FAO were discussed and it was explained how data were validated and checked with national governments and other sources such as export data, information from regional bodies and other international organizations.

Double counting of data

In relation with the issue of the substantial quantity of fishmeal/fishoil and to a lesser extent “trash” fish used for aquaculture purposes it was discussed whether there exists some double counting. The Secretariat explained that the removal of fish used for fishmeal from fishery production would result in gaps in the data. For example, the economic value of the fishmeal industry and the employment generated by the fishmeal sub-sector could not be estimated.

The other issues briefly discussed during the session include:

- *Comparability of data between sectors* – it was recognized that there exists a need for national government to be able to compare the aquaculture data with those of other sectors; which might be important to justify investment in and indicate the importance of the sector.
- *Fishstat+ software* – <http://www.fao.org/fi/statist/statist.asp> Experts recognized that the Fishstat + software used by FAO and accessible for the public via internet is very user-friendly compared to other systems.

⁸ http://europa.eu.int/comm/fisheries/doc_et_publ/factsheets/legal_texts/aqua/index_en.htm.

- *COFI reporting* – It was suggested to the secretariat to prepare a one-page summary of the main issues to solve in aquaculture status and trends reporting to be presented to the next session of COFI.

12 GLOBAL ISSUES IN RELATION TO STATUS AND TRENDS REPORTING ON AQUACULTURE

The secretariat presented document EC:/STA/2004/4, General issues in relation to FAO status and trends reporting on aquaculture. Issues of data quality and constraints to better data were highlighted. The opportunities for international cooperation and greater participation of stakeholders were discussed.

To improve the quality of data received from members, it was recommended that FAO develop substantial guidelines for the completion of the questionnaires and proper interpretation of concepts and terminology as has been done for capture fisheries status and trends reporting. The glossary of aquaculture terms currently being developed by FAO should be of great help to address this need. In addition, FAO was encouraged to continue the development of the aquaculture module of ARTFISH to provide tools for cost-efficient survey methodology and data processing to members. Furthermore, countries should consider appropriate inclusion of basic aquaculture questions in fishery and agricultural census.

The consultation recognised that in the face of static or declining resources for data collection and analysis, there are sources of information other than national governments are available, and these should be utilized in addition to the official statistics provided by governments (e.g. organizations of aquaculture producers could be brought into the data collection process). Additionally, registration or administrative records could also be used to gather more information.

Prioritization of data needs:

It was requested that the Consultation participants prioritize the data needs and establish minimum requirements for data reporting for the national, regional, and international level. A subgroup was assembled to specifically address this task by considering the purpose of each data element, the information required to report, the method of collection, the recommended frequency of collection, issues related to the implementation, and the constraints expected and capacity required.

The Expert Consultation discussed a conceptual framework for status and trends reporting in aquaculture. The Consultation agreed that the overall goal should be to report on the status and trends in aquaculture to support management and sustainable development of the sector.

To support the goal of sustainable development of the sector, the Consultation emphasised that status and trends reporting should serve the following six themes:

- Quantifying aquaculture production, species and values
- Assessing natural resource use and environmental management
- Contributions of aquaculture to poverty reduction, social impact and livelihoods
- Contributions of aquaculture to food security and food demand, and development of food policy
- Contributions of aquaculture to national economies and trade
- Development of institutions that support responsible development of aquaculture

The Consultation decided that all six themes were important in global status and trends reporting. However, it recognized that there would be practical difficulties in collection and analysis of some information within each theme, and this would influence collection priorities.

For each theme, the Consultation identified the following criteria:

- What are the potential indicators for measurement, and information required to develop the indicators.
- How the required information would be collected (source, frequency, quality considerations), with special emphasis on FISHSTAT AQ, NASO and other mechanisms for data collection.

The framework is attached as Annex 4. The Consultation suggested that the framework be used as a reference for development of supporting guidelines and strategy implementation.

The consultation endorsed the need for a working group, comparable with the Coordinating Working Party on Fishery Statistics (which deals primarily with capture fisheries). This working group would consider all aspects related to aquaculture information and statistics (for example, concepts, definitions, data requirements and questionnaire formats). It was suggested that such a group could be established under the FAO COFI Sub-Committee on Aquaculture.

While there are many data elements for which the Consultation recognized the need, it was noted that not all elements could be collected on an annual basis. Some detailed information may be contained in FAO National Aquaculture Sector Overviews (NASO) produced and updated approximately every 4–5 years. The consultation recognized that a series of such profiles could still contain valuable trend information even if not on an annual basis.

As a tool for increasing national commitment to the collection of aquaculture statistics, it was suggested to analyse what would be the consequences if certain data were not collected. That is, what tasks could not be accomplished and which planning activities would be constrained without the data.

As countries have a wide range of expertise, capacity, and experience, it was suggested that good examples of national aquaculture data reports, trends analysis, and data collection methods be provided to the global community as models and tools to facilitate improvement for all countries. Regional and inter-regional working groups may provide excellent venues for this exchange of ideas and experiences among nations with different levels of capacity and commitment. The Consultation emphasized that improvements in national aquaculture data collections and reporting are ultimately beneficial to the country and to the aquaculture sector of the country, in terms of strategic planning for the sustainable development of the industry.

13 INFORMATION NEEDS AND AVAILABILITY: DEFINING BASIC INFORMATION NEEDS AT THE GLOBAL LEVEL, AND RECOMMENDATIONS TO THE WORKING GROUP ON THE FAO QUESTIONNAIRE, FISHSTAT AQ

The Secretariat presented this agenda item highlighting that the deliberations of experts on this subject were important for the further work that would be done by the Working Group, which convenes on 26–28 January. In particular their input was requested on which data elements they saw as needed and which, if any, were unnecessary in the current FAO survey. Experts were asked to discuss the required frequency of data collection, and the proper methodology for each element. The experts were also requested to identify how to overcome national constraints.

The ensuing discussion was much broader in its scope and participants referred also to data and information needs at other institutional levels.

The consultation was informed that typical requirements of producers associations included not only sector-related data and information but also those concerning sectors “upstream” (e.g. fry and feed suppliers markets) and “downstream” (e.g. processing and marketing). Data and information requirements from units within the sector are different according to the scale of the production units and the aquaculture practice.

However a clear and agreed definition of the variables to be measured is essential (e.g. whether production refers to biomass growth, harvested output, or marketed production) for a reliable estimate across the sector. The range of information required includes also employment, market of utilization (domestic, foreign), processing and for some practices the quantification of variables that have an environmental impact (e.g. effluents).

The same diversity of needs applies at the national level, as data and information needed and the availability of the data varies (as an example between the list of certified producers and semi-commercial and rural units). At policy level there is the need for indicators and for the data necessary to their construction, especially those which indicate environmental performance (for example: volume of water per weight unit of the farmed organism, disposal of solid residues etc.). Better coordination between the line Ministry and the National Statistical Office typically conducting Agricultural Censuses would result in the improvement of the array of questions concerning aquaculture in the form, and thus generate useful information with little additional cost. A recent case in Myanmar demonstrated the potentiality of including even a few questions on aquaculture at the level of the household.

An area where current surveys do not adequately address aquaculture concerns is that of socio-economic data. As far as employment is concerned, the difficulty of obtaining upstream and downstream employment data was highlighted. The EU had conducted a survey of status and trends of employment in the fisheries sector (including aquaculture). This study confirmed the difficulty in obtaining data on upstream employment and highlighted a more general problem of a lack of harmonization of concepts and definitions and of a variety of frequently inconsistent sources of information.

The consultation addressed the problem of the coverage and quality of the global data set collated annually by FAO. The Secretariat was inquired on the methodology for estimating values (which were meant to measure the gross revenue at the farm, at the point of first sale), to which extent it searched for alternative global sources of information (e.g. the data set of other organizations), and the extent to which trade data were used to validate production. The consultation recommended that FAO expand data collection on social and economic aspects, and on employment in particular.

The secretariat informed the consultation that the FAO data set is based on nationally available information, and thus is influenced by national priorities for data collection. The data requirements and availability of “cash crop”-type species (salmon, shrimp, sea-basses, sea bream etc.) often produced for the international market by a highly structured, well organized sector, sometimes in large establishments, are widely different from those of the semi-commercial, subsistence, small-scale sector. While the first is generally well-monitored by national systems, and produce data of known quality, fish farming for local markets and self-consumption/subsistence in small family farms (typically in Asia) is generally not well covered in national statistical systems. For the latter, the collection of the array of data on employment of the smaller establishments (e.g. by type of occupation, gender, age, time spent in the profession) is not usually possible through standard employment surveys. This has probably resulted in underestimation of the contribution of the sector to social and economic goals, and in particular the important role of women in aquaculture, in many countries.

Some time was devoted to reaching consensus on the understanding of the terms “status” and “trends” and on the desirable frequency of the collection of data and information on the two elements. The group agreed that status is the situation prevailing at one specific point in time, thus describing the condition of the sector in respect of identified elements (as a minimum the output in volume and value, employment, but also income, market demand, prices of products and inputs etc.), whereas trends are measurements of the changes of such variables over time. Knowledge on the latter is

important for policy decisions concerning sustainability and development, as they provide the indication of a global direction.

The participants noted the usefulness of trade statistics, but recognized that this is limited by the lack of specific identification of farmed products available in international trade nomenclatures (e.g. the Combined Nomenclature, the Harmonized Commodity Description and Coding System). Participants were informed that the forthcoming session of the COFI Sub-Committee on Fish Trade was addressing this issue to make recommendations to the classification maintenance organization.

Some of the salient points emerging were:

- the agreement on definitions;
- the need to draw data lists at political level (e.g. few aggregate statistics), at policy making level (differentiate the global into sub-national–regional estimates), elaborate clear indicators; and
- the need to draw a data list at farm unit level.

Policy goals vary from country to country and determine the array of data required. For example some participants recalled that the EU policy on aquaculture had to respect 3 main basic goals:

- social aspects (guarantee employment and people's well being);
- consumer protection (guarantee the quality of the product);
- environment protection (guarantee the respect by the industry of the quality of the environment); and

that the information sought for aquaculture had to cover all those aspects.

The participants noted that the reliability of the FAO global dataset would improve when making comparisons with the information available in other national and international organizations. They recommended that the existing exchanges of data between organizations should be intensified and institutionalized through a mechanism similar to the Coordinating Working Party on Fishery Statistics. They also recommended that national offices should exploit all sources of available information on aquaculture (data held by producer organizations, regional organizations, the academy, projects, other agricultural surveys) before undertaking new surveys and also to validate results of data collected.

14 STRATEGY AND OUTLINE PLAN FOR IMPROVING INFORMATION ON STATUS AND TRENDS OF AQUACULTURE

Discussion of the strategy

The consultation reviewed the draft strategy and outline plan for improving information on status and trends of aquaculture (EC:STA/2004/5). There was broad agreement among the experts on the need for such a strategy to improving information on aquaculture status and trends. The consultation made a number of recommendations for the clarification and improvement of the strategy document.

Significant recommendations for the strategy were:

- Development of guidelines to assist planning and implementation of data collection should be included.
- Software development (e.g. ARTFISH and FIGIS) in support of data collection, exchange and analysis should be undertaken.
- The strategy should be more specific on socio-economic, environmental and economic indicators (refer also to the discussions above).
- Responsibilities of member states in data collection, and the need for resources, should be emphasized. FAO should encourage member states to invest in data collection and meet their international reporting responsibilities.

- Reference should be made of the need for coordination of data collection with the agriculture sector, when appropriate. Natural resources use and environmental management should be coordinated with departments charged with monitoring land and water use. Incorporation of aquaculture questions within censuses is consistent with this approach and should be mentioned.
- Emphasize cooperation with concerned departments at national levels, such as national statistical offices.
- Give greater emphasis to the involvement and partnership with regional organizations with a remit for aquaculture (e.g. in Asia these could include NACA and SEAFDEC).

Discussion of a model project proposal

A presentation of the FishCode Programme, a multi-donor global program of FAO that supports FAO members in the implementation of the FAO Code of Conduct for Responsible Fisheries proceeded the final discussion session.

Following the presentation, the consultation reviewed the draft project outline for supporting improving collection and processing of data and information on the status and trends of aquaculture.

The consultation strongly supported the idea of a project to assist FAO and its members in improving information on status and trends of aquaculture. The consultation identified a number of areas for amendment and emphasized that the objectives should be made clearer to emphasize the use of data for policy, planning and management not just collection of data and analysis. The document should emphasize the importance of data collection and how it could be used to support implementation of the CCRF.

The consultation urged FAO to seek funding support for this important initiative and suggested that the FishCode Programme would be an ideal partner for implementation of the strategy.

Adoption of the report

The report was adopted on 23 January 2004.

Annex 1

AGENDA OF THE EXPERT CONSULTATION

1. Opening of the Consultation
2. Appointment of Chairperson(s)
3. Adoption of the Agenda and Timetable EC:STA/2004/1
4. Current Status and Main Issues of National Monitoring and Reporting of Aquaculture Status and Trends: identification of institutional and technical issues for priority action at the national and global level. EC:STA/2004/2
5. Current FAO Procedures for Monitoring and Reporting Production and Status of Aquaculture: review and discussion EC:STA/2004/3
6. Global Issues in Relation to Status and Trends Reporting on Aquaculture: prioritizing key issues and defining a way forward. EC:STA/2004/4
7. Information Needs and Availability: defining basic information needs at the global level, and recommendations to the Working Group on the FAO Questionnaire, FISHSTAT AQ EC:STA/2004/2,4, Info.3
8. Strategy and Outline Plan for Improving Information on Status and Trends of Aquaculture EC:STA/2004/5, 2-4, Info.4
9. Adoption of the Report (including the proposed strategy and plan)

Annex 2

LIST OF DOCUMENTS OF THE EXPERT CONSULTATION

Document	Title
EC:STA/2004/1	Provisional Agenda and Timetable
EC:STA/2004/2	Regional Syntheses/Summaries of Procedures and Issues in Relation to National Monitoring and Reporting on Aquaculture
EC:STA/2004/3	Current FAO Procedures for Monitoring and Reporting Production and Status of Aquaculture
EC:STA/2004/4	General Issues in Relation to FAO Status and Trends Reporting on Aquaculture
EC:STA/2004/5	Draft Strategy and Outline Plan for Improving Information on Status and Trends of Aquaculture
EC:STA/2004/Info.1	Provisional List of Documents
EC:STA/2004/Info.2	Provisional list of Participants
EC:STA/2004/Info.3	Guidelines on the Collection of Aquaculture Structural Statistics: Supplement to the Programme for the World Census of Agriculture 2000 (publication for distribution at the meeting)
EC:STA/2004/Info.4	Strategy for Improving Information on Status and Trends of Capture Fisheries

Annex 3

LIST OF PARTICIPANTS OF THE EXPERT CONSULTATION

Experts and Resource Persons

Lionel AWITY
Assistant Director, Head of Inland Fisheries & Aquaculture
Fisheries Directorate, P.O. Box 630
Accra
Ghana
Tel.: (233) 24 591458
E-mail: lawity@hotmail.com

David CROSS
Head of Fisheries Sector
Statistical Office of the European Communities
BECH Building
5, rue Alphonse Weicher
L-2721 Luxembourg
Tel.: (352) 4301-32249
Fax: (352) 4301-37318
E-mail: david.cross@cec.eu.int

DONG Shuanglin
Vice President, Ocean University of China
5 Yushan Road
Qingdao
People's Republic of China
Tel.: (0532) 2032827 (Office)
Fax: (0532) 2032799
E-mail: dongsl@ouc.edu.cn

Alejandro FLORES NAVA
Director
Centro de Investigación y de Estudios Avanzados del I.P.N.-Unidad Mérida
Km.6 Carr.Antigua a Progreso
A.P. 73 Cordenex 97310
Mérida
Yucatán
México
Tel.: (999) 981-29-15 ext.214
Fax: (999) 981-29-23
E-mail: aflores@mda.cinvestav.mx

Marit H. HELLER
Higher Executive Officer
Ministry of Fisheries
PO Box 8118 Dep.
NO-0032 Oslo
Norway
Tel.: (47) 22 24 65 02
Fax: (47) 22 24 95 85
E-mail: marit.heller@fid.dep.no

Courtney HOUGH
General Secretary, FEAP
Rue Nicolas Fossoul 54
B-4100 Bonnelles
Belgium
Tel.: (32) 4 3382995
Fax : (32) 4 3379846
E-mail : secretariat@feap.info

Svein MUNKEJORD
Regional Director of Fisheries and Aquaculture
Directorate of Fisheries
Region Rogaland
Havnegata 4
Postboks 43
N-4291 Kopervik
Tel: (47) 52 74 56 00/56 05
Fax: (47) 52 84 56 01
E-mail: svein-magnus.munkejord@fiskeridir.no

Ricardo NORAMBUENA
Head of Aquaculture Department
Subsecretaría de pesca
Bellavista 168 – 17th Floor
Valparaíso
Chile
Tel.: (56-32) 502741 / 502742
Fax: (56-32) 502740
E-mail: rnorambu@subpesca.cl

Michael J. PHILLIPS
Environment Specialist
Network of Aquaculture Centres in Asia-Pacific
Suraswadi Building, Department of Fisheries
Kasetsart University Campus
Ladyao, Jatujak
Bangkok 10900
Thailand
Tel.: (66-2) 561-1728 ext.115
Fax: (66-2) 561 1727
E-mail: michael.phillips@enaca.org

James SHAPIRO
Fisheries Biologist
Kinneret Fisheries Laboratory
Department of Fisheries
Ministry of Agriculture and Rural Development
Tel Aviv
Israel
Tel.: (972) 4-6722840
Fax: (972) 4-6725649
E-mail: james@moag.gov.il

Felipe M. SUPLICY
General Coordinator of Marine Aquaculture
Presidency of the Republic of Brazil
Special Secretariat of Aquaculture and Fisheries
Esplanada dos Ministérios
Bloco "D" -2 andar
70043-900 Brasilia/DF
Brazil
Tel.: (5561) 218-2901
Fax: (5561) 224-5049
E-mail: fsuplicy@agricultura.gov.br

Albert G.J. TACON
Aquaculture Research Director
Aquatic Farms
49-139 Kamehameha Hwy
Kaneohe, HI 96744,
USA
Tel.: (808) 239-2929
Fax: (808) 239-8436
E-mail: agjtacon@aol.com

H. Stetson TINKHAM
Office of Marine Conservation
OES/OMC. Room 5806
U.S. Department of State
Washington, DC 20520-7818
USA
Tel.: (202) 647-3941
Fax: (202) 736-7350
E-mail: tinkhamsx@state.gov

K. Narayanan UNNI
Deputy Registrar General
Office of the Registrar General, India
Ministry of Home Affairs
V.S. Division, West Block-I,
R.K. Puram, New Delhi-110066
India
Tel.: (91) 26100678 (Office)
E-mail: rgcrs@vsnl.net

Constantin VAMVAKAS
Head of Unit, Aquaculture
Fisheries Directorate-General
European Commission
J-99 02/91, B-1049 Brussels
Belgium
Tel.: (32-2) 295 57 84
Fax: (32-2) 296 83 79
E-mail: constantin.vamvakas@cec.eu.int

Laszlo VARADI
Director – Research Institute for Fisheries, Aquaculture and Irrigation
P.O.B. 47, 5541 Szarvas
Hungary
Tel.: (36) 66 515-302
Fax: (36) 66 312-142
E-mail: varadil@haki.hu

FAO Secretariat

Adele CRISPOLDI
Senior Fishery Statistician
Fishery Information, Data and Statistics Unit
FAO Fisheries Department
Viale delle Terme di Caracalla
00100 Rome,
Italy
Tel.: (39) 0657056454
Fax: (39) 0657052476
E-mail: adele.crispoldi@fao.org

Simon FUNGE-SMITH
Aquaculture Officer
Aquaculture and Inland Fisheries
FAO Regional Office for Asia and the Pacific
Maliwan Mansion, 39 Phra Atit Road
Bangkok 10200,
Thailand
Tel.: (66-02) 697-4149
Fax: (66-02) 697-4445
E-mail: simon.fungesmith@fao.org

Alan LOWTHER
Fishery Statistician (Aquaculture)
Fishery Information, Data and Statistics Unit Fisheries Department
Viale delle Terme di Caracalla
00100 Rome
Italy
Tel.: (39) 0657054029
Fax: (39) 0657052476
E-mail: alan.lowther@fao.org

Rohana SUBASINGHE
Senior Fishery Resources Officer (Aquaculture)
Inland Waters and Aquaculture Service
Fishery Resources Division
Fisheries Department
Food and Agriculture Organization of the UN
Viale delle Terme di Caracalla
00100 Rome
Italy
Tel.: (39) 06 570 56473
Fax: (39) 06 570 53020
E-mail: Rohana.Subasinghe@FAO.Org

Shunji SUGIYAMA
Associate Professional Officer
(Fishery Statistics)
FAO, Regional Office for Asia and the Pacific
Maliwan Mansion, 39 Phra Atit Road
Bangkok 10200
Thailand
Tel.: (66-2) 6974242
Fax: (66-2) 697445
E-mail: shunji.sugiyama@fao.org

Raymon VAN ANROOY
Aquaculture Economist
Fishery Policy and Planning Division
FAO Fisheries Department
Food and Agriculture Organization of the UN
Viale delle Terme di Caracalla
00100 Rome
Italy
Tel.: (39) 06 570 53031
Fax: (39) 06 570 56500
E-mail: raymon.vanAnrooy@fao.org

Annex 4

STATUS AND TRENDS REPORTING OF AQUACULTURE: AN ANALYTICAL FRAMEWORK

1 BACKGROUND

The following analytical framework was prepared by the Experts attending the Consultation to assist in defining information requirements for global analysis of status and trends in aquaculture development, and to provide a basis for further discussion and development of guidelines and approaches to status and trends reporting. It is organized around three questions: Why the data are needed?, What data should be collected?, and How should these data be collected? The framework has been edited but not all parts have been completed so as to accurately reflect the deliberations of the Expert Consultation.

Why?

The overall goal of status and trends reporting in aquaculture is to support management. In order to better facilitate this goal, it is important to focus on the following status and trends:

- quantifying aquaculture production, species and values;
- assessing natural resource use and environmental management;
- contributions of aquaculture to poverty reduction, social impact and livelihoods;
- contributions of aquaculture to food security and food demand, and development of food policy;
- contributions of aquaculture to national economies and trade; and
- development of institutions that support responsible development of aquaculture.

The Expert Consultation considered that at international level the six points above should have equal priority in status and trends reporting, while recognizing that there would be constraints to reporting on some that could not be easily addressed.

What?

For each of the six points above, potential indicators followed by information required for developing those indicators should be identified, considering the necessary collection frequency, data quality and quantity, and any standardization required.

How?

Having established the indicators and information requirements, the methodology for collection of data and reporting of trends and status should be considered, with special reference to:

- information sources – the Expert Consultation gave special attention to the FISHSTAT AQ questionnaire, circulated by FAO to members. However, in some cases required information would need to come from other sources, both within and outside FAO (e.g. agriculture census information, etc.);
- quality control issues;
- infrastructure required;

- any regional differences or considerations;
- dissemination strategies (NASO, FAO publications (such as circulars); and
- cooperation and partnerships to assist in collecting, collating and disseminating status and trends reporting.

2 SUPPORT REQUIREMENTS

Recognizing that there is a need to develop tools for collecting and disseminating information and building capacity for implementing the strategy for improving status and trends reporting in aquaculture, the Expert Consultation also suggested the framework should include; (a) constraints analysis and capacity building requirements and (b) tools that can support national and regional awareness and capacity building (e.g. guidelines for collection of aquaculture statistics, etc.).

3 POSSIBLE INDICATORS AND INFORMATION FOR IDENTIFYING THEM

Why?	What indicators?	What information?	How?	Constraints and support requirements
1) Aquaculture production, species, values	<p>Production and (farm-gate) value by species and culture environment</p> <p>Number of aquaculture establishments (grow out and hatchery)</p> <p>Water surface area by establishment and species</p>	<p>Production, species, aquaculture establishment, farm-gate value</p>	<p>FISHSTAT as major source of information. However, water surface area might be collected by other means.</p> <p>Information on the values could be improved through involvement of national experts. Should aim at providing best estimate on prices.</p> <p>Remote sensing/satellite data could be used for water surface area and coverage information.</p> <p>GLOBEFISH could be used to validate farm-gate prices by comparison with market prices.</p> <p>Frequency of collection should be annual.</p>	<p>Value – difficult to assess, thus clear instructions are required in FISHSTAT AQ.</p> <p>Environment – difficult to assess the differences between brackishwater and marine. Might include categories such as inland / freshwater, and coastal/others.</p> <p>Tools – better instructions on forms for determining value would be helpful.</p>

Why?	What indicators?	What information?	How?	Constraints and support requirements
2) Environment and resources	Land use	land area and classification land area per unit of production	Not only FISHSTAT Special studies/NASO Feed mills/associations	Availability of information and costs of studies will be the main constraints
	Water use	total area of water and classification volume per unit of production	AAPQIS, OIE DIAS (biodiversity) Environmental authorities	Guidelines are required
	Nutrient use	percentage farms with effluent treatment	Licence requirements regional differences exist	It is important to understand what is meant by environmental management.
	Chemical use	classification of nutrients percentage of farms using each nutrient feed inputs per unit of production	more frequent studies on fast growing sub-sectors consider sub-sampling countries rather than complete coverage environmental certification	Two aspects to the environment – impact of environment on aquaculture and impact of aquaculture on environment should be considered.
	Species use	classification of chemicals percentage of farms using each chemical classification	All above are of high priority, as they reflect all aspects of sustainable development.	Other aspects as alien species should be included.
	Disease occurrence	chemical inputs per unit of production	Environmental licenses issued for aquaculture and CCRF reporting would also be other mechanisms.	
	Energy use	percentage of farms using native and non-native species disease classification and percentage of farms affected for each disease economic costs of disease energy classification (renewable or non-renewable) energy inputs per unit of production	Frequency of data collection – periodic studies rather than routine FISHSTAT data.	

Why?	What indicators?	What information?	How?	Constraints and support requirements
3) Social impacts and employment	<p>Social</p> <p>Economic</p>	<p>Number of employees (full, part time, in full time equivalents)</p> <p>Gender</p> <p>Educational status</p> <p>Age</p> <p>Nationality</p> <p>Income</p> <p>Ownership of the establishment</p> <p>Presence of associations (also covered under institutions below)</p>	<p>Employment data through FISHSTAT</p> <p>Upstream and downstream information is desired, but technical difficulties are recognized.</p> <p>May be better to concentrate on aquaculture proper.</p> <p>Employees to be seen in a wide context recognizing social and national structural differences.</p> <p>Priority – high priority for employment, but medium-high priority for other data.</p> <p>Frequency – changes are such that annual surveys are not required. Information best obtained by periodic surveys/studies</p>	<p>FAO should undertake FAO consultations (e.g. with ILO, and UN HLD) to ensure proper data coverage.</p>

Why?	What indicators?	What information?	How?	Constraints and support requirements
4) Food security and poverty reduction	<p>Contribution</p> <p>Consumption</p> <p>Self-sufficiency</p> <p>Trade balance</p> <p>Price elasticity</p>	<p>Contribution of aquaculture to GDP</p> <p>Per capita consumption (in live weight equivalents, in protein input)</p> <p>Degree of self-sufficiency</p> <p>Trade balance in national economy</p> <p>Price elasticity of products/commodities</p>	<p>Consumption and self-sufficiency are traditionally derived from food balance sheets compiled by FAO using available basic (production and trade) data.</p> <p>Priority – high priority</p> <p>Frequency – annual if possible</p> <p>An additional input is the annual questionnaire on the use of fishery products.</p> <p>Priority – high priority, but there will be difficulties in compiling balance sheets specifically for aquaculture products.</p> <p>Trade balance – is available from trade data, but maybe difficult to identify aquaculture products</p> <p>Price elasticity – by special studies and not annually</p> <p>Priority – medium</p>	<p>Tri annual average of consumption would be sufficient but annual is better if possible.</p> <p>Results should be sent to national bodies and peer review for comment before publishing.</p> <p>Some social information could be collected through NASOs.</p> <p>Relative price difference between species originated from the wild and culture.</p> <p>Special studies for separating fish destined for tertiary purposes vs. food use could be appropriate. This may allow interpretation of aquaculture figures in relation to fish supply, imports, and other food (meat) products.</p>

Why?	What indicators?	What information?	How?	Constraints and support requirements
5) Economies and trade	Export value Export volume Investment Subsidies and incentives	Export and trade figures compared across sectors GDP figures National export figures	Not through FISHSTAT AQ General statistics office (GDP information) National export figures Trading bodies (UN COMTRADE, WTO) FAO statistics, NASO, GLOBEFISH, etc. Priority – medium at global level Frequency – If possible annual basis and if not less frequently.	Difficult to obtain in many countries. Difficult to separate aquaculture from capture fisheries and overall economic data. Make estimates based on assumptions of contribution. Data may not be collected on a global basis. Need for inter-institutional cooperation.

Why?	What indicators?	What information?	How?	Constraints and support requirements
6) Institutions to support responsible development of aquaculture	State support Education and training NGO assistance Banking and finance	Government and other public institutions administrative structure budget allocation legal framework staffing Educational and research institutions classification/ quantification of educational/research institutions engaged in aquaculture related activities staffing Non-Government institutions quantification of NGOs engaged in aquaculture related activities (upstream and downstream) Banking and finance institutions	For the entries in this category, information would be collected from the institutions involved or through other research – it would not be included on any existing questionnaires.	The major constraints would involve the availability of information, interest in cooperation, and improvement of communication among institutions.

Report of the Meeting of the Working Group of Experts on the FAO Aquaculture Questionnaire “FISHSTAT AQ”

1 BACKGROUND AND RATIONALE

The role of FAO in collating global aquaculture statistics and in the preparation of information on the global status and trends of the world aquaculture sector is unique. Such global data and reports are important in alerting regional organizations, national policy makers and advisors, industry, donors, banks and other financing institutions, NGOs and the public to the global aquaculture situation and global issues which can influence the regional and national levels. In recent years the demand for reliable data and information and for separate reporting on fisheries and aquaculture has greatly increased, driven by the need to formulate and monitor the impact of sound policies and development plans for sustainable aquaculture development, and management of resources and the environment; and the increasing public demand for transparency and accountability.

Systematic collection of aquaculture statistics separate from capture fisheries, by the FAO Fishery Information, Data and Statistics Unit (FIDI) started in 1984, when the questionnaire, FISHSTAT AQ, designed in consultation with regional experts and HQ Aquaculture experts, was introduced to enable yearly reporting of aquaculture production statistics and selected structural data at the national level. The FAO questionnaire and its instruction sheet intended to (a) promote standardized usages of variables to facilitate international comparability of data and meaningful world aggregates and (b) improve monitoring and analysis of trends in aquaculture development. There have been no substantial changes in the structure and content of the questionnaire since then.

The FAO aquaculture database, formed by pooling together validated national statistics collected through the questionnaire, currently reports aquaculture production in terms of quantity and value, in marine, brackish and freshwater environments, and provides information on rearing facilities. There is great variation in the quality of the national data submitted to FAO. Some of the received (e.g. hatchery output and structural) data are not published because of completeness and quality issues. A growing percentage of production is identified to the family/order level only, and some problems arise from inadequate harmonization of terms and definitions.

The development of the FAO aquaculture statistical database is still in progress. FAO efforts to improve the completeness and quality of the data are a continuous process, and much remains to be done. However, the growing need for the collection of additional information not now included in the questionnaire, together with other reporting required in connection with international agreements and sustainability issues, will probably put a strain on certain developing Member countries and pose problems in terms of country response. Accordingly, any modification of FISHSTAT AQ must take this into consideration, and should perhaps aim at the collection of priority basic data for global reporting that is, optimally, also of priority at the national

level, and at approaches and tools which will help simplify and reduce the cost of data collection, while ensuring data reliability, particularly in countries with limited capacity and resources. Modifications to the questionnaire must also be carefully evaluated and should be made, as far as practicable, in consultation with the data “providers”.

Other international fora have identified information needs for aquaculture as a priority area for attention at the national, regional and global level and some designated improvement of the quality of FAO global aquaculture statistics, including establishment of unified standards and guidelines for data collection and clearer definitions as a priority area of work for FAO. It was also suggested that a minimum set of data should be collected for global reporting on status and trends of aquaculture.

The FAO Fisheries Department convened the Working Group in response to these recommendations and needs, to specifically address practical and achievable modifications to the FAO aquaculture questionnaire, FISHSTAT AQ.

2 OBJECTIVE AND SCOPE

The overall objective was to improve the information base for global reporting within the practical limits of national capacities and resources while responding to the extent possible to changing management perspectives and widespread concerns about sustainable development, and management of the environment and natural resources.

The purpose of the Working Group was to provide expert advice and guidance concerning the FAO questionnaire, FISHSTAT AQ and its instruction sheet, in order to identify and prioritize modifications that are deemed most necessary to improve the FAO database on aquaculture.

Specifically, the Working Group was called to review the FISHSTAT AQ questionnaire in its content and user friendliness, to provide recommendations on what modifications are necessary and feasible (e.g. in terms of scope, harmonization of terms and classifications, definitions, periodicity of data collection, adequacy and clarity of the instruction sheet, user-friendliness), as well as to prioritize the suggested modifications and to identify specific approaches and actions to achieve them to meet global information requirements.

The WG was also requested to take into consideration in its deliberations the following:

- the discussions and recommendations of the preceding Expert Consultation on Improving Information on Status and Trends of Aquaculture regarding:
 - minimum essential data needs
 - national issues and priorities for improving statistical data
 - issues concerning the FAO global statistical data base on aquaculture
 - modifications to FISHSTAT AQ suggested earlier (for the Asia region), and
 - the response of concerned Member States
- possible need for modifying the scope of statistical data collected to meet new management perspectives and to respond to increasing public concerns about resources and the environment, including minimum needs for relevant indicators;
- the revised definitions and additions to structural and non-structural statistics suggested in the FAO publication “Guidelines for the collection of structural aquaculture statistics”;
- differences in development stages of the sector;
- issues relating to the collection, processing and dissemination of statistical data and information at the national level, as reported and discussed in the preceding Consultation; and
- the need to address effects of modifications of the FAO questionnaire on the integrity of historic data sets at the national, regional and international level.

3 ORGANIZATION AND VENUE

The Working Group was convened in the German Room at FAO headquarters in Rome, Italy, from 26 to 28 January 2004. It was held in English and its deliberations were conducted in plenary sessions.

4 PARTICIPATION

The list of participants is attached as Annex 2.

5 OPENING

Dr Richard Grainger, Chief of the FAO Fishery Information, Data and Statistics Unit (FIDI) welcomed the participants and invited them to provide their advice on how to improve the reliability of the global data on aquaculture to contribute to management needs and to better understand the links with other sectors. He recalled the importance of reliable statistics in measuring the current contribution of aquaculture to economic, social and food security goals. He recalled the process through which data are collated by FAO. He highlighted the need to revise the form after some twenty years of being used in its current form, in the light of dynamic technical developments in aquaculture and of increasing demand for data and information.

6 APPOINTMENT OF CHAIRPERSON

Mr David Cross was appointed Chairperson of the Working Group.

7 ADOPTION OF THE AGENDA

The Agenda was adopted as proposed. (Annex 1).

8 IDENTIFICATION OF A CORE SET OF ESSENTIAL DATA FOR GLOBAL REPORTING

Introducing agenda item 4, the secretariat informed the Working Group of the discussions which had taken place in the Expert Consultation the week earlier. Various key questions were addressed. The question "why we collect data?" was followed by "what data should be collected?" and "how should these data be collected?" Annex 4 of the report of the Expert Consultation, titled "Status and trends reporting in aquaculture: a draft analytical framework for discussion and development" was proposed as guidance for the Working Group discussion under this agenda item. That document outlined six primary areas and their data needs:

- aquaculture production, species, and values
- environment and resources
- social impacts and employment
- food security and poverty alleviation
- economies and trade
- institutions to support responsible development of aquaculture

The discussion began with the issue of which indicators should be collected to address the national and global information needs on aquaculture production, species and values. Aquaculture production, in metric tons by species, was recognized by the Working Group as the single most fundamental data element and its inclusion was assumed on any questionnaires and revisions that were discussed.

8.1 Number of units

Questions were raised whether the current version of the FISHSTAT AQ questionnaire should be changed in such a way that the number of units per method of culture (ponds and tanks, enclosures and pens, cages, raceways and silos, and barrages) should be replaced by the number of establishments, as the size of the units differ considerably

and the resulting information obtained was thought to be of little use. The secretariat explained that originally “units” was included as means for measurement to allow control and validation (to some extent) of the reliability of the production data reported.

It was argued that some establishments can include different types of units and that the term “establishment” implies that a certain type of license or registration is in place which is not often the case in many countries. Non-registration would then lead to non-inclusion in the completion of the questionnaire, leaving out major parts of the aquaculture production. The use of the terms “aquaculture operation” or “farm” was proposed, both of which would make it possible to include both commercial and non-commercial ventures in the statistics. It was agreed that “farm” would probably be the best term. It was argued that the number of farms should be collected, preferably by species or species group produced. Although species-specific data were considered important, it was argued that it was not essential to include them in the questionnaire in view of the complications in collecting data at national level arising from polyculture and sequential aquaculture, as well as for the general desire of simplifying the questionnaire.

8.2 Volume and Area

Although area under culture can change considerably during the year it was generally considered to be an important indicator. The national authorities should report the most appropriate measure of area and advice concerning this should be included in the notes for completion. It was suggested that countries should indicate the time of the year when the area measurement was taken. Information on area is easier to obtain than information on volume of water used. For planning and environmental management purposes, the area under culture would be of greater importance than the volume of water used.

In view of the rather low response rate from the member countries on this subject it was suggested to keep “area” as an indicator in the annual FISHSTAT AQ questionnaire. Inclusion of volume may be considered in the future.

8.3 Value

Following the recommendations of the Expert Consultation, clarification of the reporting of value at first point of sale (also known as “farm-gate” value as opposed to wholesale or retail value) was endorsed. The instruction sheet specifies this value but the current format of the FISHSTAT AQ questionnaire merely requests “Price/kg.” It was suggested that total farm gate value might be easier to report for practitioners and authorities. The experts agreed the option for reporting either price/kg at first point of sale or total (usually farm gate) value should be included in the questionnaire, as one can be calculated from the other. Total value should be the preferred option. However, the Working Group noted that the value of the final product may be distorted in operations which process (or add value) to the aquaculture production. Relevant explanations and clarifications to guide respondents should be provided in the notes for completion.

8.4 Level of intensity of culture

Although it is not present in the current FISHSTAT AQ questionnaire, it was suggested by some of the participants to include a question on the intensity of production, distinguishing culture practices into the categories: extensive, semi-intensive and intensive. This change would support management decision-making processes and environmental monitoring. It could also show that some systems are under-utilized, as demonstrated by an example of intensive culture systems of tilapia in Mexico. Although many countries will not be able to provide these data on culture practices,

it was generally felt that the collection of data on this subject should be promoted and should be accompanied by capacity building on this subject.

Collection of data on the volume (metric tons) and area (hectares) might also give an indication of the intensity of production, as does stocking density and feeding system used, but still preference was given to include the distinction between extensive, semi-intensive and intensive in the FISHSTAT AQ questionnaire, accompanied with clear definitions of each. Concerns were raised whether there is a need to collect this information on an annual basis or if less frequent collection would suffice. The need to develop clear, internationally accepted definitions for these terms was also emphasized. The Working Group suggested that this matter should be referred for technical advice to a future working group on aquaculture statistics (as recommended by the Expert Consultation) and for its policy implications to the COFI Sub-Committee on Aquaculture.

8.5 Culture environment

The current breakdown in culture environment (freshwater, brackishwater and marine) was considered complicated by many of the experts and left to the subjective criteria of reporters. Instead, a simple distinction between freshwater and saline water (marine/brackish) was proposed. This would solve most of the problems related to reporting on this subject, such as the measurement of salinity levels and changes of salinity levels over the year. In view of the very limited loss of information when the two environments (marine and brackishwater) would be combined, the few responses obtained from countries on this subject and the fact that a number of countries do not make the distinction among the three groups, the Working Group suggested a change to the questionnaire to collect data on only these two environments.

8.6 Hatcheries

It was noted that hatchery production can contribute both to the enhancement of natural populations and to on-growing for market production. Regarding production for release into the wild, data on volume (as opposed to numbers) was considered sufficient. However, production volume for on-growing should not be included with final aquaculture production volume, as this would be "double counting". A specific note should be included in the FISHSTAT AQ questionnaire instructions on this subject. The currently collected hatchery data were considered to be important for providing an indication of the economic value produced by the hatchery sub-sector of the aquaculture sector. The questionnaire should be revised to specifically allow reporting on this value. It was also suggested to collect information on the number of hatcheries and the employment in hatcheries under the FISHSTAT AQ questionnaire.

One country reported that they are able to provide an indication of the life stage of the organisms released to a controlled environment. However, the Working Group considered that this was not practicable to collect through the FISHSTAT AQ questionnaire.

The Working Group recognized there could be difficulties in obtaining value and prices particularly in vertically integrated operations. While the Working Group recognized the importance of collecting this information at the national level for its contribution to employment, trade and management purposes, the inclusion of these data were not recommended for the FISHSTAT AQ due to limited global relevance.

8.7 Wild caught fry (e.g. eel, oyster and other mollusc seed)

It was proposed to collect volume and value of the wild caught fry under the FISHSTAT AQ questionnaire. The Working Group noted the importance of this information for management especially at national level. It also noted the difficulty of accurately

measuring these variables and therefore it was recommended that they should not be included in the FISHSTAT AQ at this time.

8.8 Data for monitoring the environment and resource use

Reference was again made to the Annex 4 of the report of the Expert Consultation, titled “Status and trends reporting in aquaculture: a draft analytical framework for discussion and development” and participants generally agreed that it was important to get information on land, water, chemical, energy, nutrient and species use and disease occurrence. However, the indicators could be collected on a less frequent basis than the annual FISHSTAT AQ questionnaire. Availability levels for the information requested are low. The importance of guidance to the member countries, through a document specifying the guidelines for aquaculture data collection, was raised. Such guidelines might encourage countries to collect this type of information.

Some information such as land area use and classification of integrated agriculture-aquaculture production may be available from other sources including the agricultural statistics system.

A point was raised that there were possibilities that some environmental performance indicators were readily available or could be derived from statistical data in the agriculture sector. However, it was noted that limitations of such data do exist as problems of completeness and timeliness are also prevalent with agriculture statistics.

There are opportunities of generating environmental performance indicators if countries exercise environment licensing/permission schemes for aquaculture practices, yet the number of countries with such schemes has been very limited.

Having reviewed all the limitations and constraints with environmental performance indicators, the Working Group viewed that it would be premature to include these indicators in the FISHSTAT AQ questionnaire. It was, however, noted that the importance of these indicators cannot be denied, and hence the Working Group recommended that the subject be kept under review and further discussed by a coordination body to deal with aquaculture information and statistics⁹.

8.9 Social impacts and employment

The Working Group was reminded that the Expert Consultation had identified key indicators to monitor social and employment aspects of the aquaculture sector, including the number of employees by gender, educational status, age, income, and nationality, and information on ownership and the presence of associations.

It was reiterated that the primary importance of employment data lies in the fact that it is a viable social indicator to assess the contribution of the aquaculture sector to poverty reduction. Furthermore, employment data can be used to indicate the needs for education, training and extension as upstream supporting services for the sector. However, care should be taken because inclusion of employment data in the questionnaire could lead to situations where countries provide inaccurate data when accurate national employment data for the aquaculture sector are absent. Such information would probably underestimate employment benefits.

It was recognized that data collection on employment requires the significant efforts and resources. Although inclusion of employment data in the FISHSTAT AQ questionnaire may encourage countries to consider this aspect of the aquaculture sector, it could be too demanding for countries to conduct such a survey on an annual basis. It was noted that in some countries where fishery employment data are collected aquaculture is not separately identified.

⁹ The Expert Consultation endorsed the need for a working group, comparable with the Coordinating Working Party on Fishery Statistics, to consider all aspects related to aquaculture information and statistics.

The Working Group agreed that basic employment data for the time being should continue to be collected annually through the FAO FISHSTAT FM questionnaire.

8.10 Food security and poverty reduction

Indicators for food security and poverty reduction identified by the Expert Consultation include contribution of aquaculture to the Gross Domestic Product (GDP), per capita consumption, degree of self-sufficiency and trade balance. Price elasticity of aquaculture products was also regarded as important information. The Working Group agreed that these indicators could be derived from existing sets of data outside the FAO scope of global compilation rather than requiring direct measurements of aquaculture activities. As such, the Working Group unanimously agreed that there was no need for additional data to be requested in the FISHSTAT AQ questionnaire for this purpose.

8.11 Economies and trade

Similar to indicators for food security and poverty reduction, indicators for economics and trade are available from the existing data sets FAO traditionally compiles, and hence no specific amendments for FISHSTAT AQ questionnaire were required. However difficulties in monitoring trade balance of aquaculture inputs/outputs were recognized since international trade classifications do not distinguish products of capture fisheries and aquaculture.

8.12 Institutions to support responsible development of aquaculture

It was noted that indicators for institutional aspects such as government/public institutions, educational/research institutions, non-governmental institutions and banking/finance institutions were qualitative rather than statistical. Therefore, the FISHSTAT AQ questionnaire may not be an ideal means to take charge of collecting such data. On the other hand, the National Aquaculture Sector Overview (NASO), which has been compiled by the Fisheries Department of FAO, will provide a well-suited platform for collection and disseminating of the qualitative information on the aquaculture sector.

9 CURRENT ISSUES WITH FISHSTAT AQ

The secretariat introduced agenda item 5 "Discussion of current issues with FISHSTAT AQ" by summarizing the forms used for collecting aquaculture data from FAO member nations. Issues with the FISHSTAT AQ were highlighted including the sparseness of the data received for hatchery production, structural statistics, and to a lesser degree, the average farm-gate value. Production by species was recognized as the best-reported data item. The need for clear, concise, and harmonized definitions throughout the FISHSTAT AQ was noted. The Working Group was asked to comment on the current issues and suggest improvements on the design and content of the FISHSTAT AQ.

It was suggested that data items in FISHSTAT AQ questionnaire be divided into two categories; one as a primary set of data to monitor global status and trends that requires annual reporting (mainly production related parameters), and the other that requires reporting only when the data become available (e.g. structural data). Categorization of data items can be decided based on their requirements for collection frequency. It was noted that presence of a large number of blank items in the questionnaire (simply because of unavailability of such data in the national data collection system) often resulted in significant delays or even deterring the submission of the questionnaire. It was expected that provision of "options" in the questionnaire format to suite widely-varied countries' monitoring capabilities would encourage national respondents to

provide their best available data and hence lead to improved coverage and timeliness of the global compilation of aquaculture statistics. The Working Group suggested looking into increasing the flexibility of the questionnaire.

9.1 Other issues and suggestions for FISHSTAT AQ

Other suggestions made during the discussion concerning the content of the form included:

- Raceways and tanks should be in one category on the FISHSTAT AQ questionnaire
- Ponds should be retained in a separate category
- Silos should be removed
- Rice fields should be added to the methods of culture
- The definitions in the notes for completion should be revised accordingly and, in general, the notes for completion of the FISHSTAT AQ questionnaire should be made clearer
- A glossary of terms should be compiled and submitted to accompany the questionnaire
- Agriculture and Fisheries Censuses could be used for structural trends reporting by collecting specific aquaculture data, such as stocking density, ownership structure and tax information. A five or 10 year basis would be appropriate as the exercise of complete enumeration is very costly

9.2 Recommendations from questionnaire design experts

Based on the recommendations made by the Expert Consultation and on extensive personal interviews with selected national data providers conducted in the preceding three days, a team of two questionnaire design experts presented a proposal for a revised format for the FISHSTAT AQ questionnaire and the rationale for the proposed changes (Annex 3). They proposed suggestions for the improvement of the “unwieldy” form, but also noted that it was important to separate the role of the form from the intrinsic problems of data availability. This first prototype of the redesigned form included only the data elements from the current FISHSTAT AQ form.

A major amendment made in the new form is the introduction of a single clear reporting unit with a one page data sheet rather than multiple data sheets. This prototype requests one line of data for each species/method/environment/area combination so that production and value data attached to a species/method/environment/area cell will be entered in a single row.

The new format was designed with the following goals:

- To be simple and user-friendly
- To focus on the basics and collect accurate data
- To enable timely dissemination of data
- To make it comparable to capture fisheries data
- To make sure that the data collected are useful and in fact are used
- To provide a uniform data structure
- To facilitate data processing

A key need recognized in developing the new questionnaire was that of “selling the form” to the data providers. If countries recognize the objectives of global data collection together with major uses of data collected, and if consequently countries clearly view the national benefits of reporting national statistics to FAO, it would be reasonable to expect that they would invest more resources (may not be in monetary terms but resources in kind such as staff time) to the activity. Therefore, it would be important to direct some efforts to make the FISHSTAT forms “marketable.”

It was explained that an advantage with the new format is the flexibility for adding or reducing data columns in the future as required. The designers of the new form proposed the use of a Web site to assist countries in the data reporting process.

The Working Group expressed appreciation for the work done and considered the proposed form a remarkable improvement. After discussion, the Working Group endorsed the following additional recommendations:

- Adopt the widely used and preferred A4 paper format rather than the larger A3 format. Many offices need to photocopy the form for dissemination to regional offices and use of a common form would facilitate this
- Separate the instructions from the definitions in the instruction sheet
- Use of diagrams, maps, charts and examples in the instruction sheet in order to make the instructions simpler and easier to understand
- Avoid the trilingual format where possible. Separate instruction sheets should be printed for the three languages
- Add a cover page that briefly and clearly explains why the requested information is required and how it will be used

Although a web-based data compilation system could reduce administrative burdens for FAO, at this time, it was thought that it would not be workable in many countries. The concept will certainly remain valid for the future, however, and development of such a system should not be ruled out.

9.3 Recommendations for inclusion of core data in the FISHSTAT AQ questionnaire

To further refine the questionnaire with the goal of producing a form consistent with the previous recommendations, a discussion was held regarding the core data elements as detailed by the Expert Consultation, and agreed by the Working Group. The following list of parameters would be important to include in an annual survey for analysis of the status and trends in aquaculture:

- Volume of production by species by method of culture
- Aquatic environment and area
- Production in volume
- Production in value
- Area under culture
- Volume of water
- Hatchery production released to the wild
- Hatchery production put in controlled environment
- Number of farms/hatcheries
- Employment in full time equivalent
- Production by intensity level
- Environmental indicators
- Input of fry/juveniles from the wild.

Some of these elements were not recommended for inclusion in the FISHSTAT AQ at this time due to conceptual, technical and other problems. In particular, the level of intensity, the volume of water and inputs from the wild were eliminated.

The questionnaire design experts strongly recommended keeping the FISHSTAT AQ form as short as possible, at least for the first revised version. Additional items such as employment could be considered for inclusion at some future date once the core version of the form has been well established.

Noting the recommendations of the questionnaire experts, the recommendations of the Expert Consultation, and their preceding discussions, the Working Group drafted and agreed to a revised form for the FISHSTAT AQ questionnaire (Annex 4).

9.4 Definitions

There was a discussion concerning the definition of “aquaculture.” Discussions also touched upon the terms included in the definition of aquaculture such as aquatic plants (submerged and surfaced), ornamental fishes, amphibians, reptiles, and pearls. The consensus was finally formed that the current definition of aquaculture should stand as it is¹⁰. However, footnotes should be provided to clarify whether or not to include data for some practices in aquaculture such as fattening of wild-caught species.

The Working Group was informed that FAO will continue discussions on aquaculture definitions and related terminologies. It was advised that unresolved complexities in separating capture fisheries and some aquaculture practices merit further discussions, possibly by a joint group of capture fisheries and aquaculture experts. The Working Group was informed that the establishment of such a group is a matter for FAO to pursue.

10 IMPLICATIONS OF AMENDMENTS TO FISHSTAT AQ AND ACQUISITION OF OTHER RELEVANT DATA

The Working Group discussed the other form used by FAO to collect aquaculture statistics, the FISHSTAT NS AQ questionnaire, (NS meaning “National Summary”). This data collection form is intended to be used by countries to report updates to the aquaculture data already provided to FAO in the FISHSTAT AQ questionnaire, or estimated by FAO in the case of non-reported data. Countries are asked to check the production and value for the latest seven years.

It was noted that because there are two data collection forms, any revisions of either form should consider how the two data collection forms complement each other. The FISHSTAT NS AQ questionnaire should be considered as a supplement to the FISHSTAT AQ questionnaire.

It was argued that the FISHSTAT NS AQ questionnaire format could have a more “friendly” style and that a cover page could be added to emphasize the purpose of the questionnaire – i.e. that it is intended for the revision of data and not for reporting the data for the current year.

In general, the issue of ensuring that FAO questionnaires are sent to the appropriate person for completion was discussed. It was noted that although the questionnaire officially has to pass through certain channels, such as responsible Ministries or Departments, it would also be advisable to send a duplicate form directly to the person involved in completing the form, where this person is known.

Agenda item 6 titled “Discussion on the implications of amendments to FISHSTAT AQ” was presented by the secretariat. While it was noted that all the implications of change could not be assessed so quickly, it was thought that the proposals made for changes to the current questionnaire would not have serious implications for FAO. Continuity of the databases would be guaranteed and there would not be any significant loss of information due to the changes. Only the proposed combining of the brackishwater and marine environments into one category would have a significant effect on the databases.

The electronic and paper versions of the FISHSTAT AQ questionnaire would have to be revised. In view of the time required it will not be possible to be implemented for the 2004 (2003 data) inquiry. More time and resources from FAO would be required for modifying the databases and the data storage and reporting procedures (e.g. FAO yearbooks, FISHSTAT +, FIGIS).

¹⁰ Rana, K.J. Guidelines on the collection of structural aquaculture statistics: supplement to the Programme for the World Census of Agriculture 2000. FAO. Rome, 1997.

The impact of the suggested changes on the reporting offices of Member countries was considered to be fairly limited and may even stimulate countries to invest more in data collection.

To facilitate the discussion on this item it was agreed that agenda item 7 entitled "Discussion of how to acquire essential data for global reporting that cannot be collected with FISHSTAT AQ" be combined with agenda item 6. The presentation of agenda item 7 included a list of other procedures / partnerships for obtaining information on status and trends, information on the possibility of introducing multiple forms of the FISHSTAT AQ questionnaire and the potential incorporation of occasional additional test questions. The presentation posed two key questions: "How to achieve essential data that can not be collected by the FISHSTAT AQ?" and "If the data are considered "essential" are there alternative methods which are feasible?"

10.1 Alternative methods

During the discussion following the presentations, it was argued by various Working Group participants that a specific questionnaire conducted less frequently than annually (perhaps every five years) might be an appropriate way to collect essential data that cannot be captured under the FISHSTAT AQ questionnaire. Other possible ways to obtain additional information on aquaculture might include the World Census on Agriculture, dedicated national censuses, or special surveys. The cost of a census was considered too high to allow a specific aquaculture census. It was suggested that FAO and national authorities involved in aquaculture statistics should do their best to include an aquaculture "module" with key questions within planned agricultural censuses, for use in countries where there is significant overlap between agricultural holdings and aquaculture operations. The idea of a specific aquaculture census should be kept in mind as a long-term option.

The proposed introduction of a more detailed, periodic survey was discussed in the light of the recently initiated FAO National Aquaculture Sector Overviews (NASO) project, in which most of the additional essential data could be incorporated. The need for sustainability of this important but costly exercise for FAO was noted. Also it was considered that another means of data collection (a 5 yearly questionnaire in addition to NASO and the FISHSTAT AQ questionnaire) could create more confusion and that inclusion of more questions to the FISHSTAT AQ questionnaire or FISHSTAT NS AQ questionnaire on a five yearly basis might result in lower response rates.

Suggestions were made that the issue of new data collection efforts to collect the additional essential information should be raised in the third session of the COFI Sub-Committee on Aquaculture scheduled for 2006. The Working Group emphasized that although not all the necessary information could be collected through the FISHSTAT AQ, ways should be found to collect this additional information. This was raised as a priority issue for discussion of a future working group on aquaculture statistics, as proposed by the Expert Consultation.

10.2 Donor support

The arguments of some participants from developing countries that statistics do not have priority when funds were lacking was brought into the discussion. It was stressed that it is also in the interest of developed countries to support the collection of aquaculture statistics in developing countries, as a large part of aquaculture products for consumption originates there and traceability concerns are increasing among consumers. However, official requests for donor assistance on aquaculture statistics issues have been limited and it was stressed that developing countries should more actively search for support on this subject. In this respect it was mentioned that the strategy and outline plan for improving information on status and trends of aquaculture, which was one of the outcomes of the Expert Consultation on Improving Information

on Status and Trends of Aquaculture, would be a useful tool to attract donor support in assistance to the implementation of the proposed changes with regard to the collection, analysis and reporting of aquaculture data.

10.3 Code of Conduct for Responsible Fisheries

Reference was made to the Code of Conduct for Responsible Fisheries on various occasions during the discussions. The topic of promotion of the collection and analysis of aquaculture statistics and trends is very much related to the “Code” and a document, similar to the one entitled “What is the Code of Conduct for Responsible Fisheries?” might be used to emphasize the importance of aquaculture statistics.

10.4 Partnerships and collaboration

The issue of partnerships was discussed in depth under agenda items 6 and 7. It was suggested that FAO intensifies collaboration with regional bodies involved in aquaculture such as NACA (Network of Aquaculture Centres in Asia-Pacific), SEAFDEC (Southeast Asian Fisheries Development Center), APFIC (Asia-Pacific Fishery Commission), APEC (Asia-Pacific Economic Cooperation), GFCM (General Fisheries Commission for the Mediterranean), COPESCAL (Commission for Inland Fisheries of Latin America), CIFA (Committee for Inland Fisheries of Africa), EIFAC (European Inland Fisheries Advisory Commission) and with other UN agencies and programmes that collect data and information on employment and environmental issues such as ILO (International Labour Organization), UNEP (United Nations Environment Programme). The secretariat noted that under the ISIC (International Standard Industrial Classification) revision framework coordinated by the United Nations Statistical Division it is collaborating to have from 2007 onwards aquaculture separated from fisheries as an economic activity, which is currently not the general case. Under this change, the contribution of aquaculture to the GDP could be obtained at national level.

10.5 Data quality issues

Some participants in the Working Group raised issues concerning the quality and the origin of the national aquaculture data. In particular, it was noted that FAO should request more detailed information on methodology of data collection and compilation from countries. As an example, participants were made aware of the information available on the Web site of the IMF (International Monetary Fund) with respect to metadata, <http://dsbb.imf.org/Applications/web/sddshome/#metadata>. The secretariat informed the participants that there are plans in this direction and that FIGIS could be a useful tool for dissemination of these metadata.

11 ADOPTION OF THE REPORT

The draft report was prepared with the assistance of participants, edited by the secretariat and submitted for adoption by the Working Group of Experts. The report was adopted on 28 January 2004.

Annex 1

AGENDA OF THE WORKING GROUP

1. Opening of the working group
2. Appointment of Chairperson and rapporteurs
3. Adoption of agenda
4. Identification of a core set of essential data (for global reporting) to be collected with the questionnaire
 - Content: what should be measured
 - Scope of reporting
 - Level of detail/aggregation
 - Frequency of reporting
5. Discussion of current issues with FISHSTAT AQ
 - Harmonization of terms
 - Structural data
 - Culture environments
 - Hatchery/nursery output
 - Production facilities/systems
 - Instruction sheet
6. Discussion of implications of amendments to FISHSTAT AQ
 - Relevance to national needs and priorities
 - Impact on historic national, regional and international databases
 - Impact on national data collection systems and procedures
 - Recommended actions by FAO to facilitate data collection
7. Discussion of how to acquire essential data for global reporting that cannot be collected with FISHSTAT AQ
 - What are the un-met data needs
 - Approaches
 - Mechanisms
 - Costs
8. Report preparation
9. Adoption of Report

Annex 2

LIST OF PARTICIPANTS OF THE WORKING GROUP

Hossein ABDOLHAY

General Director of Fish Reproduction
and Stock Enhancement
Iranian Fisheries, Aquaculture Department
250 Fatemi St., Teheran
Tel.: (98) 21 694 1366
E-mail: abdolhay@yahoo.com

Nicole BARTLETT

Survey Statistician
Office of Statistics and Economics,
NOAA-Fisheries, 1315 East-West Highway
Silver Spring, MD 20910
USA
Tel.: (301) 713 2328 -216
Fax: (301) 713 4137
E-mail: nicole.bartlett@noaa.gov

David CROSS

Head of Fisheries Sector
Statistical Office of the European Communities
BECH Building, 5, rue Alphonse Weicher
L-2721 Luxembourg
Tel.: (352) 4301-32249
Fax: (352) 4301-37318
E-mail: David.Cross@cec.eu.int

DONG Shuanglin

Vice President, Ocean University of China
5 Yushan Road, Qingdao
People's Republic of China
Tel.: (0532) 2032827 (O) 2032697 (H)
Fax: (0532) 2032799
E-mail: dongsl@ouc.edu.cn

Alejandro FLORES NAVA

Director, Centro de Investigación y de Estudios Avanzados del I.P.N.-Unidad Mérida
Km.6 Carr. Antigua a Progreso
A.P. 73 Cordenex 97310, Mérida, Yucatán
México
Tel.: (999) 981-29-15 ext.214 – (999) 981-29-27
Fax: (999) 981-29-23
E-mail: aflores@mda.cinvestav.mx

Sharon FORD

Director, Programs
Office of Sustainable Aquaculture
200 Kent St. Ottawa, ON
Canada
Tel.: (613) 990 1459
Fax: (613) 998 8262
fords@dfo-mpo.gc.ca

Karol KROTKI

Statistician, Research Triangle Institute
1615 M St, NW, Suite 740
Washington, DC 20036
USA
Tel.: (202) 728 2080
kkrotki@nustats.com

Felipe M. SUPLICY

General Coordinator of Marine Aquaculture
Presidency of the Republic of Brazil
Special Secretariat of Aquaculture and Fisheries
Esplanada dos Ministérios
Bloco "D" -2 andar, 70043-900 Brasilia/DF
Brasil
Tel.: (5561) 218-2901
Fax: (5561) 224-5049
E-mail: fsuplicy@agricultura.gov.br

Dyah RETNOWATI

Chief of Data and Statistics Unit
Directorate of Fisheries Resources
Directorate General of Capture Fisheries
Jl. Harsono RM No. 3
Ragunan, Pasar Minggu, Jakarta Selatan
Indonesia
Tel.: (62) 21 782 7254
Fax: (62) 21 782 7254
dgcfsat@indosat.net.id

Albert G.J. TACON

Aquaculture Research Director
University of Hawaii at Manoha
Hawaii Institute of Marine Biology
P.O.Box 1346, Kaneohe, HI 96744
USA
Tel.: (808) 236-7452
Fax: (808) 236-7443
E-mail: agjtacon@aol.com

H. Stetson TINKHAM

Office of Marine Conservation
OES/OMC. Room 5806, U.S. Department of State
Washington, DC 20520-7818
USA
Tel.: (202) 647-3941
Fax: (202) 736-7350
E-mail: tinkhamsx@state.gov

K. Narayanan UNNI

Deputy Registrar General
Office of the Registrar General India
Ministry of Home Affairs
V.S. Division, West Block-I,
R.K. Puram
New Delhi-110066
India
Tel.: 26100678 (O) – 23073851(R)
E-mail: rgcrs@vsnl.net

Aune VIHERVUORI

Fisheries Statistician
Finish Game and Fisheries Research Institute
P.O. Box 6
FIN-0072 Helsinki
Finland
Tel.: (358) 205 751 245
Fax: (358) 205 751 201

FAO SECRETARIAT**Adele CRISPOLDI**

Senior Fishery Statistician
Fishery Information, Data and Statistics Unit
Fisheries Department
Viale delle Terme di Caracalla
00100 Rome, Italy
Tel.: (39) 06 5705 6454
Fax : (39) 06 5705 2476
E-mail: adele.crispoldi@fao.org

Alan LOWTHER

Fishery Statistician (Aquaculture)
Fishery Information, Data and Statistics Unit
Fisheries Department
Food and Agriculture Organization of the UN
Viale delle Terme di Caracalla
00100 Rome, Italy
Tel.: (39) 0657054029
Fax: (39) 0657052476
E-mail: alan.lowther@fao.org

Rohana SUBASINGHE

Senior Fishery Resources Officer (Aquaculture)
Inland Water Resources and Aquaculture Service
Fisheries Department
Food and Agriculture Organization of the UN
Viale delle Terme di Caracalla
00100 Rome
Italy
Tel.: (39) 06 570 56473
Fax (39) 06 570 53020
E-mail: rohana.subasinghe@fao.org

Shunji SUGIYAMA

Associate Professional Officer
(Fishery Statistics)
FAO, Regional Office for Asia and the Pacific (RAP)
Maliwan Mansion
39 Phra Atit Road
Bangkok 10200
Thailand
Tel.: (66-2) 6974242
Fax: (66-2) 697445
E-mail: shunji.sugiyama@fao.org

Raymon VAN ANROOY

Aquaculture Economist
Fishery Policy and Planning Division
Fisheries Department
Food and Agriculture Organization of the UN
Viale delle Terme di Caracalla
00100 Rome
Italy
Phone: (39) 0657053031
Fax: (39) 0657056500
E-mail: raymon.vanAnrooy@fao.org

Annex 4

PROPOSED REVISED FISHSTAT AQ QUESTIONNAIRE AS DRAFTED BY THE WORKING GROUP OF EXPERTS

FAO/CWP FORM FOR REPORTING	FISHSTAT AQ									
	Method / Location of Culture		Production	Value	Area	Hatchery Production		Farms / hatcheries	Employment numbers	
	Method of Culture	Aquatic Environment				Released to wild	Put in controlled environment			
Species	Ponds=1 Enclosures/pens=2 Cages=3 Raceways/tanks=4 Barrages=5 Molluscs-on bottom=6 Molluscs-off bottom=7 Rice fields=8 Other-Specify	Freshwater=FR Saline (Brackish/Marine)=SA (Indicate countries may separate)	tonnes	1000's Indicate currency. USD	Hectares	million early stages	million young forms	Number of Operational units	full-time equivalents	
<i>Cyprinus carpio</i>	1	FR	11780							
Common Carp										
<i>Oreochromis (=Tilapia)</i>	1	MA	8845							
Tilapia										
<i>Salmo salar</i>										
Atlantic salmon	4	FR		10		1				
Atlantic salmon	3	SA	20.000	35.000	500					

**SUPPORTING DOCUMENTS PREPARED
FOR THE EXPERT CONSULTATION ON
IMPROVING INFORMATION ON STATUS
AND TRENDS OF AQUACULTURE**

Current FAO procedures for monitoring and reporting production and status of aquaculture

SUMMARY

The Fisheries Information, Data and Statistics Unit (FIDI) of the Food and Agricultural Organization of the United Nations (FAO) has been systematically collecting and disseminating statistics on global aquaculture production by weight and value since 1984. The Fisheries Department has also been reporting regularly on status and trends of the aquaculture sector to alert regional fishery organizations, national policy makers and advisors, industry, NGOs and the public to the global aquaculture situation and global issues which can and do have effects at the regional and national levels. Several databases of non-statistical information have also been developed and are drawn upon in global reporting. Efforts are underway to harmonize and integrate internal databases for easier access and more comprehensive presentations. This document briefly describes the content and present process for the compilation and dissemination of statistical and non-statistical information, and the reporting on status and trends of aquaculture.

1 BACKGROUND

FAO is the only source of comprehensive global fishery statistics and most reviews of the state of world fisheries and aquaculture, past trends and future prospects rely on FAO statistics. FAO analyses these statistics in order to monitor many aspects of world fisheries such as fishery production from capture fisheries and aquaculture, fish production and trade of fishery commodities, fish consumption, fishing fleets, and employment in fisheries. On the basis of these analyses, FAO reviews trends and outlines prospects of the contribution of fish to food security. The contribution of fish to national food supply (particularly to protein supply) is monitored for all countries of the world and this necessitates collating information on production, disposition of catches to food and non-food uses, and production and trade of fishery commodities.¹¹

FIDI, the FAO Fishery Information, Data and Statistics Unit, is responsible for the collection of global fishery statistics.

2 PROCUREMENT OF AQUACULTURE STATISTICS

FAO/FIDI collects, collates, evaluates, analyses and disseminates annual statistics on world aquaculture production. The statistical database on aquaculture is a key vehicle for monitoring and strategic analysis of global, regional and national developments in aquaculture, which constitutes one of the three long term objectives of the FAO Fisheries Department – *the promotion of responsible fisheries and aquaculture sector*

¹¹FAO. 1997. FAO fishery statistics programme. Paper prepared for the FAO-SEAFDEC Regional Workshop on Fishery Statistics, 19-21 August 1997. Bangkok, Thailand. FAO/SEAFDEC/97/4. 9p.

management at the global, regional and national levels; promotion of increased contribution of responsible fisheries and aquaculture to world food supplies and food security; and global monitoring and strategic analysis of fisheries and aquaculture.

The aquaculture statistics database system is of a relatively recent origin and is still under development, lagging behind systems for fisheries and agriculture. Systematic collection of aquaculture statistics by FIDI started only in 1984. Before then, one questionnaire was used to collect fish production from capture fisheries and aquaculture combined. A separate questionnaire, FISHSTAT AQ, designed in consultation with regional experts under the remit of the Coordinating Working Party on Fishery Statistics (CWP) was introduced in 1984 to identify the aquaculture component in the total fish production statistics reported at the national level. Nominal catches for marine and inland capture fisheries were then inferred by subtracting the country returns from FISHSTAT AQ from the national summary of total fish production (FISHSTAT NS 1). Questionnaires for collection of separate statistics for capture fisheries and aquaculture were eventually introduced in 1997.

Through this reporting mechanism, countries inform FAO of aquaculture production, in terms of quantity and value, in marine, brackish and freshwater environments, as well as provide information on rearing systems and stocking to the wild. Even though some structural information on culture systems and production from hatcheries is collected at present, FAO has not so far disseminated this information due to problems with quality and completeness. The same species classification, coding scheme and record format used for nominal catches and landings are being used by FAO to store these data in order to ensure full comparability with capture fisheries. The current FAO aquaculture production database shows annual figures from 1950 and is organized by country, three aquatic environments and more than 350 species/items of commercial importance.

The total separation of the FAO aquaculture and capture fisheries databases along with the separate collection of statistics for capture fisheries and aquaculture facilitates access to marine and inland capture fisheries data in the Catches and Landings Yearbook, permits analysis of trends over a longer period of time for both capture fisheries and aquaculture, and improves the quality of nationally reported data.

Aquaculture statistics are usually obtained from national reporting offices, notably: Departments of Fisheries, Ministries of Agriculture and, at times, research institutions. Annually all countries receive:

- FISHSTAT AQ questionnaire, which is designed for reporting data for one year. It is sent to all countries for reporting production by weight and value from aquaculture in marine, brackish and freshwater environments, as well as information on rearing facilities. Where inland (fresh water) aquaculture and marine and brackishwater aquaculture are the responsibility of different agencies, both agencies receive the questionnaire and report independently to FAO. An explanatory sheet is sent with FISHSTAT AQ. This provides a definition of what constitutes aquaculture activities (definition of aquaculture for statistical purposes) and the terms used in the questionnaire. To ensure clarity of the definition, a table, entitled *Classification Proposed for Various Aquaculture and Capture Fisheries Practices* is regularly published in the *FAO Yearbook of Fishery Statistics: Aquaculture Production* together with the explanatory sheet.
- AQUASTAT NS AQ a new questionnaire, equivalent to the NSI form for capture fisheries statistics, was introduced to allow countries to update the time series for total aquaculture production tonnage and value for the previous seven years.

3 QUALITY CONTROL OF STATISTICAL DATA

The quality of aquaculture data varies depending on each country's ability to collect and compile such statistics. FIDI uses all the verification information at its disposal to evaluate data accuracy and completeness, and corresponds with the countries when data are questionable. Often the reliability of national fishery statistics can be assessed by comparison with information from other sources, i.e., industry reports and by checking for internal consistency amongst the national data sets (e.g. production and foreign trade for the same commodity) or consumption statistics. FIDI 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, requires 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 FAO 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 data sets.

The mechanisms for collecting data and the coverage and quality of data on production from aquaculture provided by countries to FAO have been constantly under review with the aim of improving their quality and relevance to future national and global needs.

4 DISSEMINATION OF AQUACULTURE STATISTICAL DATA AND OTHER INFORMATION

4.1 FAO fishery statistics database systems

Aquaculture statistics collated by FAO are stored in a database which is disseminated once a year through an annual publication, *FAO Yearbook of Fishery Statistics: Aquaculture production*. The database is also downloadable from the Internet and is made available upon request in CD-ROM form. At present, the total national production (aquaculture and capture) categorized by country, major fishing area and species items, are disseminated electronically as FISHSTAT PLUS for years from 1950 onwards. Fishery databases, including aquaculture, presently maintained by FIDI are described in Annex 1.

Initially, aquaculture production statistics were combined with those of capture fisheries and published in the *FAO Yearbook. Fishery Statistics. Catches and Landings*, until Volume 80 (1997). Since 1989, they have been also published as *FAO Fisheries Circular No. 815: Aquaculture production statistics*. This circular, reporting production as tonnes, and value (USD), was upgraded to a yearbook in the year 2000 (*FAO yearbook. Fishery Statistics. Aquaculture production*). This has improved dissemination of the statistics and increased its visibility since, as a yearbook, it was distributed to member governments according to country quota, whereas the Circular was not.

4.2 Non-statistical FAO database systems

In addition, the Fisheries Department is taking advantage of technical advances in hardware, software and communications technology to develop, through the Fisheries Global Information System (FIGIS) project, new ways of capturing data from States. The *FAO World Fisheries and Aquaculture Atlas*, the *UN Oceans Atlas* and *OneFish* provide additional new tools for capturing and disseminating information. FAO

maintains other non-statistical data bases of relevance to status and trends reporting; these databases are described briefly in Annex 2.

5 COORDINATION AND INTEGRATION AQUACULTURE STATISTICAL AND NON-STATISTICAL INFORMATION

5.1 Coordination

5.1.1 *The Coordinating Working Party on Fishery Statistics*¹² (CWP)

The CWP comprises representatives of inter-governmental organizations which have a competence in fishery statistics. FAO provides the Secretariat. CWP has as its purpose to (a) keep under continuous review the requirements for fishery statistics for research, policy-making and management, (b) agree on standard concepts, definitions, classifications and methodologies for the collection and collation of fishery statistics, and (c) make proposals for the coordination and streamlining of statistical activities amongst relevant intergovernmental organizations. The CWP considers and debates matters related to aquaculture statistics, but member organizations are mainly concerned with management of natural resources of commercially important fish. Some have no mandate for the collection of aquaculture statistics, or for reporting on aquaculture.

The CWP, supported by the participating organizations, has served since 1960 as the premier international and inter-organization forum for recommending common definitions, classifications and standards for the collection of fishery statistics. It has developed common procedures for statistics collection which have streamlined the collation process and reduced the burden on national fishery statistical offices. It has provided technical advice on fishery statistical matters to participating organizations and has facilitated the preparation of methodological and reference documents. In the process it has shaped the statistical programmes of all participating organizations to some extent, and those of FAO in particular, while leaving organizations complete autonomy in their areas of responsibility. By integrating and coordinating the statistical programmes among organizations, CWP made possible the standardization and streamlining of reporting through procedures and concepts which have served as models throughout the world.

5.1.2 *FAO regional fishery bodies and arrangements*

Some of the FAO fishery regional bodies have subsidiary working parties (WPs) which periodically address issues of fishery statistics on a regional basis and make recommendations for appropriate action to improve the quality and reliability of the data (e.g. APFIC, GFCM, CECAF, CARPAS¹³). Others sometimes deal with fishery statistics in the context working parties on economics. The recommendations of these bodies are discussed in the meetings of the CWP for final advice and guidance. These bodies play an important role in improving national capacities for several reasons, including providing economies of scale, coordination of information requirements,

¹²The participating organizations of the CWP are: Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR); Commission for the Conservation of Southern Bluefin Tuna (CCSBT); Food and Agriculture Organization of the United Nations (FAO), also on behalf of FAO regional fishery bodies; Indian Ocean Tuna Commission; International Commission for the Conservation of Atlantic Tunas (ICCAT); International Council for the Exploration of the Sea (ICES); International Whaling Commission (IWC); North Atlantic Salmon Conservation Organization (NASCO); Northwest Atlantic Fisheries Organization (NAFO); Organisation for Economic Co-operation and Development (OECD); Secretariat of the Pacific Community (SPC); Statistical Office of the European Communities (Eurostat).

¹³Asia-Pacific Fishery Commission (APFIC); General Fisheries Commission for the Mediterranean (GFCM), Fishery Committee for the Eastern Central Atlantic (CECAF), Regional Fisheries Advisory Commission for the Southwest Atlantic (CARPAS).

standards and standardization, and training. Because of limited resources and the relatively recent history of aquaculture statistics, working parties of most of the regional bodies are largely focused on statistics of capture fisheries. The APFIC Joint Working Party on Fishery Statistics and Economics is a notable exception. Due to resource limitations at FAO, many of these regional WPs now meet on an ad hoc basis rather than according to periodic meetings with continuity of expert members.

5.1.3 Collaboration/coordination with other FAO departments and non-FAO regional organizations

- FAO Statistical Division, Economic and Social Department, FAO-Rome
- FAO Asia Pacific Commission on Agricultural Statistics (APCAS)
- Southeast Asian Fisheries Development Center (SEAFDEC)
- Network of Asia Pacific Aquaculture Centres (NACA)
- Research Institute for Fisheries, Aquaculture and Irrigation (HAKI), Szarvas, Hungary

Recognizing the similarity between agriculture and inland aquaculture, in terms of animal husbandry and a common dependence on natural resources, as well as the need to use existing mechanisms for collection of aquaculture statistics to defray costs, matters relating to aquaculture statistics are incorporated in the agenda of FAO/APCAS sessions whenever possible. Collaboration is also established with the FAO Statistical Department, which eventually lead to the development and publication of *Guidelines for the Collection of Structural Aquaculture Statistics*¹⁴ to encourage countries to incorporate aquaculture into the World Census of Agriculture 2000. This was intended to improve national surveys of aquaculture and provide a framework for those countries intending to develop databases on aquaculture. It also served to encourage integration of agriculture and aquaculture statistics where possible and appropriate.

Close liaison has existed for a long time with SEAFDEC, which also collects aquaculture statistics from its Southeast Asian country members (10 countries) and consists of periodic meetings, workshops and consultations on aquaculture, the most recent of which (for aquaculture statistics) was in 1999. In fact the FAO definition of aquaculture was based on a definition elaborated by SEAFDEC. The Fisheries Department also collaborates closely with NACA on a number of initiatives including the development of the AAPQIS-Asia database mentioned above.

Some other organizations, including regional and inter-regional organizations (OECD¹⁵, EU¹⁶, SPC¹⁷, etc.), regional and national producers associations (e.g. FEAP¹⁸), national agencies (USDA¹⁹; Fisheries Department, Thailand; China P.R., etc.) and commercial concerns (e.g. Shrimp News; INFOFISH International, etc.) collect and publish aquaculture statistical and non-statistical information. Such reports are often consulted to check and supplement country statistics submitted to the FAO as necessary, and in global reporting on aquaculture status and trends.

The FAO also collaborates, though not systematically, with other regional organizations and national institutions (e.g. NACA, HAKI²⁰, SEAFDEC) in the preparation of national and regional overviews of aquaculture, and reviews of specific

¹⁴ Rana, K.J. Guidelines for the collection of aquaculture statistics. Supplement to the programme for World Census of Agriculture 2000. FAO Statistical Development series No. 5b. Rome, FAO. 1997. Rome, FAO. 56p

¹⁵ Organization for Economic Cooperation and Development

¹⁶ European Union

¹⁷ South Pacific Commission

¹⁸ Federation of European Aquaculture Producers

¹⁹ United States Department of Agriculture

²⁰ Research Institute for Fisheries, Aquaculture and Irrigation, Szarvas, Hungary

development issues, which contribute to the global information base on aquaculture, and analysis of the state of global aquaculture.

5.2 Integration

It is increasingly accepted that managers must take a wider range of issues into account in decision-making. Thus, information on resource utilization, the environment and socio-economics plays an enormous part in the multifaceted research required for modern management. This greatly increases the need for more reliable, more integrated and more accessible information. The need is underlined further, by the growing interaction of aquaculture with other sectors, particularly fisheries and agriculture, in terms of resources and markets, and the anticipated future application of the ecosystem-based approach to management.

The FAO Fisheries Department is in process of integrating its various data and information bases on fisheries and aquaculture, and improving the way information is collected, authenticated and analysed (see examples below). In addition, efforts are underway to integrate all FAO statistical data bases (agriculture, fisheries and forestry).

5.2.1 *The Fisheries Global Information System (FIGIS)*

The FIGIS project is aimed to provide useful, compiled and analysed information at the global scale, available to all and subject to rigorous authentication. The intention is that it becomes the internationally-accepted standard (at specified, higher levels of detail) on all the world's fisheries and aquaculture. It seeks to provide information to both international agencies and institutions and higher audiences, including the general public. But, in so doing it also provides national governments, in most cases the originators of the data, with access to information on a wider geographic scope. Bilateral and regional issues and concerns will thus benefit from access to data of international origin. FIGIS, therefore, needs to investigate not just what information needs to be generated, analysed and shared, but how to do it in ways that meet the needs of all levels of clients.

5.2.2 *World Fisheries and Aquaculture Atlas CD-ROM*

The first edition of this atlas was launched at the Conference on Responsible Fisheries in the Marine Ecosystem (Reykjavik, Iceland) in October 2001. The Atlas presents a comprehensive and global view of capture fisheries and aquaculture. It touches on all aspects of fisheries – from technology and trade to research and resources – and addresses a broad range of policy issues such as ecosystem management, safety at sea and biotechnology. The CD-ROM will be published at least every two years for distribution at the biennial meeting of the FAO Committee on Fisheries (COFI) as a companion to the FAO publication.

5.2.3 *Integration at the regional level*

Collation of aquaculture information, and other related information, is underway at the regional level for the Mediterranean region through SIPAM²¹. A sister system (SIPAL)²² was designed earlier (1995) for Latin America through a FAO/Italy regional aquaculture project, but is not operational as yet. A start was also made in 1998 to establish a regional system for Asia²³ through a cooperative effort with regional

²¹ Information System for the Promotion of Aquaculture in the Mediterranean

²² Information System to Assist Aquaculture Planning in Latin America and the Caribbean

²³ FAO/NACA. 1998. Workshop on Aquaculture Information Systems. Bangkok, Thailand, 17-20 July 1998.

institutions (NACA, AIT²⁴, SEAFDEC, etc.). The intention was to eventually link these regional information systems as an interregional network with similar architecture and standards to enable exchange of information. Though the FAO can assist in the establishment of such a system, it will be sustainable only if it is need-driven and consequently hosted and supported by countries of the region. This is the case in the Mediterranean, where the regional HQ of SIPAM is hosted and supported by the Government of Tunis.

6 GLOBAL ANALYSIS OF AQUACULTURE STATUS AND TRENDS

The Code of Conduct for Responsible Fisheries provides a framework for the conduct of sustainable capture fisheries and aquaculture against which FAO appraises global fishery and aquaculture status and trends, and reports on these through periodic publications. These reports are intended to describe the general status in all regions of the world, rather than design and implement specific management measures, which is the purpose of regional fishery organizations and national authorities. FAO's reviews are important in alerting regional fishery organizations, national policy makers and advisors, industry, NGOs and the public to the global aquaculture situation and global issues which can and do have effects at the regional and national levels. FAO reports, which cover aquaculture status and trends, exclusively or as part of wider coverage, are listed below.

6.1 Review of the State of World Aquaculture (FAO Fisheries Circular 886)

The state of the world's fish stocks and aquaculture are reviewed by the Fishery Resources Division for COFI. The review formerly included all capture fisheries, but for the Twentieth Session of COFI (1993) it was separated into two parts: the world's marine resources, and inland fisheries and aquaculture, identified respectively as Part I and Part 2 of the *FAO Fisheries Circular* No. 710. Due to the increased importance of aquaculture production, the review was produced in three parts for the Twenty first Session of COFI, March 1995, each part as a separate document under the same title: *Review of the State of World Fishery Resources*. The document dealing with aquaculture was issued in 1995 as *FAO Fisheries Circular* No. 886, entitled *Review of the State of World Fishery Resources: Aquaculture*. In 1997, Revision 1 of Circular 886 was published under a new title: *Review of the State of World Aquaculture*, and prepared in a new format.

The purpose of the Circular 886 is to provide policy makers, aquaculture planners and managers, producers and other stakeholders, as well as the public at large, a comprehensive, objective and global overview of aquaculture, including major development trends issues and outlook. In view of its narrower focus, the Circular provides much more detailed coverage of the aquaculture sector than the FAO State of Fisheries and Aquaculture (SOFIA; see below), where coverage of capture fisheries usually is more extensive than that of aquaculture. The Circular is intended to be issued every five years, with biannual updating through SOFIA and "Fact Sheets" posted on the Fisheries Department home page.

Circular 886 Revision 1 (1997) provides a highly comprehensive view of aquaculture. The review is prepared in three parts:

- *A global perspective of production trends*, including the contribution of the sector to food fish supplies, based on FAO statistical databases; major strategic issues facing aquaculture development and projected production by the year 2000;
- *Review of developments and trends in selected fields*, including environmental interactions, biodiversity and genetics, feed resources, fish health and quarantine,

²⁴Asian Institute of Technology

regulatory frameworks, product safety, international trade, and international aid to research and development; and

- *Review of production and production trends, including main development issues and outlook on a regional basis* (PR China separately), for each of seven regions: Asia, Africa, Europe, former USSR Area, North America, Latin America and the Caribbean, and Oceania.

Each of the articles and regional reviews has its own reference list. No general statistical tables of production are included, although the trends analyses offered in all sections are graphed clearly and appropriately.

Circular 886 Revision 2 covers the basic topics as Revision 1 (global and regional production analysis, outlook and main issues and developments in selected fields) and adds sections on some special themes. Countries previously reported under the Former USSR Area are now incorporated in the European and Asian regions. Statistical tables used for graphic illustrations in the global analysis section are annexed. The Circular is organized in the following sections:

- *Global aquaculture production trends analysis*, based on aquaculture statistics compiled by FAO, including regional profiles;
- *Development outlook section: major issues, opportunities and challenges* at the regional and global level;
- *Inland fisheries – aquaculture interactions*, with summary comparison of FAO inland capture fisheries and aquaculture statistics 1970-1999, and challenges and prospects;
- *The role of aquaculture in rural development*;
- *Recent technological innovations in aquaculture*; and
- *Producer associations and farmer societies*.

Circular 886 is prepared mainly by staff of the Inland Water Resources and Aquaculture Service (FIRI), supported at times by staff of other services of the Fisheries Department and FAO Legal Office, and a few external experts. There are no internal or external advisory committees. Contributions from outside the service and the organization are decided on an *ad hoc* basis, while selection of development issues to be covered is decided by the FIRI project team. The section on production and production trends is based exclusively on the FAO aquaculture statistics database. Other sections draw upon and cite information from other FAO publications, unpublished FAO information, and non-FAO information from conference proceedings, reviews, journals and books.

The Circular is still under development in all respects. Efforts are underway since 1997 to increase transparency and participation in its preparation. The quality of aquaculture statistics is being commented on and information sources are cited. Information from both FAO and non-FAO sources are used and, in some instances, professionals from outside FAO, with specialized expertise in selected subject matter covered in the review, have been invited to participate in preparing certain segments of the document. External participation has increased since Revision 1 and is much more extensive and evident in all sections of Revision 2. Regional reviews of status, trends and outlook were prepared by regional organizations, national centres of excellence, or individual experts in collaboration with FIRI staff. The reviews were discussed and amended by a working group consisting of those involved in preparation of the reviews.

The reliability of the statistical database, collated, checked and disseminated by FAO, which forms the basis of reporting on production and production trends, has been raised on some occasions. The quality of country data submissions is highly

variable and there are problems with some of the data. Issues related to aquaculture statistics submitted to FAO are discussed in detail elsewhere (EC:STA/2004/4).

6.2 The State of World Fisheries and Aquaculture (SOFIA)

The biennial Committee on Fisheries (COFI) receives a comprehensive report on *The State of World Fisheries and Aquaculture* (SOFIA), prepared by staff of the Fisheries Department. The purpose of the publication is to provide policy makers, civil society and those who derive their livelihoods from the sector a comprehensive, objective and global view of capture fisheries and aquaculture, including related policy issues. Four issues have been prepared to date, in 1996, 1998, 2000 and 2002. The 2002 issue includes the *FAO World Fisheries and Aquaculture Atlas*. The document has a standardized content consisting of five parts:

- Part 1. *World Review of Fisheries and Aquaculture*, a global review of the status of resources, production from capture fisheries and aquaculture, utilization and trade;
- Part 2. *Selected Issues Facing Fishers and Aquaculturists*, complemented by reports on national and international activities undertaken to address them;
- Part 3. *Highlights of Special FAO Studies*;
- Part 4. *Outlook*; and
- Part 5. *Fisheries Activities of Country Groupings* (e.g. ASEAN²⁵, EU, etc.).

There are no internal or external advisory committees for SOFIA, and the choice of issues beyond the 'standard' world review section rests with the project team.

6.3 Fishery Country Profiles²⁶

FAO's Fisheries Department prepares and publishes Fishery Country Profiles (FCP). Each FCP summarizes the Department's assessment of activities and trends in fisheries and aquaculture for the country concerned. The profiles have a standard layout. Economic and demographic data are based on UN or World Bank sources; data on fisheries are generally those published by the FAO Fisheries Department. Contents are organized in the following sections:

- General economic data;
- Fisheries data;
- Structure and characteristics of the fishing industry (including aquaculture);
- Development prospects;
- Research;
- Aid; and
- Internet links.

6.4 National Aquaculture Sector Overviews (NASO)

The Inland Water Resources and Aquaculture Service (FIRI), FAO Fisheries Department, has recently (2002) initiated the preparation of national aquaculture sectors overviews according to a standard outline developed by FIRI. The intention is to provide a general overview of aquaculture and culture-based fisheries and to link this information to the FCPs to provide more extensive information on aquaculture.

The NASO is tentatively arranged in the following sections:

- *Characteristics, structure and resources of the sector* – history and general overview, human resources, farming systems – characteristics and distribution, and cultured species;

²⁵Association of Southeast Asian Nations

²⁶<http://www.fao.org/fi/fcp/fcp.asp>

- *Sector performance* – production, marketing and markets, contribution to the economy, impact on poverty, environmental interactions and use of resources.
- *Promotion and management of the sector* – institutional framework; regulations; research, education and training;
- *Trends, issues and development* – main development trends (10 years) in various aspects of development; and
- *References* – bibliographic; internet links; illustrations and photographs.

6.5 Progress Report on the Implementation of the Code of Conduct for Responsible Fisheries (CCRF)

Monitoring and reporting on the implementation of the CCRF is part 6 of the Resolution that adopted it. Article 4 of the Code requires the FAO COFI to monitor its application and implementation. A questionnaire is forwarded to all FAO Members for this purpose. The returns are used to report to COFI and to the UN General Assembly on national measures taken towards implementation. This reporting gives national and international forums an indication of how far their pledge to collaborate in conducting fisheries responsibly is being achieved.

The report is prepared and presented to COFI biannually. States have been surveyed three times to date for this purpose, and a report on the *Implementation of the Code of Conduct for Responsible Fisheries* presented to COFI in 1999, 2001 and 2003. The document summarizes the main activities undertaken by FAO at global and regional levels to promote the implementation of the Code, activities and applications at national level by FAO Members, and initiatives by non-FAO regional fishery bodies.

7 THE STATE OF FOOD AND AGRICULTURE (SOFA)

The State of Food and Agriculture is FAO's annual report on current developments affecting world agriculture. It reviews policy factors underlying recent agricultural performances at the world and regional levels. It also discusses issues of current or emerging interest, and presents each year an in-depth analysis of a selected topic of importance to world food and agriculture. The review includes a brief section entitled "Fisheries: production and trade", which includes aquaculture, in Part I of the document *Current Agricultural Situation – Facts and Figures*. There is also occasional coverage of aquaculture-related issues in Part IV *Selected Issues*, such as *Integrating Fisheries and Aquaculture to Enhance Fish Production and Food Security* (SOFA, 1998 issue).

8 OTHER RELEVANT FAO INITIATIVES

8.1 Conference on Aquaculture in the Third Millennium

The Conference, convened in 2002, in Bangkok, Thailand, was jointly organized by NACA²⁷, FAO and the Thailand Department of Fisheries, with support from a number of other organizations. The intensive preparatory work included organization of expert consultations, national studies and workshops; regional workshops; and an international expert meeting that refined the draft regional reviews and initiated the preparation of the global synthesis on trends in aquaculture development.

The Conference produced three major publications: (a) *Report of the Conference on Aquaculture in the Third Millennium*²⁸, (b) *Technical Proceedings of the Conference on Aquaculture in the Third Millennium*²⁹, and (c) the Bangkok Declaration and

²⁷Network of Aquaculture Centres in Asia-Pacific

²⁸NACA/FAO. 2000. Report of the Conference on Aquaculture in the Third Millennium, 20-25 February 2000, Bangkok, Thailand. NACA, Bangkok and FAO, Rome. 120p.

²⁹NACA/FAO. 2000. Aquaculture in the Third Millennium. Subasinghe, R.P. Bueno, P.B., Hough, C., McGladdery & Arthur, J.E. (Eds.) NACA, Bangkok and FAO, Rome. 471p.

Strategy for Aquaculture Development Beyond 2000³⁰. The three publications provide a useful reference for anyone with an interest or stake in aquaculture development. The Technical Proceedings represent one of the most comprehensive reviews of the current state of aquaculture development in the world assembled to date.

The Bangkok Declaration addresses the role of aquaculture in alleviating rural poverty, improving livelihoods and food security, and maintaining the integrity of natural and biological resources and the environment. The Strategy comprises 17 elements that focus on measures government, the private sector and concerned organizations can incorporate into their aquaculture development programs. It also highlights the need for regional and interregional cooperation to assist in its implementation.

8.2 The first session of the COFI Sub-Committee on Aquaculture (COFI/SCA)

The COFI Sub-Committee on Aquaculture was established in 2001 to provide a forum for consultation and discussion on aquaculture and to advise COFI on technical and policy matters related to aquaculture and on the work to be performed by the Organization in the field of aquaculture. Its terms of reference include provisions to identify and discuss major issues and trends in global aquaculture development and determine those issues and trends of international importance requiring action to increase the sustainable contribution of aquaculture to food security, economic development and poverty alleviation. The decisions of the Sub-Committee, if approved by COFI, define some elements of the FAO intercessional programme of work on aquaculture.

During its first session, in Beijing, China (18 to 22 April 2002), the Sub-Committee reviewed, *inter alia*, aquaculture information, statistics and reporting and designated improvement of the quality of aquaculture statistics and development of a strategy to improve global status and trends reporting on aquaculture as one of four priority areas of work for FAO.

8.3 Committee on Fisheries (COFI)

Beside the Circulars on the state of fishery resources and aquaculture, special reviews on current issues are often prepared as information or working papers for COFI sessions (e.g. *Future Challenges in World Fisheries and Aquaculture*; *Integrated Resource Management for Sustainable Inland Fish Production*; etc.)

8.4 Atlases

The publication of fishery status and trends is being enhanced by further developments within FAO. These include:

- World Fisheries and Aquaculture Atlas CD-ROM: The first edition of this atlas was launched at the Conference on Responsible Fisheries in the Marine Ecosystem (Reykjavik, Iceland) in October 2001. The Atlas presents a comprehensive and global view of capture fisheries and aquaculture. It touches on all aspects of fisheries – from technology and trade to research and resources – and addresses a broad range of policy issues such as ecosystem management, safety at sea and biotechnology. The CD-ROM will be published at least every two years for distribution at the biennial meeting of the FAO COFI as a companion to the FAO publication *The State of World Fisheries and Aquaculture*.

³⁰ NACA/FAO. 20010. Aquaculture Development Beyond 2000: the Bangkok Declaration and Strategy. Conference on Aquaculture in the Third Millennium, 20-25 February 200, Bangkok, Thailand. NACA, Bangkok and FAO, Rome. 27p.

- *The UN Atlas of the Oceans*³¹: This is an Internet portal providing information relevant to the sustainable development of the oceans. It is designed for policy-makers who need to become familiar with ocean issues and for scientists, students and resource managers who need access to databases and approaches to sustainability. Material contained in the UN Atlas is copyrighted but can be freely used for any personal and non-commercial purpose provided that the source is cited.
- *OneFish*: This is an online database and directory of fisheries and aquatic research and development information. Its development has been facilitated by the Support Unit for International Fisheries Research (SIFAR) and supported by major donor agencies and FAO.

Status and trends reporting on aquaculture is also undertaken by other international organizations (e.g. ICLARM, World Resources Institute, World Wide Fund, OECD, GAA³², etc.), FAO regional fishery bodies and other regional organizations (NACA, SEAFDEC, CEC³³, INFOFISH International, etc.) national agencies and the private sector. FAO draws on these reports and on peer-reviewed publications, in the preparation of its global reviews.

9 ACTION BY THE CONSULTATION

The Working Party is invited to take note of current content and procedures for the procurement, processing and distribution of statistical and non-statistical information, and the preparation of global overviews of the state of aquaculture, with a view to suggesting improvements in quality, scope, participation and transparency, for consideration in the drafting of an international strategy to improve global status and trend reporting of aquaculture.

³¹ <http://www.oceansatlas.org/index.jsp>

³² Global Aquaculture Association

³³ Committee of the European Committee

Annex 1

FAO FISHERY DATABASES

The following databases are maintained by the FAO Fisheries Information, Data and Statistics Unit (FIDI):

1 NOMINAL CATCHES AND LANDINGS

This database contains the volume of fish catches landed by country of capture, by species or a higher taxonomic level (ISSCAAP groups), and by FAO major fishing areas. Volume is measured in tons for all items except aquatic mammals, alligators and crocodiles, which are measured by number of animals, and pearls, shells, corals and sponges which are measured in kilograms. Weights are of the whole animal (live weight). Coverage includes harvest by commercial, artisanal and subsistence fisheries, including aquaculture.

2 AQUACULTURE PRODUCTION OF FISH

This database system is still under development. One problem is obtaining a universally acceptable and permanent definition of aquaculture for data collection. An important objective for the aquaculture database is to include the collection of data on aquaculture production units (surface area of growing waters, number of cages, number of pens, etc) and type of culture in addition to the existing statistics on production quantity (in live weight) and price per kilogram by species, country and environment (fresh/brackish/seawater). The same coding scheme and record format used for nominal catches and landings is being used to store these data.

3 FISHERY COMMODITIES

This database contains statistics on the annual production of fishery commodities and imports and exports (including re-exports) of fishery commodities by country and commodity description (including processing method) in terms of volume and value. The data are coded using the FAO International Standard Statistical Classification of Fishery Commodities (ISSCFC) which is derived from the United Nations Standard International Trade Classification (revision 3) and linked to the Harmonized Commodity Description and Coding System (HS) of the World Customs Organization (WCO).

4 FLEET STATISTICS

FIDI collects annual statistics by country on the number and total tonnage of fish catching, processing, and support vessels utilized in commercial, subsistence and artisanal fisheries by size of vessel measured in gross registered tons (GRT) and by type of vessel according to some 50 types of vessel defined in the International Statistical Classification of Fishery Vessels (ISCFV). Data for calendar years 1970 to 1995 constitute the series that have been collected, compiled and edited. Data for the years 1970, 1975, and 1977 to 1991 have been published.

5 EMPLOYMENT STATISTICS

This database contains statistics on the number of commercial and subsistence fishers for the period 1970–1995. It is collected on an annual basis by means of a questionnaire which requests separation of the number of workers according to the time devoted to fishing as an occupation (full-time, part-time, and occasional). Based on the revision of the International Standard Classification of Occupations, information is also collected since 1990 on the number of people engaging in commercial aquaculture and the disaggregating employment data by gender.

6 APPARENT CONSUMPTION OF FISH AND FISHERY PRODUCTS

FIDI is responsible for supplying annual statistics of supply/utilization accounts for eight groups of primary fishery commodities and nine groups of processed products. The per caput supply are derived from food balance sheets which state import, export, production and other uses of fishery products. In FAO's work, these data are required to meet the requests of its statutory bodies to keep the world's food and nutrition situation under constant review, to update FAO's analytical work in the field of food security, and to provide the statistical base for the projections of demand, supply and other assessment studies. The derived consumption statistics are as good as the basic catch, utilization, trade and production data on which they are based; therefore trends in some cases may reflect improved primary data rather, than real changes to food intake.

Annex 2

FAO NON-STATISTICAL FISHERY AND AGRICULTURE DATABASES (RELEVANT TO AQUACULTURE STATUS AND TRENDS REPORTING)

1 AAPQIS³⁴ - INFORMATION SYSTEM ON AQUATIC ANIMAL HEALTH MANAGEMENT IN AQUACULTURE

AAPQIS aims to provide a mechanism for the comprehensive tracking and reporting of diseases and parasites on a regional basis. Since this information is derived from the scientific literature, as well as a team of established experts in different fields of aquatic animal health, it can be adapted for use by national governments for establishing national systems for disease reporting and tracking, as well as for reference information for aquatic animal health diagnosticians and academia. The foundation for the Asia component (AAPQIS-Asia) is now fully functional. AAPQIS-Asia, is a joint venture between FAO and the Network of Aquaculture Centres in Asia-Pacific (NACA). AAPQIS-Asia currently contains limited information from Asia, but it is hoped this will stimulate addition and development of more information, on health management, certification, and quarantine protocols. Disease descriptions and pathogens, together with their regional distribution records, will be added on a regular basis. The Latin American chapter of AAPQIS, AAPQIS-Latin America and the African Chapter, AAPQIS-Africa, are being developed through collaborations with CIAD³⁵ Mazatlan, Mexico and ICLARM³⁶, the World Fish Centre respectively.

2 DIAS³⁷ – DATABASE ON INTRODUCTIONS OF AQUATIC SPECIES

The database includes records of species introduced or transferred from one country to another but not movements of species inside the same country (see the Glossary for more explanations about these terms). Coverage of accidental introductions of organisms (e.g., through ship ballast waters) is not complete and records on this topic have been generally entered only when important impacts on fisheries or on the environment have been caused. The database, which contains now about 3,150 records, can be queried through a Search Form. Users aware of other introductions of aquatic species not already included in the database or that have additional information on the records in the database is requested to fill in the Input Form. Links are provided to related web sites.

3 SIPAM³⁸ – INFORMATION SYSTEM FOR THE PROMOTION OF AQUACULTURE IN THE MEDITERRANEAN

SIPAM was conceived by FAO to improve aquaculture information flow, to assist aquaculture development in the region. It supports and serves as a tool for the aquaculture research and development networks under the umbrella of GFCM. It incorporates aquaculture statistics, roster of experts, bibliographies, country reports

³⁴ <http://www.aapqis.org>

³⁵ Centro de Investigación en Alimentación y Desarrollo., A.C. ; <http://www.ciad.mx/mazatlan/ciadmazi.htm>

³⁶ <http://www.iclarm.org/>

³⁷ <http://www.fao.org/fi/statist/fisoft/dias/index.htm>

³⁸ <http://www.fao.org/fi/statist/fisoft/sipam/default.htm>

on aquaculture, publications of the aquaculture research and development networks and links to FAO databases and other relevant sites. SIPAM operates under the aegis of the Committee on Aquaculture (CAQ) of the General Fisheries Commission for the Mediterranean (GFCM).

4 GEONETWORK³⁹

GeoNetwork is an integral part of the spatial information infrastructure being developed by FAO which aims to improve access to, and integrated use of spatial information to aid decision making for sustainable development. GeoNetwork allows individuals and organizations to work interactively and visually with FAO's vast wealth of map and related information, making the earth's geography a starting point for finding, retrieving and using information. This includes population density, infrastructure, administrative boundaries, land cover/use, soils, crop zones, water, aquaculture, fisheries and forest resources, livestock distribution, nutrition profiles and early warning information. The database also provides links to relevant publications and meetings.

5 GISFISH⁴⁰

This database is under development by the Inland Water Resources and Aquaculture Service, FAO Fisheries Department. It is to comprise a database characterizing all known applications of GIS in aquaculture, in depth case studies, links to current projects, and links to data, technologies and techniques of direct relevance to GIS in aquaculture including innovative application in other fields. This will complement GeoNetwork.

6 ASFA⁴¹ – AQUATIC SCIENCES AND FISHERIES ABSTRACTS

ASFA is an abstracting and indexing service covering the world's literature on the science, technology, management, and conservation of marine, brackish water, and freshwater resources and environments, including their socio economic and legal aspects. The ASFA bibliographic database contains over 820 000 references, with coverage since 1971 (some 800 000 are computer searchable from 1973 onwards). About 3 500 new bibliographic references are added each month to the database. Each bibliographic reference includes: the title of the document in its original language (all non-English titles are also translated into English), an English language and/or non-English language abstract and subject, taxonomic and geographic index entries as relevant.

7 ASFIS SPECIES⁴² – LIST OF SPECIES FOR FISHERY STATISTICS PURPOSES

FIDI collates world capture and aquaculture production statistics at either the species, genus, family or higher taxonomic levels in 1 375 statistical categories (2000 data) referred to as species items. Three types of codes are assigned to each species item: 1) ISSCAAP code; 2) taxonomic code; and 3) 3-alpha code. The ISSCAAP code is assigned according to the FAO "International Standard Statistical Classification for Aquatic Animals and Plants" (ISSCAAP) which divides commercial species into 50 groups on the basis of their taxonomic, ecological and economic characteristics. The taxonomic code is used by FAO for a more detailed classification of the species

³⁹ <http://www.fao.org/geonetwork/srv/en/main.search>

⁴⁰ Kapetsky, J.M. and J. Aguilar-Manjarrez. 2002. GIS for the development and management of coastal aquaculture: Present applications and new opportunities. Paper prepared for Aquaculture Europe 2002, Trieste, Italy, October 16-19, 2002.

⁴¹ <http://www.fao.org/fi/asfa/ASFA.asp>

⁴² <http://www.fao.org/fi/statist/fisoft/asfis/asfis.asp>

items and for sorting them out within each ISSCAAP group. The 3-alpha identifier is a unique code made of three letters that is widely used for the exchange of data with national correspondents and among fishery agencies. The list is a part of the *Aquatic Sciences and Fisheries Information System (ASFIS)* which presently includes 10 381 species items.

8 SPECIESDAB⁴³ – GLOBAL SPECIES DATABASE FOR FISHERY PURPOSES

The information compiled by FAO's Species Identification and Data Programme were computerized in a database that forms a global inventory of commercially important species. SPECIESDAB is the name given to this database and the associated computer software that manipulates the data. SPECIESDAB was created to offer quick and easy access to the fisheries and biological information in the FAO Species Identification Sheets and World Catalogues. SPECIESDAB represents FAO's standard authority on nomenclature and identity of aquatic species used by man. It constitutes a global framework for continuous storage and updating of information and for the exchange of data between FAO and fisheries institutions of Member Countries.

9 AQUASTAT⁴⁴ – FAO INFORMATION SYSTEM ON WATER AND AGRICULTURE

The purpose of the program is to help support continental and regional analyses by providing systematic, up-to-date and reliable information on water for agriculture and rural development, and to serve as a tool for large-scale planning and forecasting. The database includes, country profiles – standardized text by country and summary tables; regional overviews – standardized text by region and summary tables; maps and GIS – spatial data on water resources and irrigation; institutions – online database of national and regional institutions; water resources – by country ; documents – online publications and links to document databases; and links – interesting links on water and agriculture.

10. AFRIS⁴⁵ – ANIMAL FEED RESOURCES INFORMATION SYSTEM

Provides descriptions and chemical data on plants and other feed materials with 650 references and abstracts

11 TERRASTAT⁴⁶ – LAND RESOURCE POTENTIAL AND CONSTRAINTS STATISTICS AT COUNTRY AND REGIONAL LEVEL

Contains country statistics of soil, terrain, climatic and agricultural land use limitations, and potential extent.

12 FAOLEX⁴⁷

FAOLEX is a comprehensive and up-to-date computerized legislative database, the world's largest electronic collection of national laws and regulations, as well as treaties, on food, agriculture and renewable natural resources. It is a tool of great value to governments, practitioners, non-governmental organizations and scholars. Selected texts of major significance pertaining to FAO's mandate, including legislation on agriculture, animals, environment, fisheries, food, forestry, land, plants, water and wildlife, are summarized and indexed in English, French or Spanish. Direct access to the summary, index and full text of each piece of legislation is provided.

⁴³ <http://www.fao.org/fi/statist/fisoft/SPECIES.asp>

⁴⁴ <http://www.fao.org/ag/agl/aglw/aquastat/main/index.stm>

⁴⁵ <http://www.fao.org/ag/AGA/AGAP/FRG/AFRIS/default.htm>

⁴⁶ <http://www.fao.org/ag/agl/agll/terrastat/>

⁴⁷ <http://www.fao.org/Legal/default.htm>

General issues in relation to status and trends reporting on aquaculture

Summary

Considerable progress has been by FAO in the establishment of a global database on aquaculture statistics, but the process is still in the early stages of development and much more needs to be done to improve knowledge of the sector, particularly in view of increasing demands for information at the national, regional and international level by a variety of data users. The document highlights and discusses a number of interlinked institutional and technical constraints, with national, regional and international dimensions. Suggestions are presented for moving forward, including development of an international strategy to improve knowledge and enable sustainable management of aquaculture with the help of the donor community.

1 INTRODUCTION

Statistical information is the main foundation of status and trends reporting and for the derivation of various sector indicators. Despite the increasing need and appreciation for statistical data, the growing Internet-based national, regional and international systems which enhance accessibility and dissemination of aquaculture data and information, many countries still do not have an adequate system of statistics for aquaculture. Therefore international standards and practices for data collection methods and programmes, and for data management have yet to be fully developed and tested.

The need to improve aquaculture statistics and the information base on aquaculture in general, is not surprising. Though aquaculture has been practised for centuries, aquaculture management is a fairly new concern. Aquaculture was recognized only recently (March 2001) as an independent economic activity by the United Nations Statistical Commission (and defined as such in the International Standard Industrial Classification of All Economic Activities). Accordingly, the collection of statistical data and other information on aquaculture separately from fisheries data is a recent endeavour in many parts of the world and much remains to be done.

Equally, global collection of aquaculture statistics by FAO is a relatively recent activity and is still under development, lagging behind systems for fisheries and agriculture. FAO has been reporting and promoting the reporting of aquaculture production statistics, separately identified within the total fishery production, for about 20 years only (i.e. since 1984).

Nevertheless, the growing importance and rapid growth of aquaculture requires closer attention to some aspects of data collection and their accurate reporting and analysis. It is important that effective statistical collection systems are established by all the major producing countries. Regional and international cooperation is required to improve data collection to adequate statistical standards, promote harmonized reporting for the sector and ensure the availability of reliable statistics as demanded by an increasing audience of data users.

2 INSTITUTIONAL ISSUES

There are difficulties involved with the collection of global aquaculture data. These can occur at the international level where FAO compiles the worldwide statistics; at the national level where the countries compile and submit their aquaculture statistics; and in the field within the country where proper data collection procedures need to be available and be followed. Additionally, problems can occur if there is a lack of, or poor, communication between any of these steps.

2.1 Quality of national statistics

The problems associated with the international datasets are deeply rooted in national data constraints. In fulfilling its role as the compiler of the aquaculture data received from national reports, the most serious problems encountered by FAO have traditionally included for some countries a complete lack of reporting, a lack of timely reporting, a lack of complete reporting or a lack of accurate reporting. FAO works to encourage timely, accurate, and complete reporting from all countries, but primarily depends on the countries to respond properly to the questionnaires and data requests. When requested, the Organization provides assistance to Member countries for improving the collection, processing and dissemination of data and information through its Technical Cooperation Programme (TCP).

National statistical systems and capabilities differ widely among countries. Proper reporting and trends monitoring at the national level depend on a number of institutional and technical factors, e.g. the relative economic importance of the sector, how it is administered, the level of commitment and support for the collection of data and information, and the accuracy, completeness and timeliness of collected data.

The most frequently indicated constraints to proper data collection at the national level include varying combinations of the following factors:

- poor understanding of the purpose of data collection and lack of coordination and linkage between information “users” and information “providers”;
- lack of high level commitment and inadequate support for involved government institutions at all levels to collect statistical information from, and to monitor the aquaculture industry;
- lack of human capacity or facilities for the processing, storage and analysis of data;
- poor or inconsistent quality of data and collection methods;
- lack of proper licensing system for aquaculture establishments which prevents controlled growth of the industry and impedes collection of information from the establishments;
- lack of quantitative assessment of small-scale rural (subsistence) and semi-commercial aquaculture⁴⁸; and
- dispersal of data in various institutions, in both the public and private sectors, and absence of systematic efforts by institutional aquaculture authorities to collect the dispersed information on a regular basis.

Many of the above issues, and others, have been recognized and discussed at length in earlier meetings, and means to address them suggested. The recommendations of three such meetings, during the period 1997–2000, are provided in Annex 1.

It has been suggested by SEAFDEC that the lack of follow up on recommendations and high level commitment and support (in SEAFDEC member countries) “... generally reflects the inability of fishery (and aquaculture⁴⁹) statistics to have a demonstrable record in the provision of useful and reliable information for the decision-

⁴⁸ Semi-commercial aquaculture: refers to small enterprises where produce is mainly consumed by the producer and excess is marketed.

⁴⁹ Author’s addition

*making process. The resources required for the collection of these data have decreased accordingly, and the quality, availability, reliability, accuracy and timeliness of data compiled at the national level are not satisfactory.*⁵⁰

It is clear that countries need to collect aquaculture statistics for their own national interest, for policy-making, planning and management. The provision of statistics to FAO (and regional fishery bodies) is only of secondary importance. The usefulness of the national statistics depends on their accuracy and completeness. In view of the current status of aquaculture statistics, it is of the greatest importance that national aquaculture statistical systems are reviewed and improved.

FAO has conducted national and regional seminars to identify methodological shortcomings and how they may be rectified, and prepared detailed guidelines for the collection of aquaculture statistics (the Census guidelines). But, given the short history of aquaculture statistics, there is a need for a long term, sustainable and proactive effort to assess and improve national aquaculture statistical systems. To succeed, even such a concerted effort will require conviction and commitment on the part of interested Member countries, particularly the major aquaculture producers, regarding the need for and usefulness of statistical and other information for policy, planning and management, and assessment. Support from bilateral aid agencies will be essential.

2.2 Coordination of aquaculture statistics and status and trends reporting

2.2.1 Regional and global working parties on aquaculture

Unlike the international nature of some marine capture fisheries, aquaculture is largely a national concern. International commissions similar to those for capture fisheries do not exist for aquaculture; nor does an international mechanism similar to the Coordinating Working Party on Fishery Statistics (CWP). The CWP has considered and debated matters related to aquaculture statistics, but member organizations are mainly concerned with management of commercially important fish resources. Some have no mandate for the collection of aquaculture statistics, or for reporting on aquaculture.

Consequently, while many refinements such as zonation, sampling standards and surveys and definitions were introduced and evolved through statistical working parties of the International Fishery Commissions for marine capture fisheries, the international harmonization of terminology and standardization of data collection procedures for aquaculture have been relatively neglected⁵¹; e.g. the first expert consultation on variables and terminology in aquaculture was convened in 1999.

Aquaculture statistics have not figured prominently in the work of CIFA⁵² (Africa), COPESCAL⁵³ (Latin America), or the GFCM⁵⁴ (Mediterranean), though working parties of experts in aquaculture, or economics and statistics, have occasionally addressed problems of aquaculture statistics. However, statistical data and other information on aquaculture are now collected and maintained by SIPAM⁵⁵, which operates under the GFCM. Aquaculture statistics have received the most attention in Asia, mainly through joint meetings/workshops of FAO/APFIC⁵⁶ Joint Working

⁵⁰ SEAFDEC. 2001. Report of the SEAFDEC Conference on Sustainable Fisheries for Food Security in the New Millennium. Bangkok, Thailand, 19-24 November 2001.

⁵¹ Rana, K.J., R. Grainger, A. Crispoldi-Hotta. 1999. Present procedures and constraints for monitoring production and development of aquaculture and inland capture fisheries. SEAFDEC/FAO Ad Hoc Expert Consultation on Variables and Terminology for Aquaculture Monitoring in Asia. 13-16 September 1999, Bangkok, Thailand.

⁵² Committee on Inland Fisheries of Africa

⁵³ Commission for Inland Fisheries of Latin America

⁵⁴ General Fisheries Commission for the Mediterranean

⁵⁵ Information System for the Promotion of Aquaculture in the Mediterranean.

⁵⁶ Asia-Pacific Fishery Commission

Party on Fishery Statistics and Economics (JWP) and SEAFDEC, and occasionally, through the APFIC Working Party on Inland Fisheries and Aquaculture.

Regional projects on fishery statistics also have been focused almost exclusively on capture fisheries, as has the development of statistical software by FIDI. Almost all fishery statistical assistance and training provided by FAO and bilateral agencies has been related to the collection and processing of catch and effort data from artisanal and industrial fisheries.

Recognizing the need for an international mechanism to advise and coordinate work on aquaculture statistics, the 1999 SEAFDEC/FAO Ad Hoc Consultation on Variables and Terminology for Aquaculture Monitoring in Asia called for the establishment of a working group to assist (Asian) countries develop their capacity for the collection and processing of aquaculture data, and to help standardize and harmonize methodologies, terms and definitions.

2.2.2 Integration mechanisms

There is need for integration of information from various sources, at all levels, to ensure the availability of inter-disciplinary information needed for policy-making and monitoring of the impact of policies and programmes in the light of new management perspectives. This will require integration of data collection across sectors at the national, regional and international level through appropriate institutional arrangements.

Cooperation between FIDI and regional bodies concerned with agriculture and fisheries statistics has been described elsewhere (EC:STA/2004/3), together with efforts to integrate all FAO fisheries and aquaculture information and databases through the FIGIS programme. In addition to FIGIS, efforts are underway to harmonize and integrate all FAO statistical databases (agriculture, fisheries and forestry).

Collation of information on aquaculture and of concern to aquaculture, is underway at the regional level for the Mediterranean region through SIPAM. A sister system (SIPAL)⁵⁷ was designed earlier (1995) for Latin America through a FAO/Italy regional aquaculture project (AQUILLA II, GCP/RLA/102/ITA), but is not yet operational. A start was also made in 1998 to establish a regional system for the Gulf area, through the Commission for the development and Management of the Fishery Resources of the Gulf⁵⁸, and for Asia⁵⁹ (1998) through a cooperative effort with existing regional institutions (NACA, AIT⁶⁰, SEAFDEC, etc.). It was intended to eventually link these regional information systems as an interregional network with similar architecture and standards to enable exchange of information. Though the FAO can assist in the establishment of such a system, it will be sustainable only if it is need-driven and consequently hosted and supported by countries of the region. This is the case in the Mediterranean, where the regional HQ of SIPAM is hosted and supported by the Government of Tunis.

2.2.3 Participation and transparency

Participation in the establishment of standardized terms and definitions, improving national aquaculture statistics and in the preparation of FAO status and trends reports in aquaculture (i.e. *Review of the State of World Aquaculture*) have been described elsewhere (EC:STA/2004/3). Collaboration in the establishment of regional aquaculture information systems was also described in the preceding section.

⁵⁷Information System to Assist Aquaculture Planning in Latin America and the Caribbean

⁵⁸Second Meeting of the Ad Hoc Working Group on Aquaculture, IOFC Committee for the Development and Management of the Fishery Resources of the Gulfs, Kuwait Institute for Scientific Research, Kuwait, 18-20 May 1998 .

⁵⁹FAO/NACA. 1998. Workshop on Aquaculture Information Systems. Bangkok, Thailand, 17-20 July 1998.

⁶⁰Asia Institute of Technology

Though the improvement of statistics and information systems for aquaculture has been pursued regularly in collaboration with FAO and Non-FAO regional bodies/organizations, and with concerned national authorities, participation in the FAO reporting of status and trends in aquaculture has followed an *ad hoc* procedure. However, separate, in-depth reporting of aquaculture status and trends by FAO started only recently (1994) with three reports issued since then. External participation in, and review of the current report (*FAO Fisheries Circular 886, Revision 2*) have been quite extensive and progress to date on this issue has been rapid and substantial.

Nevertheless, though participation has increased, the process has varied for each of the status and trends reports published since 1994. Stabilization of the process, to the extent possible, would be both timely and appropriate. The role of national institutions and regional bodies, individual scientists, NGOs, and industry in the collection, analysis and reporting of information on status and trends should be defined. A procedure for their regular participation in a transparent, consensus-seeking effort should also be considered.

Consideration should also be given to earlier regional recommendations for the establishment of a working group on aquaculture statistics (Asia), as well as an inter-regional working party to assist in the assessment and improvement of national aquaculture statistics and the standardization of aquaculture terms, classifications and definitions; i.e. similar to the CWP on Fishery Statistics, but focused on aquaculture. In the interest of consistency within the Fisheries Department, special attention should be given to the ACFR recommendation⁶¹ to establish a global review process to provide independent and objective support for status and trends reporting for capture fisheries (SOFIA⁶²) to secure wider acceptance of its transparency and objectivity. This might be developed and conducted through the appointment of a global panel on the basis of expertise, not on affiliation (see Section on Quality Control and Assurance).

2.2.4 Continuity of content and organization

Although there is considerable similarity in the content and organization of the two issues of the *Circular 886 (Review of the State of World Aquaculture)*, there are also considerable differences. It would be both appropriate and timely to standardize both content and organization to establish continuity and allow comparability of information among reports.

3 TECHNICAL ISSUES: THE FAO AQUACULTURE STATISTICS DATABASE

The FAO global statistical database on aquaculture, FISHSTAT AQ, is still in the development stage. The database currently provides production (quantity and value) information by species, in three environments: inland, brackishwater and marine. FIDI is facing a number of technical constraints in the collection of aquaculture statistics due to lack of attention by some countries to timely and accurate reporting. The need to resolve these constraints is made more urgent by the increasing demand for additional information to satisfy new management perspectives, e.g. concerns about resources and the environment and how they are used, and the impact of policies and development plans, as well as changes in aquaculture production processes. Some of the more immediate constraints of the FAO aquaculture database are briefly considered below.

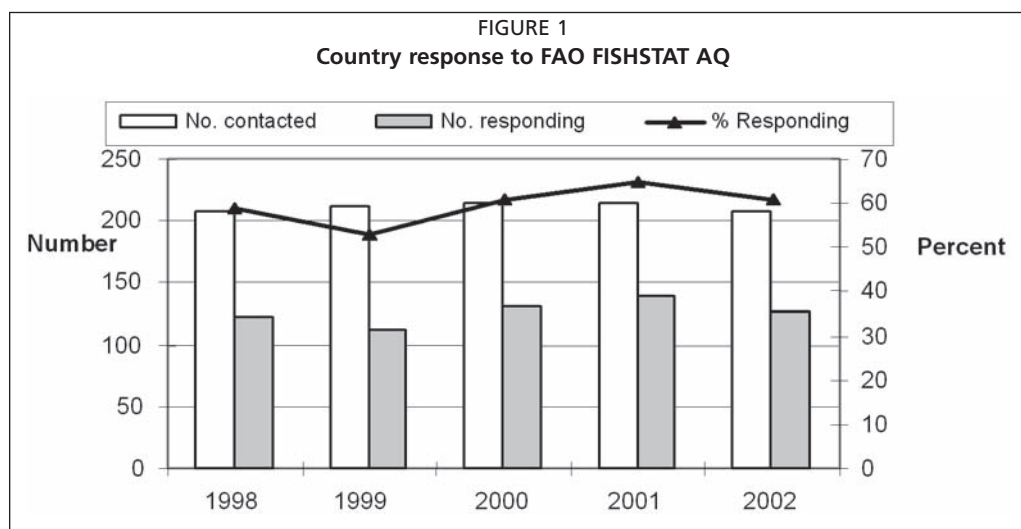
3.1 Country response

The global FAO data set suffers from the little attention paid by some countries to timely and accurate reporting. During the early 1990s, approximately 60 percent of the countries approached did not report their aquaculture production to FAO. There

⁶¹ACFR. 1999. Report of the Working Party on Status and Trends in Fisheries. (ACFR/99/2). Rome, Italy, 6-9 December 1999.

⁶²State of Fisheries and Aquaculture

has been a gradual improvement in the number of requests returned since then, with returns stabilizing at about 60 percent (Figure 1). In 2002, 61 percent of the countries responded.



3.2 Timeliness

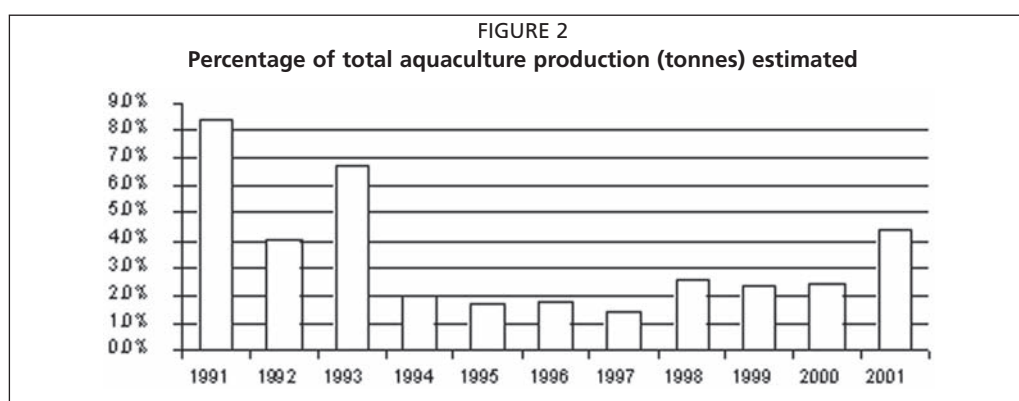
Timely preparation of FAO aquaculture statistics is constrained by late submission of data by States. For example, in 2002, only 23 percent of the countries submitted their data for 2001 by the deadline of 31/08/2002 and about 27 percent submitted data in January - February of the following year (2003). The rest (50 percent) submitted between 1/9/2002 and 31/12/2002. In 1998 the corresponding figures were 25, 22 and 70 percent respectively.

There is an urgent need to speed up the process of collecting, compiling, analyzing and disseminating national and international aquaculture statistics. Prolonged delays in the collection and publication of aquaculture statistics is a major source of frustration for data users. Limited resources for processing and lack of appropriate electronic tools and equipment slows down central collation, analysis and reporting of national statistics with additional delays in submission of statistics to FAO, because of the need to re-aggregate data. The current FAO Yearbook of Fishery Statistics for aquaculture, Volume 90/2, published in 2002, contains statistics only up to 2000. The same is true of regional statistics published by SEAFDEC for its member countries (Asia). The long time gap reduces the benefits of statistics in the decision-making process, as recent changes in production trends, and similar information that tends to become dated quickly, are not reflected in the published data. Such information may be especially misleading, for example when production approaches limits of sustainability and levels off, but less recent data indicates continuing growth.

Processing of aquaculture statistics has long since been computerized at FAO. 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 efficiency. In order to fully utilize the potentials of computerization, the current wide diversity of computer hardware and software used by national agencies has to be reviewed or standardized. Alternatively, FAO could develop standard software for the compilation, processing and analysis of aquaculture statistics, as it has done for artisanal fisheries, as has been recommended by the APFIC JWP (see Annex 1). At present, the FAO FISHSTAT AQ questionnaire is being prepared in electronic form which can be downloaded from the FAO home page. In addition ARTFISH, the FAO statistical software for planning, collection and processing of artisanal fisheries statistics, is being adapted for aquacultural purposes.

3.3 FAO estimated data

As mentioned elsewhere, 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 estimates are identified in the statistics database with the letter "F". A review of production (quantity) estimated made by FAO, expressed as percent of total aquaculture production quantity (fish, molluscs, crustaceans, plants and miscellaneous), shows a decline in the production value of estimates, from 8.4 percent of total production in 1991 to 2.4 percent in 2000, with an increase to 4.4 percent in 2001 (Figure 2). Prior to 1990, the quantity of global aquaculture production, based on estimates, was between 8 percent and 15 percent of the total production⁶³.



3.4 Structural statistics

An immediate objective for improvement of FAO aquaculture statistics is to make accessible, as a database, information on structural statistics; i.e. production methods by main categories of cultured organisms, area of production and number of production units in three environments. The information is critical for the design of frame surveys and for deriving some resource use indicators.

Information on structural statistics (Sheet 1 of FISHSTAT AQ questionnaire) submitted to FAO by Member countries has not been reported due to the scarcity of reporting and the dubious quality of the historical data. A recent review⁶⁴ of country submissions for 1999 showed that only 20 of 176 Member countries completed FISHSTAT AQ Sheet 1. Of these, 15 were from the top 30 producing countries; one was from the top 10 African producers; and 4 were from the top 10 Latin America producers. Only 13 of the 20 countries with complete structural statistics also completed Sheets 2-3 (production and value by species and environment).

As a result of FIDI initiative, the FAO Programme for the World Census of Agriculture 2000 has recommended the inclusion of aquaculture in the census. The Census is a statistical exercise to collect quantitative information on the structure of the food producing sector in Member countries. FIDI has prepared a guideline document⁶⁵ as a supplement to the Programme to assist countries improve their current surveys of aquaculture, and to provide a framework for those countries intending to

⁶³ FIDI. 1994. The quality of catch and aquaculture statistics submitted to FAO. In: SEAFDEC. 1994. Status of Fishery Information and Statistics in Asia. Volume II. Proceedings of the Regional Workshop on Fishery Information and Statistics. Bangkok, Thailand, 18-22 January 1994.

⁶⁴ FAO. 2000. Review of FAO selected aquaculture statistical data and related bibliographic background and reference material. (unpublished FIDI document)

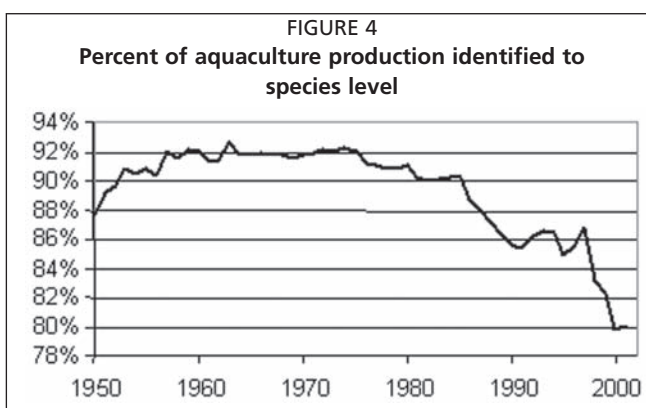
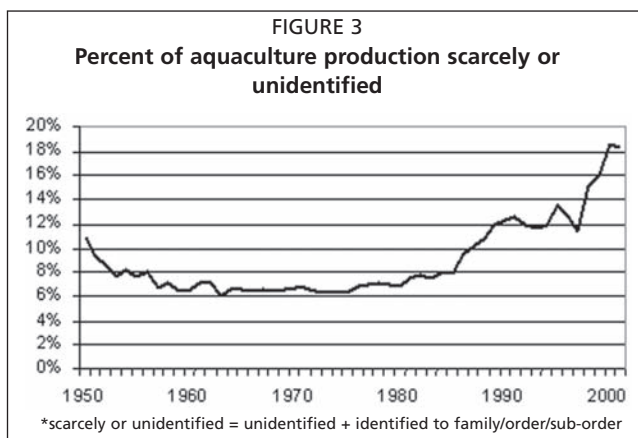
⁶⁵ Rana, K.J. 1997. Guidelines on the collection of structural aquaculture statistics. Supplement to the programme for the World census of Agriculture 2000. *FAO Statistical development Series* No. 5b. Rome, FAO. 1997. 56p.

develop databases on aquaculture information. The Supplement provides definitions, concepts, standards and guidelines for collecting internationally comparable structural aquaculture statistics.

3.5 Unidentified aquatic organisms

Often in reporting, large amounts of farmed fish are not identified to the species level and are either generically reported at higher taxonomic level (family, order, sub-order) or as an all-embracing miscellaneous category (e.g. “miscellaneous freshwater fishes”; “freshwater fishes nei”⁶⁶). This is a major problem in the FAO aquaculture statistics database.

The percent of farmed aquatic organisms which are scarcely identified varied between six and seven percent of total aquaculture production (including plants) during the period 1958-1981 but has been increasing since then, reaching 18 percent in 2001 (Figure 3). This represents 7 million metric tonnes of farmed plants and animals. At the same time, the percentage of total aquaculture production identified to species level has decreased from about 92 percent in the late 1970s to 80 percent in 2001 (Figure 4). The problem is evident in both marine and inland aquaculture. Countries have been repeatedly encouraged to address this problem and to provide field enumerators with identification guides for the farmed species in question.



3.6 Harmonization of terminology and definitions

The COFI Sub-Committee on Aquaculture, in its first session in April 2002, identified improvement of the quality of aquaculture statistics, including establishment of unified standards and guidelines, and clearer definitions for data collection as a priority area of work for FAO⁶⁷.

3.6.1 Intersectoral harmonization

The more holistic monitoring of aquaculture which is required to manage the sector in a broader ecological perspective, and the increasing interaction of aquaculture with other sectors, particularly agriculture and fisheries, will require greater harmonization of data and information to permit inter-sectoral integration of information and comparison

⁶⁶ nei = not elsewhere identified

⁶⁷ COFI Sub-Committee on Aquaculture. 2002. Report of the first session of the Sub-Committee on Aquaculture. Beijing, People's Republic of China, 18-22 April 2002. *FOA Fisheries Report No. 674*. 30 p.

among sectors for decision-making. Although much standardization has taken place through international and regional cooperation, and is still continuing, there are many unique aspects to each country's system, based on local needs and capabilities.

3.6.2 The FAO definition of aquaculture

The FAO definition of aquaculture defines the conditions under which an activity can be classified as aquaculture, for statistical purposes. The current definition (Annex 2) is widely used and accepted by international fishery bodies; e.g. Eurostat, ICES, SEAFDEC, etc⁶⁸. Many of the problems encountered in the application of the definition in the past (e.g. differentiation between aquaculture and "fisheries enhancement", "culture-based fisheries", holding and fattening of wild juveniles, fish aggregation devices, various interpretations of the "ownership" concept, etc.) have been largely resolved in consultation with the CWP, by (a) use of separate questionnaires, one for aquaculture and another for capture fisheries and separate collection of statistics for the two sectors, to obviate the need to subtract aquaculture from total production to obtain production from capture fisheries (and related problems), and (b) the preparation and dissemination of a proposed classification of various aquaculture and capture fisheries practices in table form to add clarity to the definition.

The wording of the current FAO definition presents problems in the distinction between capture fisheries and aquaculture due to the increasing levels of intervention in the management of aquatic resources, particularly in inland fisheries (e.g. stocking, fertilization, predator removal, environmental engineering, etc.). These interventions have created a continuum of activities from production without intervention (fishing from wild stocks) to production from organisms grown in a fully controlled environment (thus including ownership). Consequently, the definition for aquaculture for statistical purposes must draw a pragmatic, though informed, line to separate activities of capture fisheries from those of aquaculture. A revised *working definition* of aquaculture with a suggested classification table was prepared for use in the World Census of Agriculture 2000 (Annex 2) and published in 1997 in the aquaculture guidelines prepared for the Census. The guidelines were approved by ad hoc consultations and by the Asia and Pacific Commission on Agriculture Statistics (APCAS). However, the guidelines, including the revised definition, have not yet been tested for census taking and may require revisions before formal adoption.

3.6.3 Other terminology and classifications

Hatchery output. Information submitted to FAO on hatchery output for stocking aquaculture facilities and to the wild has not been published by the FAO due to problems with the data stemming from improper interpretation of terms used in the questionnaire (e.g. larvae, fingerlings, juveniles, etc.) and differences among countries in designation of life stages. The Census guidelines for aquaculture address this problem, but the FISHSTAT AQ instruction sheet still lacks adequate guidelines. The guidelines also suggest increasing the scope of information on seed production to include use of wild seed in aquaculture (e.g. for culture of groupers, tuna, milkfish, carps, catfish, etc.), for monitoring of natural resource use and environmental impact.

Compartmentalization of aquatic environments. The use of "inland", "brackishwater" and "marine" designations for aquaculture has created problems of interpretation due to variations in how countries define brackishwater, and lack of adequate guidelines in the FAO instruction sheet. Again, the Census guidelines propose a way of dealing with this matter but clarifications are still lacking in the FAO instruction sheet. Asian countries and the CWP have recommended merging of the coastal and marine

⁶⁸Eurosta : Statistical Office of the European Union; ICES: International Council for the Exploration of the Sea; SEAFDEC: Southeast Asian Fisheries Development Center

environments as “marine” or “coastal” while maintaining the “inland” designation^{69,70,71}. The Census guidelines for aquaculture suggest use of freshwater, brackishwater and marine.

Aquaculture systems. Though the FISHSTAT AQ Sheet 1 provides a column for “Method of Culture”, this refers only to the physical facilities of aquaculture. Typologies/classifications for the main aquaculture systems are yet to be developed even on a regional basis.

Glossary. The development of a glossary of agreed definitions of terms used in aquaculture is fundamental to the development of nationally and internationally harmonized systems for monitoring and reporting on the aquaculture sector. The glossary would facilitate international comparison of trends, outputs, resource use, etc. and should fundamentally include those variables and terms that are required for developing and managing aquaculture and for preserving the aquatic environment. A proposal was made by FIDI to this end in the context of an ad hoc expert consultation in Asia in 1999⁷² which approved the idea and requested countries to submit to FAO national glossaries of terms used in aquaculture and aquaculture monitoring to assist in the process. Resource limitations at FAO have not allowed progress on this matter.

3.6.4 Guidelines and instructions

Some of the above concerns indicate a need for more substantial guidelines for the completion of the FAO questionnaire and for proper interpretation of its terms. It may be useful to include in the guidelines the following statements that:

- FAO recognizes that opinions differ, from country to country, of what activities constitute capture fisheries and aquaculture and that completion of the FAO questionnaire may require the re-aggregation of national data according to the FAO definition. However, this is deemed necessary for standardization purposes and to enable accurate trend analysis.
- The FAO definition of aquaculture has no legal connotations at the national, regional or international level.

Suggestions for amplifying the guidelines and definitions in the instruction sheet of the FAO questionnaire have been proposed and approved in the context of an expert consultation⁷³ and need to be revisited and formalized.

4 EXPANDING THE SCOPE OF INFORMATION AND REPORTING

Changing management perspectives and the globalization of concerns about resources and the environment are changing requirements for information. The type of information required for management varies with the stage of development of the aquaculture sector and its importance in the national economy, as well as management

⁶⁹ SEAFDEC-FAO. 1999, Draft Report of the SEAFDEC-FAO Ad Hoc Expert Consultation on Variables and Terminology for Aquaculture Monitoring in Asia, 13-16 September 1999, Bangkok, Thailand. 32p. (un-published)

⁷⁰ SEAFDEC. 1994. Report of the Workshop on the Status of Fishery Information and Statistics in Asia. Bangkok, Thailand, 18-22 January 1994. 54 p.

⁷¹ FAO. 1992. Report of the fifteenth session of the Coordinating Working Party on Atlantic Fishery Statistics. Dartmouth, Nova Scotia, Canada, 8-14 July 1992. *FAO Fisheries Report* No. 473. Rome, FAO. 1992. 34 p.

⁷² Immink, A.J. and K. J. Rana. 1999. Harmonization of terms and variables and their definitions: A practical review. (SEAFDEC-FAO/AQ99/WP10). SEAFDEC/FAO Ad Hoc Consultation on Variables and Terminology for Aquaculture Monitoring in Asia. Bangkok, Thailand, 13-16 September 1999.

⁷³ FIDI. 1999. Proposed changes to the aquaculture questionnaire FISHSTAT AQ and possible changes in the scope for monitoring aquaculture production and development. (SEAFDEC-FAO/AQ99/1P08). SEAFDEC/FAO Ad Hoc Expert Consultation on variables and Terminology for Aquaculture Monitoring in Asia. 13-16 September 1999, Bangkok, Thailand.

objectives. How much information and routine, long-term data are essential and how reliable the data should be has to be determined on a case by case basis.

Any increase in the scope of collected statistics, to be practical, must be considered in the context of national needs and priorities, data collection costs and national capacity, and the trade-off between the scope of coverage and data accuracy. The costs of gathering additional data may well mean that in reality a compromise between accepting risk (based on lack of, or inadequate knowledge) and financing the collection of additional data will be made in many cases⁷⁴.

A more holistic approach to aquaculture analysis and management requires more quantifiable information covering issues such as:

- Socio-economic performance,
- Resource utilization and efficiency,
- Distribution and consumption of products;
- Contribution of subsistence and semi-commercial aquaculture to food security; and
- Environmental performance.

Optimally, the collected information also should enable the calculation of performance and sustainability indicators, as needed.

4.1 Minimum requirements

The FAO/COFI Sub-Committee on Aquaculture (COFI/SCA), during its first session in April 2002, suggested that as a minimum, the following information should be collected and reported to FAO⁷⁵:

Structure⁷⁶

- Number and types of installation, and their location, size and capacity.

Production volume

- Estimates of total production of fish, by species of major commercial importance, by aquatic environment and types of site, in terms of weight.

Socio-economics

- Estimates of total farm-gate value of aquaculture products by species (These data are essential in assessing the relative importance of the sector within the national economy, and combined with costs, provide an indication of income from aquaculture);
- Unit prices at farm-gate level (product prices) by species; (This information, combined with data on costs, can provide indices of productivity, and is used in economic analyses and market studies);
- Number of aquaculture workers and labourers, whether permanent or occasional;
- Estimates of net earnings from aquaculture; and
- Data to verify information on the contribution of aquaculture to rural development.

Distribution and consumption of products

- the estimation of data on the domestic consumption of aquaculture products; and
- Data on export quantity and value.

⁷⁴ CWP. 1999. Report of the eighteenth session of the Coordinating Working Party on Fishery Statistics. Luxembourg, Grand Duchy, 6-9 July 1999. *FAO Fishery Reports* No. 608. Rome, FAO. 1999. 62 p.

⁷⁵ COFI. 2002. Report of the first session of the Sub-Committee on Aquaculture. Beijing, China, 18-22 April 2002, *FAO Fisheries Reports* No. 674. Rome, FAO. 31p.

⁷⁶ Headings are author's additions

Accordingly, in addition to improving the quality of, and filling the gaps in country statistics submitted to the FAO at present, the scope of aquaculture statistics will also have to be expanded to include socio-economic data (other than value of production), including the assessment of the contribution of rural aquaculture to household food security, and marketing. This responds to Article 7.4.5 of the CCRF: “*In order to ensure sustainable management of fisheries (including aquaculture)⁷⁷ and to enable social and economic objectives to be achieved, sufficient knowledge of social, economic and institutional factors should be developed through data gathering*”.

4.2 Socio-economic, consumption and marketing data

The development of economic and social statistics has lagged behind that of production and biological data. Such statistics are essential for estimating the net benefits that a nation derives from its aquaculture sector and its distribution, for measuring the impact of policy and management decisions and monitoring the economic evolution of such decisions over time. Consumption and export information will clarify domestic and international demand for aquaculture products, including consumption patterns, product prices, trade, and market opportunities. However, the collection of information on aquaculture exports will not be possible in most cases except where labelling for origin is adopted. The Census guidelines include collection of information on employment in aquaculture by gender and age group.

The new information on the contribution of aquaculture to rural livelihoods is in line with FAO’s focus on poverty reduction and improving household livelihoods. At present, large numbers of small aquaculture units dispersed in rural areas, such as households practising integrated agriculture and aquaculture for semi-commercial purposes and home consumption, are often omitted from national surveys due to the dispersed nature of the production units and related logistic problems and high survey costs. Despite the critical contribution of these practices to food security, human nutrition and poverty alleviation in many rural areas, their individual generation of small economic value is the reason that they are frequently neglected in surveys. Cost-effective methods, tools and standards need to be established for the survey of small rural aquaculture units. In this connection, optimum use should be made of existing agricultural surveys⁷⁸.

In view of limited resources and the collection of data relevant to socio-economics and rural development, as well as consumption and marketing by other agencies, there is need to improve national inter-agency communications and coordination so that the best use can be made of all data collection schemes (e.g. population, labour, household surveys) to obtain aquaculture data. This could be accomplished by establishing national working group(s) comprising aquaculture and other statisticians, as well as technical specialists, and would maximize the use of existing available data for the needs of multiple users⁷⁹.

4.3 Performance indicators

The COFI/SCA list of minimum statistical information, does not include data to enable calculation of performance and sustainability indicators for planning, monitoring and evaluation; for CCRF and other international reporting requirements and, possibly, in support of exported products (i.e. in response to any eco-labelling requirements).

⁷⁷Author’s addition

⁷⁸COFI/SCA. 2002. Needs for better reporting on the status and trends of aquaculture. (COFI/AQ/I/2002/5). First session of the COFI Sub-Committee on Aquaculture. Beijing, China. 18-22 April 2002.

⁷⁹APFIC. 1997. Status of Fishery Statistics in Asia. Report of the first session of the APFIC Joint Working Party on Fishery Statistics and Economics. Bangkok, Thailand, 19-23 August 1997. *RAP Publication* 1997/43. 24p.

In this regard, it has been recommended (for Asia)⁸⁰ that a range of indicators should be used to reflect ecological, social, economic and institutional objectives that should be accommodated in the national statistical framework. Earlier, the NACA/FAO Conference on Aquaculture in the Third Millennium (2000) recommended initiation of studies to identify practical indicators of performance, as well as indicators of future potential, for the management of aquaculture and the associated aquatic environment.

The FAO Fisheries Department has, and continues to formulate or co-ordinate the preparation of standards, guidelines and indicators for sustainable development of fisheries and aquaculture. These are published in the FAO series *FAO Technical Guidelines for Responsible Fisheries* and other Fisheries Department publication series as appropriate. Publications relevant to aquaculture are described in Annex 3. In addition, the Department will provide assistance in the development of guidelines and standards on various aspects of aquaculture in the context of a project on “Responsible Aquaculture Development and Management”, prepared as part of the activities of “Fish Code: Global Partnerships for Responsible Fisheries”, an inter-regional, externally-funded FAO programme to assist countries implement the CCRF. Funding for the project is being sought at present.

5 QUALITY CONTROL AND ASSURANCE

As noted above, the quality of submitted country statistics varies significantly depending on sources and methodologies employed and there are serious doubts about reliability for some countries. Very often this is difficult or impossible to substantiate due to the absence of alternative information. Quality control measures practised by FAO in relation to statistical data submitted by Member countries are described elsewhere. The decline of the FAO field programme in recent years has eliminated an important avenue for quality control, while the absence of an equivalent to the non-FAO regional (capture) fishery bodies precludes the possibility of even basic, preliminary screening of data by such bodies.

As in the case of capture fisheries, despite some improvement in national statistics of some countries, analyses (based on aquaculture production statistics)⁸¹ are still constrained by the availability and quality of data, and while concerns about data quality are often expressed when the results of the analyses are reported, the analyses do not take account of uncertainty in any systematic way, due to the difficulty of assessing the level of uncertainty in most cases. In view of this, improvement of the quality of aquaculture statistics should be a priority concern and effective and practical validation or quality assurance procedures should be established for this purpose to the extent possible⁸².

The criteria, definitions and methods for quality assurance in status and trends reporting were by reviewed by the ACFR Working Party on Status and Trends of Fisheries (ACFR:STF) for capture fisheries and are summarized in Annex 4. They are equally applicable to aquaculture. However, the ACFR Working Party noted that methods outlined in the table for a consensual process might be difficult to implement. The criteria for the process (report/analysis preparation) should be that it is transparent, responsive, independent and consensual. The criteria for the concluding results of reports should be that they were relevant, and that they were credible and quality-controlled, and also that the processes and the results should be subject to both internal and external peer review to the extent practicable⁸³.

⁸⁰ SEAFDEC. 2001. Report of the SEAFDEC Conference on Sustainable Fisheries for Food Security in the New Millennium . Bangkok, Thailand, 19-24 November 2001.

⁸¹ Author's addition

⁸² ACFR. 1999. Report of the Working Party on Status and Trends of Fisheries. (ACFR/99/2). Rome, Italy, 6-9 December 1999

⁸³ *Ibid.*

The ACFR:STF also agreed in principle that where peer review processes have taken place in the institution “owning” the information, whether through working groups and/or a scientific committee, information provided by that institution should be considered as “peer reviewed”. It was recognized that quality would vary among regions according to available data and analytical capacity and that the principle should be to make available the “best available scientific evidence” rather than try to apply uniform quality standards.

In relation to the generation and communication of status and trends reports, the ACFR:STA reached certain conclusions which are also applicable to aquaculture as well: “*..it was recognised that at national, regional and international levels the process is most often founded on the efforts of Working Groups; and that this practice will continue*” and offers the best way to gather reports for the global synthesis. “However, it was noted that sometimes “*...status and trends reports are the result of work by individuals, in some cases through reviewed journal publication but in many cases simply as documents lacking formal peer review*”. The question of how to authenticate and use such reports as contributions to regional or global syntheses needs to be addressed.

Working Groups offer a primary level of peer-review and their reports may also be validated by internal and external peer-review.

6 CONCLUSIONS AND SUGGESTIONS FOR A WAY FORWARD

The formulation of aquaculture policies and management strategies should be based upon the analysis of reliable and timely information. The strengthening of national statistical systems as an integral part of a planning and decision making process should be a major national objective in the drive towards sustainable aquaculture.

Strengthening the base for sustainable aquaculture development and management through improved data collection and analysis requires a multifaceted approach in the sense that (i) there is a national awareness of the need for data to underpin decision-making, planning and assessment, and a national commitment to provide data, (ii) there is consultation with data users so that they get the data required for their work, (iii) there is appropriate data collection mechanisms and data management systems, and (iv) FAO and non-FAO regional fishery bodies and other appropriate institutions, organizations and individuals are involved in assessments of status and trends in aquaculture.

Aquaculture statistics should be consistent in terms of *comparability, continuity* and *reliability*. Substantial improvements in national systems may come from the following actions at the national level: (a) integrating the statistical system with the management system, (b) allocating adequate resources to the collection of information and capacity building, (c) establishing national statistical standards and survey methodologies, (d) promoting better co-ordination of national statistical programmes, and (e) providing timely, reliable and meaningful information to users.

Considerable progress has been made by FAO in the establishment of a global database on aquaculture statistics, but the process is still in the early stages of development and much more needs to be done to improve the database, particularly in view of increasing demands for information at all levels by a variety of data users.

The main issues still requiring attention at the global level in order to improve the global reporting on status and trends of aquaculture include:

- inadequate institutional framework, quality assurance, transparency and participation;
- incomplete harmonization of terminology and classifications;
- unclassified or incompletely identified aquatic organisms;
- lack of and/or incomplete reporting by countries;
- inappropriate methodologies for collecting information on aquaculture and

- institutional limitations at the national level; and
- inadequate scope of collected information.

Owing to the importance of status and trends reports, and the scrutiny they received, the ACFR:STF recommended that the global system of status and trends reporting for capture fisheries be advanced by *improving completeness, expanding the scope of reporting and enhancing quality assurance*⁸⁴. The ACFR:STF recommendations, with minor modifications (see following paragraph), also address most of the key issues in aquaculture reporting.

The global system of status and trends reporting for aquaculture can be advanced by:

- increasing completeness of the data (e.g. reliable structural aquaculture statistics, and seed production; species identification, etc.);
- harmonizing methodologies, terms and classifications;
- expanding the scope of current reporting, which is primarily focused on production and value, to include other dimensions of aquaculture (e.g. economic and social aspects, consumption and distribution of products; rural aquaculture, etc.);
- enhancing quality assurance and credibility by (a) renewing commitment to collect and report aquaculture data, conduct research, and build capacity, (b) greater involvement of regional groups and experts, and (c) improving documentation, transparency, and peer review processes; and
- developing tools and software to facilitate and expedite the collection and processing of data at all levels.

Simultaneous action at the national and international level will be required to address the institutional and technical constraints discussed above and to improve the quality of aquaculture monitoring and reporting. Key actions have been identified repeatedly by experts and country representatives (mainly in Asia) in a number of meetings. Clear emphasis is placed on the technical and institutional aspects of improving the quality of national aquaculture statistics, including establishment, adoption and use of unified standards and guidelines for data collection. Improvement of national statistics would have the most impact on improving the quality of global status and trends reporting on aquaculture.

Well-focused subregional and regional projects can play a catalytic role in improving national aquaculture statistical monitoring systems. Such projects constitute reference points for receiving and processing feedback information, experiences and requests for technical advice, and are also a source of technical support by means of technical consultations, training courses, and workshops. Small technical assistance projects at the national level are also very useful in the early stages of statistical monitoring programmes. They provide solutions to problems that, due to the chronic shortage of funds invested in aquaculture statistics by many fishery administrations, would otherwise take longer to be addressed and resolved. Projects at national level aim primarily at self-sustaining statistical programmes and for this purpose incorporate substantial training and technical advice⁸⁵.

Given the long term nature of the required effort to accomplish the required improvements, it seems appropriate that FAO should address international aspects of these issues in the context of a practical and sustainable international strategy with

⁸⁴ ACFR. 1999. Report of the Working Party on Status and Trends of Fisheries. (ACFR/99/2). Rome, Italy, 6-9 December 1999

⁸⁵ FIDI. 2000. Inland fishery and freshwater aquaculture production statistics in Asia/Pacific – some suggestions for their improvement. APCAS/00/13. Eighteenth Session of the Asia and Pacific Commission on Agricultural Statistics, Bali, 6-10 November 2000.

bilateral support at both the international and national levels. The strategy would provide a framework for the improvement of knowledge and understanding of aquaculture status and trends as a basis for policy-making for sustainable development of the sector.

The COFI Sub-Committee on Aquaculture (COFI/SCA) recommended that FAO develop an approach for improving information on aquaculture status and trends similar to that developed for capture fisheries through the Technical Consultation on Improving Information on Status and Trends of Capture Fisheries (2002). The elements of such a strategy for aquaculture, adapted from that for capture fisheries, could include:

- building national capacity and developing software to facilitate the collection, processing and analysis of data and its timely presentation;
- developing and promoting the use of standardized terms, definitions and classifications;
- improving completeness of FISHSTAT AQ database by filling the gap between requested and submitted information;
- improving the quality of submitted data;
- expanding, within reasonable bounds, the scope of status and trends reporting;
- developing methods and approaches for the collection of data on rural aquaculture;
- defining the role of local, regional, and global scientific working parties as a vehicle for status and trends reporting, capacity building, and quality assurance;
- establishing appropriate arrangements with entities that could contribute useful scientific information, that specify roles and responsibilities, and identifying needs and opportunities for new regional arrangements where appropriate they do not now exist; and
- developing practical methods and criteria for quality assurance.

SUGGESTED ACTION BY THE CONSULTATION

The Consultation is invited to consider the main issues raised in this document, and the suggestions made to deal with some of them, and to recommend practical ways and means of mitigating these constraints. The consultation is also invited to elaborate an international strategy as suggested in the document, for consideration by FAO as a framework for future action and external financial support. A suggested draft strategy is provided in document EC:STA/2004/Info.4 to facilitate deliberations and discussions of the Consultation.

Annex 1

RECOMENDATIONS FOR IMPROVING AQUACULTURE STATISTICS AT THE NATIONAL LEVEL.

1 NACA/FAO CONFERENCE ON AQUACULTURE IN THE THIRD MILLENNIUM, 2000⁸⁶

Purpose of data and information collection

- Improve awareness that data and information are collected to meet the information needs of the target users i.e., data and information collection is not an end in itself; it must be used to support and facilitate policy-making and management decisions.
- Strengthen national capacity to determine data needs of target users and identify types and scope of data to be collected and compiled.
- Promote awareness among data and information providers regarding the purpose of data collection through improved feedback and sharing of benefits attained from use of information derived from the data provided.
- Assess cost-benefits of data collection. Data and information collection, compilation and analysis are costly to both the agencies that collect data and to data providers. The costs associated with data and information collection and analysis should be matched by benefits to all stakeholders resulting from informed decisions and subsequent policy and management interventions.
- Initiate studies to identify practical key indicators of performance, as well as indicators of future potential, for the management of aquaculture and the associated aquatic environment.

Utilization of data and information

- Promote coordination and integration of the activities relating to collection, compilation, analysis, dissemination and utilization of information as an integral part of the sector management and planning at all levels.
- Improve the understanding of the purpose of the information base.
- Facilitate development of analytical and forecasting tools and their adoption and application.
- Improve the availability and accessibility of data and information through targeted analysis, synthesis, packaging and delivery.

Effective communication and presentation

- Improve the availability and accessibility of data and information through targeted analysis, synthesis, packaging and delivery.

Relevance, reliability, timeliness and completeness of data and information

- Strengthen national aquaculture data and statistics systems, including improving

⁸⁶NACA/FAO. 2000. Report of the Conference on Aquaculture in the Third Millennium. Conference on Aquaculture in the Third Millennium, 20-25 February 2000. Bangkok, Thailand. NACA, Bangkok and FAO, Rome. 120 p.

linkages with relevant agencies, institutions and related sectors.

- Improve the quality of the data and information collected and ensure that it is sufficient to facilitate forecasting of impacts and implications of policy and management interventions.
- Upgrade the capacity of institutions and the skills of personnel involved in data collection and compilation at the local and field levels.

Internationally comparable and compatible methodologies for data and information handling

- Give high priority to the establishment of internationally agreed-upon norms, definitions and classifications.
- Encourage and promote national efforts to harmonize and standardize the methodologies used for aquaculture data and information handling.

Capacity of national programs

- Give greater emphasis to national capacity building, particularly data and information collection at local and field levels; analysis and synthesis of data and information; and effective presentation and communication

2 SEAFDEC-FAO AD HOC CONSULTATION ON VARIABLES AND TERMINOLOGY FOR AQUACULTURE MONITORING IN ASIA, 1999⁸⁷

Appropriate national actions for the improvement of aquaculture monitoring

- As human and financial resources for developing aquaculture monitoring systems are often among the limiting factors, countries are encouraged to maximize the use of available data.
- There is need to examine the scope of the data collected in view of the changing data needs for outputs as well as processes involved in aquaculture production.
- Human resource development of statistics personnel at different levels, particularly training of primary data collectors, should be encouraged.
- Countries may consider existing arrangements, such as technical Cooperation for Developing Countries (TCDC) and the Technical Cooperation Programme (TCP) to meet training and other requirements.
- Each country should consider establishing a national multidisciplinary coordination mechanism to continuously develop and monitor aquaculture statistics programs at national and local levels.

Statistical systems

- Priority should be given to strengthening national systems for collection of statistics
- The purpose of data collection and the expected output from analysis should be clearly defined.
- Closer connection between development and monitoring should be promoted.
- An internationally comparable data system should be developed on basis of good national model systems

Harmonization of terms and variables

- Harmonization of terms and variables is needed to ensure information submitted to regional and international bodies are comparable.

⁸⁷SEAFDEC-FAO. 1999. Report of the SEAFDEC-FAO Ad Hoc Expert Consultation on Variables and Terminology for Aquaculture Monitoring in Asia, 13-16 September 1999, Bangkok, Thailand. 32p.

- A regional working group should be established to evaluate and assist countries to develop their capacity in data collection and collation and to help standardise and harmonize methodologies, terms and definitions.

Definition of aquaculture

- FAO should revise the definition of aquaculture to take into considerations concerns raised by the countries. It should contain the three concepts of the original definition: the organisms and their farming environment, aquaculture practice, and the ownership of the organism. Clear guidelines should be established to differentiate aquaculture from capture fisheries. The revised definition should be widely circulated.
- To avoid problems in the interpretation of “brackishwater environments”, aquaculture could be classified as marine, coastal and inland.. guidelines should be prepared for the disaggregation of coastal and marine data to coastal and marine data.

Glossary of aquaculture terminology

- The outline glossary of aquaculture terminology was approved by the countries and its expansion recommended
- A glossary of terms should be compiled and compared at the international level by FAO for dissemination to all types of users. The assistance of member countries in providing national glossary of terms used in aquaculture and aquaculture monitoring is needed for this purpose.

Other suggestions

- Add ornamental fish to aquaculture definition.
- Hatchery production Broodstock rearing should be an aquaculture activity.
- Add farmed edible aquatic plants to definition & statistics.

3 FIRST SESSION OF THE APFIC JOINT WORKING PARTY (JWP) ON FISHERY STATISTICS, 1997⁸⁸

Recommendations for National Action

- In order to make capture fisheries and aquaculture statistics available to users in a timelier manner, there is a need to automate data processing to speed their collation and dissemination. Software packages (e.g. ARTFISH) are required in conjunction with training of staff (e.g. enumerators) at the local and national levels
- There is need to improve national inter-agency communications and coordination so that the best use can be made of all data collection schemes (e.g. population, labour, or food surveys) to obtain fisheries data. This could be accomplished by establishing national working group(s) comprising fisheries and other statisticians, as well as technical specialists.
- There is an urgent need to improve species details in statistics collected for capture fisheries and aquaculture production, particularly for the commercially important species. Countries are encouraged to prepare local taxonomic field guides for enumerators so that at least the main commercial species landings can be quantified.

⁸⁸APFIC. 1997. Status of Fishery Statistics in Asia. Report of the first session of the APFIC Joint Working Party on Fishery Statistics and Economics. Bangkok, Thailand, 19-23 August 1997. RAP Publication 1997/43. 24p.

- To respond to the need for harmonized aquaculture statistics, countries are urged to collect structural data for aquaculture using censuses and surveys utilizing as far as possible definitions, standards and methodologies provided in the Supplement on Aquaculture to the WCA 2000 Programme.

Recommendations for Regional and Global Action

- FAO should review and revise, where appropriate, its FISHSTAT AQ questionnaire to include necessary information such as specifications of the life stages in hatchery outputs.
- In order to improve the quality and utilization of fishery statistics in the region ... special attention should be focused on development of software for compilation, processing and analysis of aquaculture statistics

The JWP placed top priority (for follow up) on the development of guidelines on definitions, standards and methodologies, to improve consistency of national statistics with international standards. This included the preparation and distribution of the Aquaculture Supplement to WCA 2000.

Recommendations to APFIC and FAO

- The JWP should ascertain the current and likely use for fisheries and aquaculture performance indicators for fisheries and aquaculture within APFIC countries and this information should be collated and distributed to all members by the Technical Secretariat.

Annex 2

THE FAO DEFINITION OF AQUACULTURE

“Aquaculture is the farming of aquatic organisms including fish, molluscs, crustaceans and aquatic plants. Farming implies some sort 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 exploitable by the public as a common property resource, with or without appropriate licenses, are the harvest of fisheries.”

The revised working definition adopted for the collection of aquaculture structural statistics in the context of the World census for Agriculture 2000 and published in “Guidelines on the collection of structural aquaculture statistics”:

“Aquaculture is the farming of aquatic organisms including crocodiles, alligators, turtles, amphibians, finfish, molluscs, crustaceans and plants where farming refers to their rearing up to their juvenile or adult phase under captive conditions. Aquaculture also encompasses individual, corporate or state ownership of the organism being reared and harvested in contrast to capture fisheries in which aquatic organisms are exploited as a common property resource, irrespective of whether harvest is undertaken with or without exploitation rights.”⁸⁹

⁸⁹ Rana, K.J. 1997. Guidelines on the collection of structural aquaculture statistics. Supplement to the programme for the World census of Agriculture 2000. FAO Statistical development SeriesNo. 5b. Rome,FAO. 1997. 56p.

Classification proposed for various aquaculture and capture fisheries practices (Modified from CWP 1992)

PRODUCTION FROM	DESIGNATION		
	AQUACULTURE	CAPTURE FISHERIES	
		Enhanced	Traditional
Hatcheries	*		
Ponds	*		
Tanks	*		
Raceways	*		
Cages	*		
Pens	*		
Barrages	*		
Integrated vallicoltura production	*		
Private, tidal ponds (tambaks)	*		
Stocked lakes, reservoirs and rivers			
- with other enhancement (predator control and/or fertilisation)		*	
- modification with "exploitation rights"		*	
- no other intervention without "exploitation rights"			*
Unstocked lakes, reservoirs and rivers			
- with enhancement (fertilization and/or predator control habitat modification), with "exploitation rights"		*	
Rice-fish culture:			
- from stocked rice-paddy	*		
- from unstocked rice-paddy			*
Finfish and other animals harvested from brush parks:			
- managed over time and with other enhancement rights		*	
- harvested on an install and harvest basis			*
Fish and other animals harvested from:			
- fish aggregating devices			*
Molluscs			
- from managed grow-out site (e.g. poles, ropes, net bags)	*		
- subject to open fisheries			*
Aquatic plants			
- harvest of planted and suspended seaweed	*		
- harvest of natural seaweed beds			*
Aquatic organisms caught in open waters			*
Privately owned recreational fisheries			*
Ranching		*	
Fish and other animals harvested from artificial reefs "with exploitation rights"		*	

Annex 3

FAO GUIDELINES AND OTHER STANDARDS FOR RESPONSIBLE FISHERIES RELEVANT TO AQUACULTURE

The technical guidelines described below are preliminary and will be evaluated and revised as information accumulates through their implementation. The guidelines have no formal legal status.

1 AQUACULTURE DEVELOPMENT⁹⁰

This document provides annotations to the Principles of Article 9 of the Code of Conduct for Responsible Fisheries. These annotations are meant to serve as general guidance, and should be taken as suggestions or observations intended to assist those interested in identifying their own criteria and options for actions, as well as partners for collaboration, in support of sustainable aquaculture development.

2 GUIDELINES ON THE COLLECTION OF STRUCTURAL AQUACULTURE STATISTICS⁹¹

The guidelines are intended to assist countries to improve their current surveys of aquaculture and to provide a framework for those countries intending to develop databases on aquaculture information. The document provides definitions, concepts, standards and guidelines for collecting internationally comparable data on aspects such as location and size of the farms, types of aquaculture activity, employment structure, use of resources and aquaculture inputs. The items proposed for collection address issues related to natural resources and utilization and sustainable aquaculture developmental issues. The document also provides examples of summary tables that could be used to develop a questionnaire.

3 GOOD AQUACULTURE FEED MANUFACTURE PRACTICE⁹²

The guidelines were compiled for FAO in support of Article 9 of the Code of Conduct for Responsible Fisheries (CCRF) concerning Aquaculture development, and in particular in support of Article 9.4.3 of the CCRF concerning the selection and use of feeds and additives. They cover a number of issues, ranging from ingredient purchasing, processing, bulk storage, handling, monitoring, and documentation, to issues such as employee training and safety, customer relations, and the delivery of finished goods to the farmer.

⁹⁰ FAO Fisheries Department. Aquaculture development. FAO Technical Guidelines for Responsible Fisheries. No. 5. Rome, FAO. 1997. 40p.

⁹¹ Rana, K.J. 1997. Guidelines on the collection of structural aquaculture statistics. Supplement to the Programme for the World Census of Agriculture 2000, FAO Statistical Development Series. No. 5b. Rome, FAO. 1997. 56p.

⁹² FAO Fisheries Department. 2001. Aquaculture development. 1. Good aquaculture feed manufacture practice. FAO Technical Guidelines for Responsible Fisheries No. 5, Suppl. 1. Rome, FAO. 2001.47p.

4 INTEGRATION OF FISHERIES INTO COASTAL AREAS⁹³

These Guidelines are provided as explanatory material to Article 10 in the CCRF, concerning the Integration of Fisheries into Coastal Management in order to assist in achieving the rational use of scarce coastal resources. In particular, they address the issue of how the fisheries sector can be integrated into coastal management planning so that interactions between the fisheries sector and other sectors can be taken into account in the establishment of management policy and practice with regard to coastal resources. The fisheries sector is taken, in the Code and these Guidelines, to refer to both capture fisheries and aquaculture, unless one or other sector is specifically mentioned.

5 PRECAUTIONARY APPROACH TO CAPTURE FISHERIES AND SPECIES INTRODUCTIONS⁹⁴

Guidelines for the application of the Precautionary Approach to capture fisheries and the introduction of species, presented in this publication, were developed by the Technical Consultation on the Precautionary Approach to Capture Fisheries (Lysekil, June 1995), for the governments, fisheries authorities, the fishing industry, regional fishery management bodies, NGOs, and others interested in fisheries, in order to: (a) raise their awareness about the need for precaution in fisheries, by providing them with background information on the main issues and implications, and (b) provide them with practical guidance on how to apply such precaution.

6 POLICIES FOR SUSTAINABLE SHRIMP CULTURE⁹⁵

The Consultation recommended a range of desirable principles to be followed in the establishment of legal, institutional and consultative frameworks and government policies for sustainable coastal aquaculture, including shrimp culture. These are intended as guidelines to assist in the establishment or amendment of national legislation. The Consultation also recommended a number of specific areas for future research including on economic incentives and on carrying capacity of coastal ecosystems for shrimp culture. Further, it recommended that FAO convene expert meetings to elaborate best practices for shrimp culture, desirable elements of the legal and regulatory frameworks for coastal aquaculture and the criteria and indicators for monitoring sustainability of shrimp culture.

7 INDICATORS AND CRITERIA OF SUSTAINABLE SHRIMP CULTURE⁹⁶

The meeting prioritized and prepared a recommended short-list of the criteria and indicators of sustainable shrimp fisheries which should form the basis for regular reporting by countries to the FAO Committee on Fisheries (COFI). The meeting stressed that these criteria and indicators related to the national level and did not encompass farm-level and local-level indicators. It noted that the regular collation of these indicators would greatly benefit the planning and management of shrimp culture development in the countries. The meeting elaborated a questionnaire to allow governments to review and comment on the recommended indicators and on their present and future ability to acquire the related data and information.

⁹³ FAO Fishery Development Planning Service, Fisheries Department. 1996. Integration of fisheries into coastal area management. FAO Technical Guidelines for Responsible Fisheries. No. 3. Rome, FAO. 1996. 17p.

⁹⁴ FAO Fisheries Department. 1996. FAO Technical Guidelines for Responsible Fisheries. No. 2. Rome, FAO. 1996. 54p

⁹⁵ Bangkok FAO Technical Consultation on policies for sustainable shrimp culture. Bangkok, Thailand, 8-11 December 1997. FAO Fisheries Report. No. 572. Rome, FAO. 1998.

⁹⁶ Report of the Ad-hoc Expert Meeting on Indicators and Criteria of Sustainable Shrimp Culture Rome, Italy, 28-30 April 1998. FAO Fisheries Report No. 582. Rome, FAO. 1998.

8 INDICATORS OF SUSTAINABLE AQUACULTURE DEVELOPMENT, 2001⁹⁷

The principal objective of the Consultation was to contribute to the preparation of technical guidelines for the selection and use of indicators of sustainable aquaculture development. These guidelines are intended to facilitate the process of developing indicators of sustainable aquaculture development, at farm, local, national and international levels. A related objective of the Consultation was to identify general and specific sustainable development indicators which can measure performance and progress of various types of aquaculture systems and practices. Such indicators would be expected to apply across a range of themes, including technical specifications, performance ratios, measures of social and economic benefit, and various descriptions of natural resource and environmental quality. This would link with broader concepts of sustainability, and could potentially form part of a framework applicable to the aquaculture sector. In view of increasing information demanded by consumers of aquaculture products, the Consultation also addressed the possible use of aquaculture sustainability indicators for purposes of developing effective and equitable certification/labelling schemes and standards. Applications of sustainability indicators in aquaculture food security projects was also discussed. The report of the Consultation is currently under preparation.

9 LAND AND WATER USE IN AQUACULTURE: TOWARDS AN IMPROVED INFORMATION BASIS⁹⁸

The broad objective of this Consultation was to generate primary baseline information and expert advice on trends, patterns, opportunities and challenges of land and water use in the various forms of aquaculture farming systems and practices. Preparatory work on FAO's aquaculture database so far has shown that there is very significant scope for enhancing, updating and organizing knowledge on required and available statistical data and bibliographic reference materials on land and water use in aquaculture. The focus in this first step of analysis was primarily on data and statistics as available, and on their collection, recording, use and interpretation. The medium- and long-term perspective here is on using and interpreting such data sets with a view to enhancing resource use efficiency and environmental performance and improving sectoral management and governance efforts.

The main objectives of the consultation were therefore:

- to compile and review available data and information on land and water use in aquaculture;
- to provide advice on experiences and approaches for the collection, use and interpretation of aquaculture land and water use data and information;
- to discuss the use and interpretation of such data and information for the purposes of analysing and comparing resource use efficiencies of aquaculture practices.

It is hoped that this stock-taking exercise will provide FAO, its member countries and interested partners with basic strategic advice on possible ways to improve the collection, organization, dissemination and general use of data and information on land and water use in aquaculture.

⁹⁷ FAO (in prep.). Report of the Expert Consultation on Indicators of sustainable aquaculture development. Rome, Italy, 24–27 September 2001.

⁹⁸ FAO (in prep.). Expert Consultation on Land and Water Use in Aquaculture: towards an improved information base. Rome, Italy, 7–10 October 2002.

Annex 4

Table of criteria, definitions and methods: A framework for fisheries science quality assurance⁹⁹

The PROCESS should be:		
Transparent	The process, rules and procedures are well-defined and public knowledge.	Tender rules Statutory arrangements Institutional publishing
Responsive:	Timely and flexible to changing needs, while ensuring best practice.	Tasks should be well-defined and timely Request should be appropriate, feasible and reasonable.
Independent	Scientifically objective and free from sectoral influence by government, industry, or advocacy groups.	Open access to data, methods, raw results (including measures of uncertainty and risk). Clear method demonstrable in the integration and presentation of summary advice.
Consensual	Reports on the process should include any alternate views, incorporated as additional uncertainties to the general mathematical or conceptual uncertainties.	Rules of procedure require no 'minority', externally published reports. Sufficient time given to reach consensus.
The RESULTS should be:		
Integrated	All issues are considered in or enter into the scientific procedures, including environmental, ecosystem, economic and social issues, as appropriate.	Research into and the application of holistic assessment methods. Time set aside for scientists to undertake theoretical research, in methods, in particular modelling and simulation.
Credible	Scientifically accurate within the limits of knowledge (methods and data) from respected scientists, and reflecting practical reality.	Good data, appropriate to the task. Acceptance by scientists of the socio-economic dimensions of the fishery. Training. Theoretical research.
Quality Controlled	Procedural error-detection at appropriate times/stages.	Process for quality control established externally to the 'group'.
The PROCESS and the RESULTS should be subject to:		
Internal peer review	Method for conducting procedural quality control and first review of results.	Institutional mechanism established for formal/scheduled quality control activities by non-tasked expert and informed non-experts.
External peer review	Process and results conform to the highest international standards.	Include the best scientists, and others, as appropriate, external to the institution, state or region.

⁹⁹ACFR. 1999. Report of the Working Party on Status and Trends in Fisheries. (ACFR/99/2). Rome, Italy, 6-9 December 1999

Asia regional synthesis: information for status and trends reporting on aquaculture¹⁰⁰

1 INTRODUCTION

The Bangkok Declaration and Strategy for Aquaculture Development Beyond 2000 (Aquaculture in the Third Millennium, 2001) emphasized the role of information in (a) the efficient management of the sector and (b) the collection and dissemination of accurate and verifiable information to improve the image of aquaculture.

The recommendation focused on improved information flows through (i) arrangements for sharing of data and information, (ii) strengthening national capacity for determining data needs and for collecting and managing data, (iii) providing mechanisms for better access to relevant and reliable information to stakeholders, and (iv) making effective use of new information technology.

The Conference identified five issues that needed to be addressed in order to achieve the above recommendations and suggested actions to address them. These are:

- poor understanding of the purpose of information and information activities,
- poor quality of data and information, which was elaborated as the result of irrelevance, unreliability and un-timeliness of the information;
- lack of internationally comparable methodologies;
- inadequate data analysis; and
- ineffective communication and presentation of information.

2 FRAMEWORK FOR THE REVIEW

A brief overview of the issues related to the use of statistical data and information is intended to provide a conceptual framework for this synthesis of six national reviews¹⁰¹.

Hierarchy of uses

A fundamental assumption is that the paramount purpose for data and information is to aid in decision-making. A decision has to be made in order to solve a problem. Therefore, the hierarchy of uses (and users) of statistical data, and the information that may be derived from the data, depends on the immediacy of the need for the decision and the number of those that would benefit from such decision. From a problem-solving standpoint, importance is based on the seriousness of the problem (seriousness being the function of severity or how large the damage a problem can cause if it occurs e.g. percent loss of production; prevalence or how widespread is its impact; and frequency of occurrence. In this light, the hierarchy of uses of national statistics (on aquaculture) would be as follows:

¹⁰⁰ Prepared by Simon Wilkinson and Pedro Bueno (Network of Aquaculture Centres in Asia-Pacific, Bangkok, Thailand) and Shunji Sugiyama and Simon Funge-Smith (FAO Regional Office for Asia and the Pacific, Bangkok, Thailand).

¹⁰¹ Of China, India, Japan, The Philippines, Thailand and Viet Nam written by commissioned authors from these countries, using a guideline provided by FAO.

- (i) for national and sector policy, planning and management – national and local governments;
- (ii) for analysis of the sector, in other words, research – R and D sector, investors and entrepreneurs, industry, development agencies, farmers’ cooperatives, aquaculture enterprises; and
- (iii) for education, training, public information and advice to the sector – academia, government, training and extension providers, development agencies, mass media.

2.1 ATTRIBUTES OF STATISTICAL INFORMATION

Based on the Aquaculture Millennium discussions, there are two fundamental and one desirable attributes of statistical information:

2.1.1 Reliability

An intrinsic attribute of data and information, regardless of how they are to be applied, is reliability. A user will want to know to what extent the information can be trusted or “how close does it represent reality”. It is the product of its adequacy and validity.

- **Adequacy** – This attribute is a function of the range of information or analysis that can be derived from the data presentation. A user will want to know to what extent, the data can be relied on to provide reliable interpretations and conclusions i.e. how far can it be extrapolated?
- **Validity** – This is a function of the representative-ness of the sample, generally a methodological and procedural issue. It primarily impacts on the extent to which the data or information can be applied for deriving conclusions about a specific population.

The importance of the above attributes, from the standpoint of government, may be summed up bearing in mind that planners and decision-makers need appropriate indicators of performance for the sector and indicators of future potential.

2.1.2 Relevance

This attribute is based solely on the purpose of the information, and would be determined by how applicable it is to solving a problem. Timeliness and the way the data is presented affect their relevance. Timeliness also impacts on validity, in the sense that information that loses currency has its applicability in decision-making eroded.

2.1.3 Complementarity

A third attribute, which is not basic but adds to usefulness, is the added value to statistical data. The usefulness of statistical information is enhanced by its being integrated with other types of information to provide a better picture and understanding of the status and trends happening in the sector.

3 DISCUSSION OF ISSUES

Before describing the constraints and weaknesses indicated or implied by the reviews, it would be useful to first establish those constraints and weaknesses that are fundamental to the problem of poor quality statistics and information; and those that merely add to the underlying constraints and weaknesses. This will help identify and prioritize those issues that need to be addressed and also determine how this can be done.

3.1 Fundamental constraints and weaknesses

3.1.1 Legal framework for aquaculture

The existence or absence of a separate legal framework for aquaculture and whether the law mandates responsibility for reporting to a distinct agency does not appear to affect procedures and quality of statistical outputs. However, having a strong legal requirement to register aquaculture operation significantly improve the information on farm number and location.

3.1.2 Administrative structures for aquaculture management

Some constraints particularly those related to reporting, collection and analysis of data, seem to be the consequence of the administrative structure for aquaculture (or fisheries) management. The structure, locus of responsibility and how far down the administrative system certain responsibilities are assigned, varies according to each country's overall administrative system (i.e. centralized, decentralized, state or provincial autonomy).

The degree of management responsibility assigned to the producer of the data and information does have an influence on accuracy of reports of farm data. A good example is Japan's system of requiring every FCA to prepare an annual report on the status and trends of aquaculture for management purposes. FCA's are originators of farm data reports as well as responsible for the management of the local aquaculture, and it is assumed that their inputs to the statistical system would be as accurate and complete as possible, in line with their own management requirement. This is an issue of the originator of the report having a high stake in the resulting output.

3.1.3 Linkages between monitoring and planning and management

Linkages between monitoring and planning and management may or may not have an influence on the quality and relevance of information. It can be generalized that the more urgent the need for a decision is the more critical is the requirement for reliable and meaningful information. Decision makers that have to deal with more localized and immediate problems, put a premium on highly accurate and very relevant data and information. It follows that they would require that the data reported to them are accurate and that their fidelity was ensured throughout the processing, analysis and presentation process.

In China, farmers or aquaculture companies in some instances tend to "over-report and bureaucrats are reported to inflate the reports from farmers for reasons that they think would benefit their companies or themselves". This tendency as well as under-reporting, in Thailand and the Philippines is related to the issue of misunderstanding of the importance of accurate statistics and lack of priority, which is a product of poor linkages between monitoring and planning and management.

It can be noted, that the independence or neutrality of the statistical agency from the technical agency (i.e. fisheries bureau or agency or department) tends to ensure that data from the source are faithfully reported during processing (in other words, not distorted deliberately).

3.1.4 Coordination among agencies concerned

Coordination is made necessary because monitoring and management frequently reside in different agencies or offices within the same agency. Lack of or weaknesses in coordination does not necessarily result in poorer statistics, but a stronger linkage does encourage the monitoring body to ensure cost-effectiveness, quality, timeliness and overall relevance of statistical outputs, and relevance of the output to the users. In this respect, the Philippines has constituted a Technical Working Group to put into users and producers together and address issues and concerns on how to strengthen statistics.

The situation in Vietnam where three agencies collect statistics (the Ministry of Fisheries on coastal aquaculture and marine fisheries; the Ministry of Agriculture and Rural Development on agriculture and inland fisheries including freshwater aquaculture; and the Office of General Statistics on all national statistics), might be a good case for studying the result of such a system on the various concerns about institutional arrangements and coordination, institutional priorities, resource allocation, impact on the communes and farmers who have to report more than once the same set of data, and to the field workers who have to ask farmers and communes probably the same or similar sounding set questions, and whether there are significant variations of the data collected by each agency. (The national review failed to deal with this issue so that this synthesis would not speculate on the effect of the Vietnamese system).

3.1.5 Absence of a crosschecking or validation mechanism

A common theme is “we know the data is inaccurate, but how inaccurate is it?”. Lack of data validation mechanisms leaves the reliability of raw data open to doubt and undermines confidence in all subsequent analyses. This reduces its usefulness to policy makers and may lead to inappropriate allocation of resources. Even when improvement of the data could not be achieved, indicators of accuracy would allow policy makers to assign a relative weighting to the value of statistical information in making decisions. Most importantly, incorporation of validation mechanism may not necessarily incur higher cost but can effectively improve the quality of data.

3.1.6 Over-centralized processing

Over-centralized processing is another issue – the ability to undertake basic first step processing at the local level not only enables the local level to benefit from the preliminary results (for use in their management and planning) but also reduces the burden at the central level, speeding up the aggregation of the national figures. There may also be some value in the increased sense of ownership at the local level and improved understanding of the purpose of the information collection

3.2 Non-fundamental constraints and weaknesses

3.2.1 Standard procedures and methodologies

The presence of guidelines and the capability to implement standard procedures and methodologies are not a constraint. All the countries that reported on this aspect (except Vietnam, which did not deal with it) follow standard statistical procedures and methodologies and have the systems and the manpower to implement them properly. The weakness appears to be the inability of sampling procedures to cope with systems growing multiple species and where species are farmed using various different systems, which characterize much of the small-scale aquaculture in Asia. There are instances when the sampling frame does not include a new species (introduced Taiwan tilapia in Japan or *P. vannamei* in current Thai reports) or culture system (marine cage in China), or with rapid changes in culture management system (as in the Philippines) but these are not technical manpower capability and/or ignorance of methodology issues.

3.2.2 Data processing and analytical capability

This is a constraint only in terms of the speed by which data goes through the system. It is not due to lack of capable personnel. It is because of the bureaucratic protocols, or the hardware being used. Field offices generally are ill-equipped, which can hardly be regarded as a constraint because technology (hardware and programs) are now readily available. The bureaucratic procedures is another matter: the passing on of data from one level to the next, and for crosschecking and validation take time.

3.2.3 Basic packaging and presentation of the information

This is not a constraint either; the reviews indicated that statistical data and information are properly packaged and presented, again following standard formats. However, it appears that beyond the standard packaging and presentation, there is little attempt by the agency in charge of statistics to add value to the information through a more extensive or a deeper analysis, as for instance using non-statistical information to provide a more holistic picture. Intermediate users such as researchers will have to do it themselves. For instance, researchers doing economic analyses on a commodity such as shrimp would still have to conduct their own survey to collect data on costs and returns. However, systems such as Japan's are able to integrate production information with those on number of aquaculture establishments, number of aquaculture facilities, area under culture, which are compiled by prefectures, released as a part of an annual report of fisheries production and contains some more detailed analyses.

3.2.4 Distribution

This is another factor that is not a constraint. The system is in place for publication in hard copy and, in almost all of the countries, on the web. Specific agencies and institutions are identified that are end users or as intermediate users, and routinely provided with the statistical information. The information is also available on demand.

3.2.5 Classification of production system and disaggregation of species

As to the broader issues that might impact on the classification of systems harvested, all the countries have their definitions of aquaculture as well as systems that are similar or consistent with those of FAO. Some countries however maintain different classifications of the aquaculture environment (i.e. brackishwater in the Philippines, various sub-classifications of mariculture in China) but this is only a constraint to having comparability of data across countries.

It is in fact necessary for countries that have significant culture areas in these environments and where a major species is cultured in different environments (i.e. milkfish) to have these classifications.

3.3 Classification of constraints

The reviews indicated three types of constraint and their effect on the reliability and/or relevance and the overall usefulness of aquaculture statistics and information. Many of these constraints and their consequences are not mutually exclusive (and are common to the issues of information in the fisheries sector), e.g. inadequate resource allocation may also be due to government priority or budgetary status of government or an agency priorities.

3.3.1 Constraints caused by inadequate funding¹⁰²

- (i) insufficient field staff - not enough enumerators;
- (ii) field staff capability – enumerators training, hiring of enumerators that are inadequately trained;
- (iii) data collection and sampling procedures – probability vs. non probability: resorting to non-probability sampling or monitoring rather than proper sampling;

¹⁰² It is too simplistic to attribute lack of money or resources to a number of shortcomings, but two good examples of this are: a) the inability to conduct probability sampling despite an impeccable plan and a management system to implement it.; b) the use of available budget for other activities rather than statistics and information (this may be a national or more local policy).

- (iv) failure to validate or “triangulate” information – i.e. crosschecking with other indicators such as market data, export statistics, trade information, census data or other agencies’ records;
- (v) limited coverage preventing comparability; and
- (vi) failure to disaggregate species – the result of lack of trained enumerators or lack of time or because sampling frame does not cover it.

3.3.2 Constraints that arise due to institutional arrangements and priorities

- (i) lower priority placed on statistical and information gathering;
- (ii) inadequate information due to improper sources (informants) of primary information (i.e. informant), as well as the inability to accurately estimate production from continuous and batch harvest systems;
- (iii) lack of disaggregation of capture from culture as a policy;
- (iv) inflation of production data;
- (v) late release or publication of information;
- (vi) “neutrality” of agency tasked with statistics and information;
- (vii) timeliness and accuracy as affected by the importance placed on a species or commodity (i.e. shrimp vs. other species);
- (viii) lack of a system to crosscheck field data sent to processing centres (a supervision as well as decentralization issue – data processors office have no direct link with collectors or authority to supervise the field data collection personnel);
- (ix) lack of reports on production from new systems (i.e. marine cages) or new species (i.e. *Penaeus vannamei* or introduced tilapia);
- (x) over-collection of more parameters than are actually needed for sectoral management adding burden and cost to the system (an important point here is that data needs for management may not be included in data collection for national statistics and equally, the data collected for statistical purposes may be of limited value in management planning); and
- (xi) priority placed on high value export commodities over other domestically marketed or lower value species.

3.3.3 Lack of understanding or ownership of the information

These that are related to farmers’ and government officer’s perceptions or understanding as to the purpose of statistical data, and other factors:

- (i) underreporting or over-reporting of production data (at source);
- (ii) distortion of data (within the system);
- (iii) non-reporting of the production of a species (i.e. *P. vannamei*).

From the above constraints (as well as from the summary of the reviews (Annexes 1 and 2), we can derive indications on the key factors that impinge on reliability and relevance. There are two factors related to institutional issues and sociological issues and neither are mutually exclusive.

4 DISCUSSION

4.1 Institutional issues

Lack of resources is an indication of the relatively lower priority placed on statistics and information. However, this may be the result of a more fundamental reason arising from the lack of appreciation or poor understanding of the importance of statistics and information. A second issue is that if the statistics are not actually useful at the local level, then the local level is unlikely to place much importance in their rigorous collection.

While inadequate resources by itself has been shown not to be an issue related to the intrinsic reliability of the statistics, it does create weaknesses that in turn affect the adequacy of the data for purposes such as forecasts and developing costs and return analyses (both of these functions rely on having up-to-date information). The net effect is that information users such as researchers and industry analysts and managers as well as policy makers will not trust the overall reliability of the statistical data. Another effect is that these data users may have to conduct their own surveys while using the statistical releases only as historical information or indicators (another effect is the creation of multiple data sets that may be contradictory!). Weaknesses in statistical systems are self-reinforcing – that is, if data is perceived to be unreliable, it will not be used or taken seriously and this will tend to result in a general sense of the lack of value of the information. In such a situation is inevitable that institutions conclude that valuable resources should not be wasted on an activity that has little value.

Some of the country reviews are indicating that measures are being taken to address this situation. The establishment or strengthening of consultative and coordinative mechanisms that involve statistical agencies and user agencies to address weaknesses in the system are in already place or are being planned. This is a strong indication of the importance for ensuring that data users to appreciate the usefulness of reliable statistics and equally, that the information provided is applicable to their needs.

Statistical information may often be of little value if taken by itself, "adding value" to statistical information is achieved by the integration of statistical and non-statistical information to increases the value of the information package. The country reviews indicate that this is an ongoing effort and there are a number information products already being disseminated that combine production, market, and other relevant information. In some cases efforts are being made to tailor the information to various levels of users i.e. national, state, local and farm.

Coordination is a non-issue in terms of the reliability or relevance of statistical data. It is a broader issue of institutional linkages and cooperation, which needs to be addressed at a wider level. However, it is important to point out that researchers, advisers and industry analysts' confidence in statistical reports would improve linkages with the Research and Development sector. There would be no or little need for them to spend more research resources by having to conduct their own field surveys.

The question of timeliness and relevance is critical among decision makers, who, because of political pressure, invariably have to make decisions with or without the best available information (sometimes without any at all).

4.2 Sociological issues

The practice of deliberate overreporting or under-reporting of production and inflation of figures by farmers and/or officials seems to have the greatest impact on the reliability of statistics. This can be due to a number of reasons.

Overinflation	
<i>by officials</i>	<ul style="list-style-type: none"> • expectation of promotion or reward for a good performance • requirement to meeting centrally-determined (possibly unachievable) production targets
<i>by farmers</i>	<ul style="list-style-type: none"> • embarrassment of low production, poor performance or stock losses
Under-reporting	
<i>by officials</i>	<ul style="list-style-type: none"> • lack of actual data collection • reliance on information from others • farms are established illegally and cannot be reported
<i>by farmers</i>	<ul style="list-style-type: none"> • avoidance of higher taxation • farm or operation may not be legal (typically related to land use, possibly the species cultured)

A system of cross-checks and validation could mitigate the effect of the practice of inflating figures, while a statistical tool could be devised to compensate for under-reporting. This would require much study but could be a worthwhile undertaking by an academic institution.

To find a way to directly address this problem, it should be noted that the basic issue is that the individual's priority system places a low rating on reporting accurate figures. Avoiding taxes and being promoted are certainly more tangible and perhaps brings more immediate rewards than having a reliable set of statistics.

This is a sociological issue and needs to be addressed as such. There is indication from the Japanese system that appreciation of the importance of up-to-date and accurate data by the final users of the information, i.e. the farmers themselves, can be developed. This is achieved by devolving the management of aquaculture and troubleshooting of farming and resource problems. In this situation, the data collectors are also the data users and this ensures that the information is of reasonable quality and accuracy.

The same generic approach of stimulating perception of greater benefit and proving that it is true, can apply to the entire range of users and stakeholders of statistical information. The national reviews and the Aquaculture Millennium Conference of 2000 described various opportunities for doing so. A generalized recommendation is that there is a need for institutional arrangements that enable the various stakeholders to be more closely linked and to cooperate better by being aware of each others' needs and understanding the value of quality information.

This review sees no need to discuss in much detail the manpower and institutional capability issues, as these have been the subject of frequent discussion. The need for training in various areas of expertise and the need for facilities, equipment and programs are also well known. It might be concluded that quick rotation of manpower (making it necessary to recruit and train replacements) is also an indication of institutional priorities.

The need for equipment and programs and for following prescribed statistical procedures and methodologies are not a critical issue, although they can be costly relative to available developing country resources. It can be summarized that, if resources are available, the governments and workers in statistical agencies are now sufficiently informed to know which ones to acquire and do not need much training to learn how to use the packages and implement prescribed survey, sampling and field data validation procedures.

The country reviews also described ongoing and planned activities to address specific problems and weaknesses in their national statistical and information systems. A number of recommendations to improve systems and procedures as well as coordination among providers and users of statistical information were also elaborated

5 LESSONS DRAWN FROM THE REVIEWS

5.1 Flexibility

The Philippines' offers a positive lesson in having various options according to the level of resources available. If budgetary resources preclude the conduct of probability sampling, alternative acceptable methodology will be employed for selected provinces, and when resources allow, additional data collection such as surveys on the cost and returns of various farming system will be conducted. Persistence to one methodology regardless of financial resources available would lead to a considerable delay of the process or deterioration of the quality and consequently reduce the usefulness of the data to users.

5.2 Neutrality and professionalism

Having a separate specialized agency for agricultural statistics assures neutrality, professionalism in the agency, and focus on the mandate. The fact that it is a specialized statistical agency means there is no other function that might compete with it for staff attention and agency priorities, as would happen in an agency with various other activities. This latter lesson was pointed by the experience in Thailand and India, where statistics is only one of many other responsibilities of the Department of Fisheries. Flexible employment of various data collection methodologies mentioned above can only be possible when specialized staff who are capable of dealing with ad hoc shift of methodology are fielded for data collection.

5.3 Coordination

Having a single national agency in charge of agricultural statistics (forestry, fisheries and crop and livestock) can be expected to provide an effective coordination of national level and local level activities, which could easily become a patchwork of uncoordinated efforts. Additional benefits include its being a one-stop shop for information, and an efficient mechanism for integration – and cross-validation – of data from the various sectors of the economy. The Bureau of Agricultural Statistics (BAS) of the Philippines, as well as China and Japan's systems exemplifies this arrangement. (The opposite could be that of Vietnam). Such a national agency eliminates unnecessary duplication of efforts. It would additionally reduce the tendency to collect more data and publish information than needed.

5.4 Decentralization of responsibilities

Two positive lessons from the Japanese system are the strict neutrality of the agency, which avoids the tendency to issue figures more for the mother agency's performance image than accuracy; and the advantage of decentralization of responsibilities. Placing of responsibility of reporting on the fish-farmers cooperatives encourages fast and accurate farm data. As discussed elsewhere, the devolution of management responsibility to the FCAs of the area's aquaculture and natural resources encourages the need to have accurate data for management purposes. Japan's predominantly mariculture and commercial-scale aquaculture sector has sharpened its statistical methodologies for the sector. It is important to note that the FCA's are excellent mechanisms for dealing with a limited number of species in a close geographical area (e.g. scallop farming in a bay), it cannot provide lessons on how to deal with freshwater aquaculture, where farmers are dispersed and often culturing a wide variety of species and have little or nothing in common and few reasons to associate.

The Philippines' system decentralizes the processing and analysis of data which allows a better and faster crosschecking and validation of reports. In contrast, all the processing and analyses are done by headquarters in the case of Thailand's DOF. The slowness of this arrangement is now compounded by the fact that the field staff are no longer under the administrative supervision of headquarters, which has made crosschecking of data with field staff virtually impossible.

5.5 Appropriate methodologies for collection and recording of farm data

There are at least two situations that relate to this issue: One is the need to cope with the wide variety of farming systems especially in Asia, the other simply has to do with the ability of respondents to recall production and other information during an oral interview.

As far as the sampling frame, the identification of aquaculture systems and the methodologies are concerned, the systems of Thailand and China deal effectively with some of the unique features of freshwater aquaculture in developing countries. These include numerous small subsistence farms, integration with other commodities and

multispecies culture. However, none of the systems seem to be able to cope effectively with sporadic harvests and harvests for home consumption. It has been repeatedly demonstrated that recall type interviews are completely unreliable for collecting information regarding in historic events (such as batch or occasional harvesting). The tendency (in Thailand and the Philippines) is thus an under-reporting of the yield, which can be significant with the predominance of small subsistence farms in both these countries.

The effect of under-estimation through recall interviews also compounds the result of deliberate under-reporting of farm production. India's schedules for farm records do account for multi-species but not for batch or occasional harvests. It does appear that this is a research opportunity to enable the development of an appropriate methodology.

A basis for improving the precision of capturing farm level information could be the monitoring forms of the BAS, Philippines and the farm record sheets of India. They could be used to develop a better instrument to obtain farm data than an oral interview relying on respondent's recall. There is significant work already done in the agriculture and livestock sub-sectors and a methodological study, akin to what has been done in cropping systems, to compare the precision and cost-effectiveness of various types of obtaining farm data would improve the instruments and the methodology.

6 COMMENTS ON THE FISHSTAT AQ

The comments and suggestions received on the FISHSTAT AQ relate to:

- the details requested of the countries being different from the information that the country's system presently requires. For instance, the Philippines says it is unable to answer number of units for ponds and tanks, enclosures and pens, cages, raceways and hatchery or nursery output, as these are not covered by their regular surveys, which is focused on production, price per kilogram of produced species and aquaculture area by type of aquaculture farm;
- the inability of ground personnel or the difficulty created by the system, in which there are various people and agencies involved in the survey, to disaggregate the species by systems as in the case of India;
- the difficulty of keeping with FAO's time requirement in order to be able to provide the classification that the Questionnaire requires as with Thailand; and
- the general weakness of the Questionnaire in its inability to capture data for more varied and meaningful economic analyses. This last comment, received from Japan, provides useful suggestions to address what the reviewer perceived as aspects in need of improvement in FishStat AQ – from the perspective of the country user and in light of Japan's experiences in developing its statistical system. (These appear as Annex 3.)

7 RECOMMENDATIONS

The following recommendations are derived from the above discussion and the summary of trends (Annex 1 and 2). No reference is made on FISHSTAT AQ as Annex 3 is felt to adequately serve the purpose.

- ensure strong coordination between statistical agency and user agency, if these are under separate government bodies;
- encourage regular consultations among the statistical agency and various users (intermediate and end-users) of the information;
- in line with devolution of management responsibilities for aquaculture and aquatic resources management, encourage the decentralization of data processing and the participation of local stakeholders in ensuring reliability of data and their processing for local management purposes;

- strengthen legislation to improve clarity regarding aquaculture operations. As part of this, encourage basic-level, decentralized farm registration;
- improve usefulness of statistical data through addition of important (and streamlining/elimination of unnecessary) parameters that allow cost-and-return and other economic analyses, value-addition such as integrating them with non-statistical information, and early release of reliable data;
- develop a model for developing countries (particularly sensitive to multi-species and small-scale farms). The reviews indicate distinctive strengths and capabilities as well as advantages of each national system, which the model would incorporate. This model could be used as a basis for incremental improvements to, if not wide ranging reforms, of national systems. The subsequent efforts should include a cost-benefit study of adopting the model;
- investigate the potential for using a range of approaches to capture specific information needs (e.g. a mixture of techniques);
- improve the precision of instruments and methodologies to capture farm level data;
- identify information that can be captured through other mechanisms such as censuses, trade and market information, proxy indicators (such as feed sales, export tonnage, tax/license revenue); and
- assess the economic impacts of the various causes of unreliability of statistical data and identify the weak links in the statistical and information development and dissemination system and ways to strengthen them.

Annex 1

SUMMARY OF TRENDS FROM THE NATIONAL REVIEWS

1. THE SETTING

1.1 National practice used to identify aquaculture separately from fisheries?

The key aspects of the FAO definition of aquaculture as outlined in the *FAO Technical Guidelines for Responsible Fisheries No. 5: Aquaculture Development* are i) some kind of intervention in the rearing process and ii) individual or corporate ownership of the stock. All countries surveyed use definitions of aquaculture that are broadly comparable with the FAO definition in this regard.

1.2 Administrative structure responsible for aquaculture development, monitoring and management and whether different for marine and freshwater environments?

Administrative structures for fisheries reflect the prevailing government structure. However, there is a trend towards decentralised administration of fisheries by local government with some national level policies and programmes from the central government.

1.3 Separate legal framework for aquaculture or if it is included under fishery of agriculture law and whether the law stipulates reporting responsibilities

Aquaculture is addressed under the prevailing fisheries law; there is no separate legal framework in any of the countries surveyed. However, in some cases aquaculture is discretely recognised within the fisheries law (e.g. China, Philippines). At the time of writing (December 2003) Vietnam's fisheries law is under consideration by Parliament, it has not yet been implemented although there are several national regulations and policies (such as Sustainable Aquaculture for Poverty Alleviation) that pertain to aquaculture. In some cases aquaculture is also regulated in some cases by non-fisheries laws, such as the Environment Protection Act of India.

Reporting responsibilities are not necessarily set under fisheries law *per se*; for example reporting responsibilities are set under the Statistics Law in China, and under the Fisheries Cooperative Association Law in Japan. Details were not provided for India where fisheries are largely administered under state law.

1.4 Is there linkage and coordination between monitoring and planning and management?

All countries reported a linkage between monitoring, planning and management except for Thailand, which indicated that the linkage is not clearly implemented. Linkage appears to mainly occur at the level of provincial/state government (China, India, Japan, Viet Nam) with a feedback loop to the national government used to formulate national plans (e.g. India, Viet Nam). The feedback may take the form of national coordination meetings between national and provincial governments (India) or submission of reports by provincial government. However, the strength of these linkages both within and between levels of government is not clear.

1.5 Are reports on status and trends of aquaculture routinely prepared for management purposes?

All countries surveyed prepare regular reports at least annually, some semi-annually or quarterly (Philippines).

1.6 Main purpose of aquaculture production and the intended use?

The main purpose varies between countries and regions within countries. As a general trend the commercial sector is on the rise. Commercial aquaculture dominates in Thailand and Japan, however, subsistence aquaculture still dominates in China and is still found in the poorer areas of Thailand as well. It is still significant in Vietnam.

1.7 Main species produced and the culture methods and facilities used?

See individual country reports for details. 'Traditional' species still dominate the production of all countries but there is an increasing trend towards the adoption of new species and high value species such as shrimp, crab and marine finfish in all countries.

2 CURRENT STATUS OF NATIONAL AQUACULTURE DATA COLLECTION AND COMPILATION OF STATISTICS

2.1 Are aquaculture production statistics currently collected?

All countries surveyed collect aquaculture statistics except for India, which does not disaggregate them from fisheries statistics. However, India has plans to collect aquaculture data separately.

2.2 How often are the data collected and on what time basis? Provide a timeline indicating the approximate schedule from data collection to data availability

Data are collected at least annually by all countries, but some collect more frequently (for example, India and Philippines collect data quarterly). In some cases countries may collect certain data more frequently than others. For example Japan collects data annually except for seaweeds which are assessed quarterly.

2.3 Indicate parameters on which data are collected

The parameters are highly variable between countries but generally include some sort of assessment of biomass, price, area under culture and socio-economic details of farmers.

2.4 Who are the data clients/users? Are they involved or consulted in the planning process for collection of statistics and other information to meet their needs?

Government are the main users identified for planning purposes. The research community and large commercial sector players were also identified as important users. Little information was provided on feedback mechanisms. The Philippines has a Fisheries Technical Group that conducts consultations with regional offices to address concerns and strengthen data collection. India has an annual planning meeting of state and national fisheries agencies that could serve this function. Both India and China have recently planned or made improvements to their statistics collection systems.

Given that methodologies are generally set centrally but collected/administered by provincial authorities, the lack of dialogue between agencies or levels of government could be an issue. No mechanisms were identified for consulting non-government users of statistics.

2.5 What institution(s) is responsible for statistical data collection?

Collection is generally carried out either by fisheries agencies directly through provincial or local level staff (India, Thailand, China), or by a dedicated government statistics agency (Japan, Philippines). National-level staff are seldom directly involved in data collection. In the case of Japan, the Ministry of Agriculture has established an autonomous statistics collection body specifically to separate the function from the fisheries agencies to avoid any potential bias or distortion in reporting by government officials, as reported to occur in China.

2.6 Are there in place different methods of estimation for different production systems? e.g. intensive cage culture, semi-intensive culture in ponds etc?

Generally the methodologies are standardised within production systems, but are variable between production systems.

2.7 Provide definitions for classification terms used for data collection

There is general consensus over the definition of freshwater and marine water, but there is variation between countries in how the intertidal zone is treated. Some countries break it up into a number of zones, for example China divides mariculture into i) shallow sea culture; ii) seaport or bay culture; iii) tidal field culture. This should not be a serious barrier to aggregating data for international comparisons but a consistent approach is needed.

2.8 Describe methodology for data collection for each production typology if applicable

See papers for details on individual country treatments of different production systems.

3 DATA QUALITY, PROCESSING AND ANALYSIS**3.1 What are the key problems in collecting high quality statistical data on aquaculture?**

The fundamental problem is the collection of high quality primary data from the field. This underpins the reliability of all subsequent analyses. This is the key to the success of the Japanese system, which can obtain very good market-based estimates due to the national system of Fisheries Cooperative Associations (FCAs) and their role in administration/marketing the produce of their members.

Other countries face a far more difficult situation due to the dispersed nature of farms and numerous/highly complex marketing and distribution systems, and inaccessibility of some regions. Other common issues were a lack of human resources and funding with which to collect field data, which may restrict the frequency of data collection or lead to downsizing of sampling (Philippines). In Thailand, data collectors have been moved out to the provinces where they are often given other assignments and reducing the capacity of the head office to supervise their activities, giving concerns about reliability of data.

Deliberate misreporting is a common issue. For farmers this is mostly related to fear of taxation or regulation (which would lead to under-reporting) but in the case of China farmers may misreport in order to promote their products. There have also been instances of Chinese officials exaggerating reports in order to appear successful and obtain promotions. Japan has addressed this issue by establishing an autonomous Department of Statistics under the Ministry of Agriculture, so that fisheries staff are not involved.

A need to establish mechanisms to validate field data, to increase confidence in its reliability was expressed in the papers on China, Thailand and India.

3.2 Assessment of current quality of statistical data?

Data comparability is generally good as all countries reported that methodologies have been standardised within country. Analyses are similarly not a constraint and adequate expertise is available. However, the completeness and quality of raw data is suspect in most countries (except Japan) due to constraints on the collection and validation of field data, as described above.

3.3 Processing, storage, compilation and distribution of statistical data – is it distributed to the users identified in the previous section, how and in what form?

Data is distributed in all countries in the form of printed publications (at least an annual report or yearbook) and distributed to government agencies and researchers at national and provincial level. There is increasing interest in use of electronic media to disseminate data (such as CDs). Thailand, Philippines, China and Japan all make data available on the web, although permission is currently required to access it in China.

Japan also makes use of mass media – television, radio, newspapers - a short report is produced as results become available in April each year.

3.4 Analysis of statistical data: How is this done and by whom? Is information from other sectors/institutions outside aquaculture used to provide a more holistic status and trends reporting? How are the major issues identified and development potential/prospects estimated?

Analysis is carried out by both fisheries agencies (India, Thailand, China) and dedicated statistics agencies under the Agriculture portfolio (Philippines, Japan), depending on country. All countries except Thailand follow a decentralised approach to collating and analysing data, with analyses taking place at the provincial or state level. Higher levels of government collate the information provided by provincial authorities to generate the national view.

The major issues in Japan are identified and solved at the prefecture level (in that case through the joint efforts of the prefecture government and the Fisheries Cooperative). It is reasonable to expect that provincial governments in other countries, where they have the main administrative responsibility for aquaculture, will also perform this role.

There is no clear trend in use of external information to aid analyses, since most authors did not respond on this issue. Japan indicated that no external information is used in analyses but China indicated that some data such as customs data is used.

3.5 Presentation/packaging: Are statistical data analysed and packaged to provide information useful for management purposes, thus promoting their use by managers and policy makers?

All countries publish at least an annual statistics report, some more frequently (Philippines is quarterly, China semi-annually), and an analyses of the statistics is generally included.

3.6 Are there any metadata available – methodological notes, other sources, etc.?

India publishes manuals on data collection and catalogues of commercially important species from time to time. Japan and China also publish some methodological notes from their statistics agencies. The other countries did not respond.

4 NON-STATISTICAL INFORMATION

4.1 Is non-statistical information used to supplement the statistical data for status and trends reporting?

Non-statistical information is not used in Thailand or the Philippines, although Thailand recognised this as an issue that needs to be addressed. Others do, such as Japan (research relevant to planning), China (fisheries yearbook) and India (gear, environment, food security, livelihoods, sustainability, consumer preference and Japan).

4.2 Describe the main national non-statistical databases / information systems which are used or could be used in status and trends reporting

Sources cited include printed media – four magazines in Japan, the Census of Fishers and Farmers conducted and National Disease Reporting System by MOA in India, a Database of Fisheries Abstracts (Chinese journals) and websites.

4.3 Are there any key problems in collecting this type of non-statistical information?

Two issues were identified in the Chinese situation: i) most information is only available in hard copy and ii) some information is not available for public use. It was felt that data could be obtained from government agencies and private sector in India and Thailand.

5 DATA NEEDS AND OPPORTUNITIES FOR IMPROVING CURRENT INFORMATION ON STATUS AND TRENDS

5.1 What are the perceived national priority needs in terms of aquaculture information and why are they needed? Is the information currently collected or available from all sources meeting these needs?

Basic production data and trends were felt to be required for government planning purposes. In China, Japan and Thailand – to help anticipate and direct further development – along with farmer status (income etc). Market intelligence was also highly rated as a need for these countries and also in India, noting that accurate and timely market information is difficult to collect.

A variety of information tools – to support planning, decision making and industry development were seen as priorities in the India paper – perhaps better described as an information system. Needs identified included resource data, comprehensive GIS data sets, seed and feed data, disease management, value addition, post harvest technology and forward socio-economic projections of the aquaculture sector.

It was generally felt that information was meeting current needs at a basic level, although there was some dissatisfaction with timeliness and accuracy.

5.2 Is available information need-driven and user oriented, and is it accessible and used? What are the fundamental issues and constraints related to effective information utilization?

Information was generally regarded as needs driven and user oriented but there was dissatisfaction with the accuracy and/or timeliness in most countries (except Japan). There is insufficient detail in some information such as insufficient disaggregation by species, production systems or geographical areas (China). It was also felt that while macro-level information was useful to managers it is not useful to entrepreneurs operating at smaller levels, and that perhaps repackaging information to suit the needs of different user groups – or to make it more user friendly – would be beneficial (India).

5.3 Assess the strengths and weaknesses of the present methodology and processes for the collection, processing, analysis and dissemination of statistical data

Positive aspects included the broad coverage of statistical systems, standardised and consistent approaches, high comparability of data and the capability of resolving analyses at both the provincial and national levels. The processing and analysis of data were not seen as problems.

A number of common weaknesses were identified, most of which revolved around the capacity to collect high quality raw data from the field. Budget and human resource issues were universally identified as a constraint and the Philippines indicated that this impacted on both the frequency of sampling and on sample size. Misreporting by farmers (due to fear of taxation, etc.) is a common issue. A clear need was expressed for mechanisms to validate field data to improve confidence in its accuracy (China, India, Thailand).

The appropriateness of extrapolating across non-homogeneous environments and production systems was identified as a threat to assessments (India).

5.4 Assess the adequacy of existing non-statistical information sources

Non-statistical sources were felt to be good in Thailand and Japan, with mass media providing coverage, and inadequate in China with a limited number of print publications providing such information.

5.5 What are the constraints and opportunities in improving quality aspects of information on aquaculture (statistical and non-statistical)?

Constraints are as discussed above – inadequate budget, lack of trained staff to collect field data, lack of coordination with other information sources, and deliberate misreporting by farmers and in some cases by officials. All of these constraints have one common impact: They reduce the accuracy and quality of the raw data.

The lack of mechanisms to validate field data was seen as a serious issue with one comment that if the quality of the field data could be improved the statistics would be much more useful (Thailand).

It was suggested that meetings of personnel to familiarise them with methodologies and reconcile/validate information would be useful (India). The increasing demand for information – including from government – was identified as an opportunity (China).

6 PLANNED IMPROVEMENTS OF INFORMATION ON STATUS AND TRENDS

6.1 Describe specific plans and actions if any to improve current information

The Philippines has established a Fisheries Technical Working Group to meet and conduct workshops with Regional Offices to address issues and concerns on strengthening fisheries statistics. Similarly, India has also made efforts to improve dialogue between (and within) data collectors and processors.

The Chinese MOA will launch a plan to amend the fisheries data collection and processing system in 2004. Changes will include: Greater disaggregation of species groups; removal of data from state owned enterprises (to be reported separately on a 5 year basis); reclassification of mariculture into marine waters, tidal flats and land-based culture; extension of freshwater classification system to include fence, indoor and cage culture; value of finfish, shrimp, crabs and molluscs will be included; 1990 price system will be abandoned; system will report on fingerlings rather than fry with more species information; and data included in other reports will not be duplicated.

India has commenced an upgrade of its statistics system. This includes the disaggregation of aquaculture from fisheries data; introduction of data warehousing and electronic dissemination through web services and CDs; increased computerisation

of data handling and communication; repackaging of information to suit different categories of clientele at the local, regional, national and international levels; and strengthening of infrastructure (IT).

6.2 FAO aquaculture questionnaire (FISHSTAT AQ)

6.2.1 Describe specific problems in providing to FAO the information requested in the questionnaire, and any reasons for these problems

Country-specific issues included inability to meet reporting time frame due to domestic delays (Thailand), species data being aggregated by group and aquaculture data not being disaggregated from fisheries (India).

Another issue raised was that the reporting forms are Euro-centric; they may need to be amended to suit the Asian situation (Japan).

6.2.2 Comment on the adequacy of the questionnaire instruction sheet

The instruction sheet was deemed to be adequate. However, it was noted that the reporting agencies at national level are not necessarily the primary collectors of data (India).

Annex 2

SUMMARY OF THE NATIONAL REVIEWS ON INFORMATION FOR STATUS AND TRENDS REPORTING OF AQUACULTURE

The Setting		India	Thailand	Philippines	Japan	China	Viet Nam	Trends
Question	National practice used to identify aquaculture separately from fisheries?	<ul style="list-style-type: none"> Broadly consistent with FAO definition 	<ul style="list-style-type: none"> Broadly consistent with FAO definition 	<ul style="list-style-type: none"> Broadly consistent with FAO definition 	<ul style="list-style-type: none"> Definition similar to FAO includes ownership and intervention 	<ul style="list-style-type: none"> Definitions of aquaculture are similar to those of FAO 	<ul style="list-style-type: none"> Definition broadly similar to FAO. Freshwater plants not considered aquaculture. 	<ul style="list-style-type: none"> All broadly similar to FAO definition, involving explicit or implicit ownership / intervention.
Administrative structure responsible for aquaculture development, monitoring and management and whether different for marine and freshwater environments ?	<ul style="list-style-type: none"> Ministry of Agriculture has Department of Animal Husbandry and Dairying, which has Fisheries Division (runs various national schemes) State Departments of Fisheries have most administrative authority 	<ul style="list-style-type: none"> Department of Fisheries 	<ul style="list-style-type: none"> Bureau of Fisheries and Aquatic Resources, an agency under the Department of Agriculture. BFAR has offices in the 16 Administrative regions and administers aquaculture in public waters Aquaculture in private waters is administered by Local Government Units (municipalities) 	<ul style="list-style-type: none"> Fisheries is administered by three levels of government: <ul style="list-style-type: none"> Ministry of Agriculture, Forestry & Fisheries (Fisheries Agency responsible for national policy) Prefecture governments have Agriculture Bureaus (responsible for most of the day-to-day administration) Municipal governments (where fisheries exist) 	<ul style="list-style-type: none"> State sets national policy Mariculture managed by provincial governments Freshwater aquaculture managed at county level 	<ul style="list-style-type: none"> Ministry of Fisheries is national level body Provincial Departments of Fisheries are being established in coastal provinces Aquaculture in Inland provinces is administered by Provincial Departments of Agriculture and Rural Development (belonging to the Ministry of Agriculture and Rural Development) 	<ul style="list-style-type: none"> A general trend towards decentralised administration by local government with some national level policies or programmes 	
Separate legal framework for aquaculture or if it is included under fishery of agriculture law and whether the law stipulates reporting responsibilities	<ul style="list-style-type: none"> Fisheries is administered under State law out to territorial limit No separate legal framework for aquaculture but some aspects may be regulated by other Acts (e.g. environmental Protection Act). Aquaculture Authority licenses shrimp farms 	<ul style="list-style-type: none"> No separate legal framework 	<ul style="list-style-type: none"> Fisheries Code clearly defines aquaculture which has distinct provisions Separate agency, the Bureau of Agriculture Statistics. Fisheries Bureau issues national (Annual Fisheries Profile) and regional fisheries information based on BAS statistic and export-import reports 	<ul style="list-style-type: none"> Included in national fisheries law (but clearly distinguished from wild catch) which does not stipulate reporting responsibilities for aquaculture National Fisheries Collective Association Law requires each FCA to prepare an annual report on status and trends of aquaculture 	<ul style="list-style-type: none"> Aquaculture included in Fisheries Law, not separate Reporting responsibilities are set by the Statistics Law 	<ul style="list-style-type: none"> Currently no fisheries law (under consideration by Parliament and Aquaculture will be included as a separate chapter) Aquaculture currently regulated through various policies (e.g. SAPA) and various regulations 	<ul style="list-style-type: none"> Aquaculture is generally addressed as part of fisheries law, but may be discretely recognised within it Viet Nam's fisheries law is currently before Parliament 	

Question	India	Thailand	Philippines	Japan	China	Viet Nam	Trends
Is there linkage and coordination between monitoring and planning and management ?	<ul style="list-style-type: none"> • Planning is State responsibility, usually by Fisheries Directorate, implemented by block and district officers • Annual national planning meeting of State/National departments of Fisheries and research agencies. 	<ul style="list-style-type: none"> • Linkage is not clearly implemented 	<ul style="list-style-type: none"> • BAS and BFAR under same Department; Fisheries Technical Working Group provides mechanism for consultation to improve statistics. 	<ul style="list-style-type: none"> • Yes, mostly handled at the prefecture level by both the prefecture government and FCA. 	<ul style="list-style-type: none"> • Yes 	<ul style="list-style-type: none"> • Yes. Provincial authorities prepare annual plans which are used by MOF to prepare a national annual plan, with quarterly field monitoring by the Board of the Programme for Aquaculture Development (since 1999) 	<ul style="list-style-type: none"> • Yes, mainly at the level of local government but with linkages back to national government
Are reports on status and trends of aquaculture routinely prepared for management purposes ?	<ul style="list-style-type: none"> • Yes, presented at annual review meetings 	<ul style="list-style-type: none"> • Yes, published annually 	<ul style="list-style-type: none"> • Yes. Regional and national data reviews are carried out each quarter. 	<ul style="list-style-type: none"> • Yes, annual reports are prepared by each FCA, each prefecture government, and by the MAFF (national government). 	<ul style="list-style-type: none"> • Yes, semi-annual and annual 	<ul style="list-style-type: none"> • Yes, semi-annual and annual 	<ul style="list-style-type: none"> • All countries prepare reports at least annually, some more frequently.
Main purpose of aquaculture production and the intended use ?	<ul style="list-style-type: none"> • Some commercial • [role of subsistence not provided] 	<ul style="list-style-type: none"> • Commercial dominates, some subsistence mainly in poorer areas (N/NE) 	<ul style="list-style-type: none"> • Not provided 	<ul style="list-style-type: none"> • Entirely commercial, mostly domestic consumption 	<ul style="list-style-type: none"> • Mostly subsistence but commercial sector is growing 	<ul style="list-style-type: none"> • Both subsistence and commercial 	<ul style="list-style-type: none"> • Both subsistence and commercial. Subsistence may be more common in poorer areas, commercial aquaculture is on the rise.
Main species produced and the culture methods and facilities used ?	<ul style="list-style-type: none"> • Carps, catfishes, prawns and freshwater mussels, marine shrimp and marine finfish, seaweeds 	<ul style="list-style-type: none"> • Freshwater: Tilapia, Clarias spp. Carps, gourami, snake head • Coastal: Grouper, seabass, mullets, tilapia, shrimp and mud crab • Marine: Oysters, mussels, cockles 	<ul style="list-style-type: none"> • Seaweeds (carageenophytes, Agarophytes, Caulerpa) • Milkfish, tilapia, Clarias spp., common grouper, shrimp, mudcrab, oysters, mussels 	<ul style="list-style-type: none"> • Marine finfish, molluscs and pearls • Trout, smelt, carps, freshwater pearls 	<ul style="list-style-type: none"> • Traditional species still dominate (carps, seaweeds - Laminaria & Porphyra - oysters and scallops. • High value species increasing. 	<ul style="list-style-type: none"> • Carps (Chinese, Vietnamese and Indian) • Pangassius • Tilapia • Penaeus monodon • Seaweeds 	<ul style="list-style-type: none"> • High value species increasingly prominent

Current status of National Aquaculture Data Collection and Compilation of Statistics							
Question	India	Thailand	Philippines	Japan	China	Viet Nam	Trends
Are aquaculture production statistics currently collected ?	<ul style="list-style-type: none"> • Yes, but as part of fisheries data collection (it is not treated separately) 	<ul style="list-style-type: none"> • Yes, since 1970s 	<ul style="list-style-type: none"> • Yes, since 1980 	<ul style="list-style-type: none"> • Yes, since the 1940s 	<ul style="list-style-type: none"> • Yes, since 1954 	<ul style="list-style-type: none"> • Yes. General Statistics Office has offices from commune to central level, published in annual yearbook • MOFI Information centre collects fishery data from provincial authorities 	<ul style="list-style-type: none"> • All countries collect aquaculture statistics, except India which does not disaggregate them from fisheries statistics (yet)
How often are the data collected and on what time basis ? Provide a time line indicating the approximate schedule from data collection to data availability	<ul style="list-style-type: none"> • Data collected quarterly. Time line not provided. 	<ul style="list-style-type: none"> • Data collected annually over 4 months; released 2-3 years later 	<ul style="list-style-type: none"> • Data collected quarterly or semi-annually (subject to budget constraints) • Data is published by 2nd quarter of next year 	<ul style="list-style-type: none"> • Most data collected annually (short analysis released 4 months later, full analysis a further 12 months later) • Some data (seaweeds) collected and released quarterly 	<ul style="list-style-type: none"> • Different data collected on different time basis – some monthly, some annually or semi-annually 	<ul style="list-style-type: none"> • Not provided 	<ul style="list-style-type: none"> • All countries collect data at least annually. Some collect more frequently (e.g. Quarterly in the Philippines) and some countries may collect more frequently for specific commodities like seaweed (Japan)
Indicate parameters on which data are collected	<ul style="list-style-type: none"> • Varies by state, but biomass and farm gate value are commonly collected. 	<ul style="list-style-type: none"> • See paper. 	<ul style="list-style-type: none"> • Surveys are carried out by major production system (see paper) 	<ul style="list-style-type: none"> • See paper for details 	<ul style="list-style-type: none"> • See paper for list 	<ul style="list-style-type: none"> • Not provided 	<ul style="list-style-type: none"> • Highly variable, but generally biomass, price, area and farmer details collected
Who are the data clients/users ? Are they involved or consulted in the planning process for collection of statistics and other information to meet their needs ?	<ul style="list-style-type: none"> • National and state governments, academia and financial organizations. 	<ul style="list-style-type: none"> • Government planners, managers, researchers, large farmers, academia 	<ul style="list-style-type: none"> • Government, academia, international organizations 	<ul style="list-style-type: none"> • Government fisheries agencies, fisheries economics societies 	<ul style="list-style-type: none"> • Government, academic and industry sectors 	<ul style="list-style-type: none"> • Not provided 	<ul style="list-style-type: none"> • Main users are government for planning purposes, followed by research and large commercial sector players.

Cont.

Current status of National Aquaculture Data Collection and Compilation of Statistics							
Question	India	Thailand	Philippines	Japan	China	Viet Nam	Trends
What institution(s) is responsible for statistical data collection ?	<ul style="list-style-type: none"> State Fisheries Departments collect data through their extension officers Processing is carried out by National Department of Animal Husbandry and Dairying Central Marine Fisheries research Institute collects data on marine aquaculture production MPEDA collects data on shrimp production through its field staff. 	<ul style="list-style-type: none"> Department of Fisheries. Collected by Provincial Fisheries Officers 	<ul style="list-style-type: none"> Data collected by Bureau of Agricultural Statistics under Department of Agriculture as part of collecting fisheries statistics Data processed at provincial operations centers, consolidated by region Collated at central office for national view 	<ul style="list-style-type: none"> Department of Statistics & Information. This sits under MAFF but is autonomous from the Fisheries Agency 	<ul style="list-style-type: none"> State Statistics Bureau sets procedure Collection is by local and provincial government Ministry of Agriculture collates and processes data 	<ul style="list-style-type: none"> Not provided 	<ul style="list-style-type: none"> Processing of data is centralised in some countries, decentralised in others Generally carried out by fisheries or statistics agencies Japan uses an agency autonomous from fisheries to avoid possible bias in data collection or processing
Are there in place different methods of estimation for different production systems ? e.g. intensive cage culture, semi-intensive culture in ponds etc ?	<ul style="list-style-type: none"> Data is not collected on the basis of production systems. It mainly relates to biomass and productivity. 	<ul style="list-style-type: none"> Yes, by species, culture system and by intensity of culture (in shrimp), by type of confinement (in fish), and by methods in molluscs 	<ul style="list-style-type: none"> Surveys are by major projection system and environment 	<ul style="list-style-type: none"> Yes – different methods are used for different production systems (e.g. pond, cage). But not different within a system. 		<ul style="list-style-type: none"> Not provided 	<ul style="list-style-type: none"> Standardisation of methodologies is not an issue, generally one method per production system
Provide definitions for classification terms used for data collection	<ul style="list-style-type: none"> Divided into ponds, tanks, lake & floodplain lake, reservoirs. 	<ul style="list-style-type: none"> Aquaculture divided into freshwater, coastal and mariculture 	<ul style="list-style-type: none"> Glossary provided, very detailed 	<ul style="list-style-type: none"> Use marine aquaculture and freshwater aquaculture only. 	<ul style="list-style-type: none"> Mariculture divided into: <ul style="list-style-type: none"> Shallow sea culture Sea port of bay culture Tidal field culture Pond, lake, river, reservoir Paddy Others 	<ul style="list-style-type: none"> Not provided 	<ul style="list-style-type: none"> Generally consistent treatment except for classification of tidal zone and near-shore/coastal areas.
Describe methodology for data collection for each production typology if applicable	<ul style="list-style-type: none"> Stratified two stage cluster sampling design, see paper. 	<ul style="list-style-type: none"> Stratified sampling methods, see paper 	<ul style="list-style-type: none"> Probability and non-probability surveys Conducted semi annually to quarterly basis 	<ul style="list-style-type: none"> Fisheries census (every 5 years) Market-based estimates through FCA system 	<ul style="list-style-type: none"> Representative sampling and extrapolation 	<ul style="list-style-type: none"> Not provided 	<ul style="list-style-type: none"> Japanese system of market based estimates is probably the best, due to the role of the FCAs in marketing members products

Data quality, processing and analysis						
Question	India	Thailand	Philippines	Japan	China	Trends
What are the key problems in collecting high quality statistical data on aquaculture ?	<ul style="list-style-type: none"> Dispersed nature of farms Farmers reluctant to cooperate Varying farm systems and productivity Absence of uniform mechanism and inadequate machineries for collection of systematic data Inaccessibility of certain regions and 'unofficial' marketing channels 	<ul style="list-style-type: none"> Enumerators recently moved out of head office into provinces where they are often given other assignments reducing their time spent on statistics (provinces don't see statistics as priority) FSIT has no jurisdiction over provincial officers and can't supervise them, so accuracy of data is in doubt Downsizing of FSIT, not enough staff Delay in field data collection, incompleteness Lack of cooperation from farmers Downsizing of FSIT 	<ul style="list-style-type: none"> Budgetary support forces downscale of sampling Have to prepare own inventory of aquaculture establishments as national census is not frequent enough to track changes in the industry 	<ul style="list-style-type: none"> No problems 	<ul style="list-style-type: none"> Less diverse collection methodologies Deliberate misreporting by farmers Inadequate monitoring in data collection Lack coordination with other national sources of information Lack of statisticians esp. at local level Some parameters for data collection are out of date 	<ul style="list-style-type: none"> Fundamental problem is the collection of high quality primary data. This is the key to the success of the Japanese system. Other countries face a more difficult situation due to dispersed farms and marketing mechanisms Lack of funding and human resources to collect good field data is an issue and may affect sampling Deliberate misreporting by farmers (all) and distortion by officials (China) are problems Lack of a mechanism to validate field data is a shared problem Timeliness is an issue
Assessment of current quality of statistical data ?	<ul style="list-style-type: none"> Not provided, however analyses follow standardised procedures. 	<ul style="list-style-type: none"> Comparability is good as methodology is standardized Some doubts over reliability 	<ul style="list-style-type: none"> Not provided, but data are reviewed at provincial and national level 	<ul style="list-style-type: none"> Good quality, complete and highly comparable data 	<ul style="list-style-type: none"> Comparable between regions, typologies and time, and with related data sets Data mostly complete Definitions mostly consistent 	<ul style="list-style-type: none"> Data comparability is generally good as methodologies have been standardised. Analysis is generally good – adequate expertise is available Quality of raw data is suspect except for Japan, due to constraints on collection and validation of primary data from the field
Processing, storage, compilation and distribution of statistical data – is it distributed to the users identified in the previous section, how and in what form ?	<ul style="list-style-type: none"> Handbook on Fisheries Statistics published annually 	<ul style="list-style-type: none"> Four separate statistics volumes are published <ul style="list-style-type: none"> i) Freshwater Fish Farm Production; ii) Statistics of Marine Fish Farms Survey; iii) Statistics of Shrimp Culture; iv) Statistics of Marine Shellfish Culture A CD version is planned. 	<ul style="list-style-type: none"> Yes, quarterly performance and situation reports published Statistical handbook published annually in hard copy and on web 	<ul style="list-style-type: none"> Yes, distributed at national and prefecture level (sometimes local as well). Prompt report released via mass media & web by end of April Annual report of fisheries production released in April 2 years after survey 	<ul style="list-style-type: none"> Distributed to government, academia, extension stations and large companies. Published after one year in hard copy and on web (access permission needed) 	<ul style="list-style-type: none"> Data is distributed to users mostly in print. There is increasing interest in electronic media

Data quality, processing and analysis							
Question	India	Thailand	Philippines	Japan	China	Viet Nam	Trends
Analysis of statistical data: How is this done and by whom? Is information from other sectors/institutions outside aquaculture used to provide a more holistic status and trends reporting? How are the major issues identified and development potential / prospects estimated	<ul style="list-style-type: none"> Fisheries Division (MOA) carries out analyses State Departments of Fisheries also analyse their own data CMRF/CIFA provide technical support 	<ul style="list-style-type: none"> Analyses conducted by Fisheries Statistics Analysis and Research Group in central office. 	<ul style="list-style-type: none"> Data processing is decentralized – carried out at Provincial Operation Centres based on system developed at Central Office. Regional summaries are prepared by Regional Operational Centres and sent to Central Office for the national view 	<ul style="list-style-type: none"> Analysis is done at both national and prefecture levels No external data used Major issues are identified and dealt with at prefecture level through FCAs 	<ul style="list-style-type: none"> Bureau of Fisheries, Ministry of Agriculture Some information used from other sources (e.g. customs) 	<ul style="list-style-type: none"> Not provided 	<ul style="list-style-type: none"> Both centralised and decentralised approaches are used in analysing the data, higher levels of government have regional summaries "passed up" to them Decentralised system allows better links with local government and between data collectors and processors, these may be comparable advantages
Presentation / packaging: Are statistical data analysed and packaged to provide information useful for management purposes, thus promoting their use by managers and policy makers?	<ul style="list-style-type: none"> No regular packaging of data other than the Annual publication on Fisheries Statistics Some available in print/electronic media from the central institutes 	<ul style="list-style-type: none"> Annual report published, data available on website, analysis of the statistics is included. 	<ul style="list-style-type: none"> Yes, quarterly reports generated 	<ul style="list-style-type: none"> Yes, annual report includes analyses of the data 	<ul style="list-style-type: none"> Two annual reports published: Analysis on Overall Fisheries Economic Development Situation Analysis on China Seafood Imports and Exports 	<ul style="list-style-type: none"> Not provided 	<ul style="list-style-type: none"> All countries publish reports at least annually, some more frequently, analyses of the statistics is generally included.
Are there any metadata available – methodological notes, other sources etc.?	<ul style="list-style-type: none"> Manuals on data collection or species are published from time to time. 	<ul style="list-style-type: none"> Not provided 	<ul style="list-style-type: none"> Not provided 	<ul style="list-style-type: none"> Yes, notes and species catalogue available at DSI 	<ul style="list-style-type: none"> Yes, in Chinese language 	<ul style="list-style-type: none"> Not provided 	<ul style="list-style-type: none"> Some

Non-statistical information							
Question	India	Thailand	Philippines	Japan	China	Viet Nam	Trends
Is non-statistical information used to supplement the statistical data for status and trends reporting ?	<ul style="list-style-type: none"> • Yes – gear, environments, food security, livelihoods, profitability, sustainability, consumer preference, gender etc. 	<ul style="list-style-type: none"> • No 	<ul style="list-style-type: none"> • No 	<ul style="list-style-type: none"> • Yes, gathered by sub-divisions in MAFF, e.g. research relevant to planning 	<ul style="list-style-type: none"> • Yes (e.g. China Fisheries Yearbook) 	<ul style="list-style-type: none"> • Not provided 	<ul style="list-style-type: none"> • No clear trend, but Thailand identifies this as a need
Describe the main national non-statistical databases / information systems which are used or could be used in status and trends reporting.	<ul style="list-style-type: none"> • Census of fishers and farmers (MOA) • National Disease Reporting System 	<ul style="list-style-type: none"> • Not provided. 	<ul style="list-style-type: none"> • Not provided 	<ul style="list-style-type: none"> • Two monthly magazines (Aquaculture, Aqua Net) and two farmer association magazines (National marine fish culture Association, Eel Farmers Association) 	<ul style="list-style-type: none"> • Database of Fisheries Abstracts (Chinese journals) • Bureau of Fisheries Website (news, documents) 	<ul style="list-style-type: none"> • Not provided 	<ul style="list-style-type: none"> • Some, mostly print sources not electronic databases.
Are there any key problems in collecting this type of non-statistical information ?	<ul style="list-style-type: none"> • No. 	<ul style="list-style-type: none"> • Data could be obtained from government agencies and private sector 	<ul style="list-style-type: none"> • Not provided 	<ul style="list-style-type: none"> • No 	<ul style="list-style-type: none"> • Most is only available in hard copy • Some information is not available for public use 	<ul style="list-style-type: none"> • Not provided 	<ul style="list-style-type: none"> • Generally information is only available in printed form, and in China not all information is publicly available

Data needs and opportunities for improving current information on status and trends							
Question	India	Thailand	Philippines	Japan	China	Viet Nam	Trends
What are the perceived national priority needs in terms of aquaculture information and why are they needed? Is the information currently collected or available from all sources meeting these needs?	<ul style="list-style-type: none"> • Resource data • GIS data sets • Seed and feed data • New species/breeds • Disease management • Soil/water testing • Value addition • Post harvest technology • Market intelligence and trade information • Incentives and schemes for financing aquaculture • Projections of aquaculture sector, contribution to GDP, employment, exports, food security and poverty alleviation 	<ul style="list-style-type: none"> • Needed for planning and research 	<ul style="list-style-type: none"> • Not provided 	<ul style="list-style-type: none"> • Not provided (but existing data meets needs) 	<ul style="list-style-type: none"> • Priority areas are aquaculture production, farmer status and markets • Needed for government & industry to realize status and direct the trend of further development • Generally meets needs, but accurate & timely market information difficult to collect 	<ul style="list-style-type: none"> • Not provided 	<ul style="list-style-type: none"> • Need basic production trends for planning purposes. • Generally meets needs but timeliness is an issue • Information tools to support planning, decision making and industry development desired (India)
Is available information need-driven and user oriented, and is it accessible and used? What are the fundamental issues and constraints related to effective information utilization?	<ul style="list-style-type: none"> • Could be more user friendly • Mostly macro-level information, good for managers but not for entrepreneurs operating at micro level 	<ul style="list-style-type: none"> • Information is available but not very accessible to farmers 	<ul style="list-style-type: none"> • Not provided 	<ul style="list-style-type: none"> • Yes 	<ul style="list-style-type: none"> • Yes. Constraints are timeliness and accuracy; and lack of detail of some information (insufficient disaggregation of species, systems, or geographical areas), deliberate miss reporting 	<ul style="list-style-type: none"> • Not provided 	<ul style="list-style-type: none"> • Available, but: • Timeliness is an issue • Insufficient detail available, could be repackaged to make it more useful to different user groups
Assess the strengths and weaknesses of the present methodology and processes for the collection, processing, analysis and dissemination of statistical data	<ul style="list-style-type: none"> • Strength: Broad coverage • Weakness: Reliability of primary data from farmers, size of sampling and appropriateness of extrapolations in non-homogeneous environments threaten assessments 	<ul style="list-style-type: none"> • Strengths: Comparability is good • Weaknesses: Delays in reporting and publishing, staff shortages, many experienced officers will soon retire, data validation, budget 	<ul style="list-style-type: none"> • Not provided 	<ul style="list-style-type: none"> • Strength: Can provide analysis at both national and prefecture level • Constraints: Limited budget and staff 	<ul style="list-style-type: none"> • Strengths: Current process is well organized and standardized, and consistent. • Weaknesses: Lack of monitoring in data collection (validation), deliberate misreporting 	<ul style="list-style-type: none"> • Not provided 	<ul style="list-style-type: none"> • Processing, analysis, comparability and distribution of data are not issues • Main problems relate to the collection of high quality primary data • Validation of primary data needed • More funding/staff for primary data collection needed

Data needs and opportunities for improving current information on status and trends							
Question	India	Thailand	Philippines	Japan	China	Viet Nam	Trends
Assess the adequacy of existing non-statistical information sources	<ul style="list-style-type: none"> Not provided 	<ul style="list-style-type: none"> Not used but seem to be available. 	<ul style="list-style-type: none"> Not provided 	<ul style="list-style-type: none"> Good, mass media provide coverage 	<ul style="list-style-type: none"> Not adequate. Sources are: <ul style="list-style-type: none"> China Fisheries Yearbook China Fisheries magazine China Fisheries Economy magazine 	<ul style="list-style-type: none"> Not provided 	<ul style="list-style-type: none"> Good in Japan and Thailand, not good in China
What are the constraints and opportunities in improving quality aspects of information on aquaculture (statistical and non-statistical) ?	<ul style="list-style-type: none"> Inadequate infrastructure to validate the data Familiarisation of personnel with methodologies and on ground realities would be beneficial, as would national and regional meeting of personnel to reconcile and validate information. 	<ul style="list-style-type: none"> Strengths: Staff experience, methodology and infrastructure is good Weaknesses: Not enough staff, no validation of data, no non-statistical information, delays Constraints: FSJT not seen as priority, low budget/staff; moving officers to provinces has reduced available manpower due to other assignments Opportunities: If the key problem of field data quality can be improved the statistics will be much more useful. 	<ul style="list-style-type: none"> Insufficient budget is major constraint, forcing downsizing of sampling sometimes 	<ul style="list-style-type: none"> No constraints No opportunities identified 	<ul style="list-style-type: none"> Constraints: <ul style="list-style-type: none"> Data collection methodologies less diversified Lack of effective monitoring in data collection Lack of coordination with other national information sources Lack of statisticians, especially at local level Lack of funding Some collection parameters are outdated Bureaucracy and corruption Lack of accessibility for public information users Opportunities: <ul style="list-style-type: none"> Increasing market demand for information WTO entry has increased pace of internationalization Information has become a top priority after China joined GDDS Statistics Law recently amended 	<ul style="list-style-type: none"> Not provided 	<ul style="list-style-type: none"> Constraints include budget, training and staff for collection of primary data Lack of coordination with other information sources is an issue Misreporting and deliberate distortion are issues An opportunity is the increasing demand for information

Planned improvements of information on status and trends						
Question	India	Thailand	Philippines	Japan	China	Viet Nam
Describe specific plans and actions if any to improve current information.	<ul style="list-style-type: none"> Data warehousing, along with more dissemination in terms of CDs, internet and online services for different clientele groups Need to increase computerization of data handling & communication Efforts are underway to collect aquaculture data separately from fisheries data Data needs to be upgraded to provide different categories of information at the national and international, regional and local levels so that it can be used by different types of clientele Strengthening the infrastructure – computers, data storage, web access and non-statistical data 	<ul style="list-style-type: none"> None 	<ul style="list-style-type: none"> Fisheries Technical Working Group meet & conduct workshops and consultations with Regional Offices to address issues and concerns on how to strengthen fisheries statistics Plans and programs for a national inventory of all type of aquaculture farms are in progress. 	<ul style="list-style-type: none"> None 	<ul style="list-style-type: none"> MOA launch plan to amend fisheries data collection and processing system in 2004. Species will be categorized in broad groups Data from state owned enterprises will be removed and reported separately on a 5 year basis. Mariculture production systems will be reclassified into marine waters, tidal flats and land-based culture Freshwater production system classification will be extended with the addition of fence, indoor and cage culture. Value of finfish, shrimp, crabs and molluscs will be included Current price will be used when values are calculated (abandon 1990 price system) Report on fingerlings rather than fry, more species information Data available in other reports will not be duplicated. 	<ul style="list-style-type: none"> Not provided
						<ul style="list-style-type: none"> Efforts to improve dialogue between (and within) data collectors and processors Efforts to improve data collection and processing systems, and to provide greater detail (e.g. regarding species, value etc) India is looking to disaggregate aquaculture from fisheries statistics Provide information more relevant to the needs of specific user groups

FAO Aquaculture questionnaire, FISHSTAT AQ							
Question	India	Thailand	Philippines	Japan	China	Viet Nam	Trends
Describe specific problems in providing to FAO the information requested in the questionnaire, and any reasons for these problems	<ul style="list-style-type: none"> National data largely pertain to capture fisheries Species data is aggregated by group (e.g. carps) 	<ul style="list-style-type: none"> DOF cannot meet reporting time frame due to delays. 		<ul style="list-style-type: none"> Forms are EU-centric 	<ul style="list-style-type: none"> Not provided 	<ul style="list-style-type: none"> Not provided 	<ul style="list-style-type: none"> Timeliness is an issue, forms may need to be adjusted to meet Asian needs
Comment on the adequacy of the questionnaire instruction sheet	<ul style="list-style-type: none"> Adequate. However the nodal agencies providing information are not the primary collectors of the data. 	<ul style="list-style-type: none"> Can follow ok. 		<ul style="list-style-type: none"> Need No. of aquaculture establishments (No. of ponds etc. useless) No linkage between two forms, this limits analyses such as farmer output and productivity/unit area Price/kg is not usually available 	<ul style="list-style-type: none"> Not provided 	<ul style="list-style-type: none"> Not provided 	<ul style="list-style-type: none"> Adequate but could be improved in some areas (see Japanese comments)
Suggest ways and means for resolving these problems at the national and international level	<ul style="list-style-type: none"> Validation is needed within country. An annual meeting would help to discuss the issues. 	<ul style="list-style-type: none"> Not provided. 		<ul style="list-style-type: none"> Combine the two forms – easier to enter national data, for FAO to process, and will improve international comparisons 	<ul style="list-style-type: none"> Not provided 	<ul style="list-style-type: none"> Not provided 	<ul style="list-style-type: none"> Japan feels the two forms should be merged to facilitate data entry and analyses

Annex 3

THE FAO AQUACULTURE QUESTIONNAIRE (FISHSTAT AQ)

1 COMMENTS AND SUGGESTIONS

1.1 Summary comments from Japan:

The present two forms of FISHSTAT AQ seem to have been designed to meet the requirements of EU member states and EU candidate countries. The present two forms for FISHSTAT AQUA are in need of thorough revision so as to suit all countries.

Fishery statistics for both capture fisheries and aquaculture are required for economic analyses as well as biological analyses. To satisfy these two requirements, at least for aquaculture the following statistics are required:

1. Number of aquaculture establishments as economic unit.
2. Number of aquaculture facilities as input item. Out of several items relating to these input items, the area of water in use is considered to be the most important items.
3. Yield (harvest) in quantity and value as output item. However, the value of the yield is the most difficult item to collect.

By having the above three items, dividing the output data by economic unit data and input data will enable a lot of useful analyses in terms of the size of fish farm, productivity per unit area/ by aquaculture facility.

When we look at the present two forms:

1. Number of aquaculture establishments is missing.
2. The number of units for aquaculture facilities may be useful for certain aquaculture systems. However, the country has to report the number of fish ponds regardless of its area. There is no country in Asia where the number of ponds is counted.
3. There is no linkage between the two forms. Therefore, analyses as referred in above is not possible.
4. The price/kg is requested for every species. In theory, it is logical. However, such a weighted price by species is not available in most countries.

[Note: In Japan, there is a fish market survey, which is divided into the survey in fish producing area and that for fish consuming area. For both areas, there are several fish markets that are selected and fixed. Based on the sales records of these markets, weighted average price by species are calculated for fish-producing area and fish-consuming area separately. Such a survey cannot be easily done by every country for reasons of resources to implement it.]

Aquaculture production data in value have been reported to FAO since 1984. Subsequently, these value data have been compiled into FAO Fishstat. However, these value data are of little use.

At present, FISHSTAT AQ has two sheets. One refers to aquaculture production methods or mean, and the other to production by species. But there is no linkage between the two sheets in terms of type of aquaculture employed such as carp culture, eel culture, shrimp culture, salmon culture, etc. Normally, aquaculture survey at country level is done separately for such type of aquaculture. Within a same type of

aquaculture, the number of establishments, the number of aquaculture facilities, area under culture and harvest in quantity are simultaneously enquired.

The instruction sheet lists only five types of aquaculture facilities. When we look at this item on global basis, there are many more different types of aquaculture facilities in use. There is a fundamental point as to whether statistics on the number of aquaculture facilities are required for all types of aquaculture or not? As an example, the number of fish ponds regardless of size has little meaning. For this reason it may be worthwhile to combine the present two different forms into one standard form as shown in the sample below.

Sample Form for Reporting Statistics on Aquaculture

Country of Area: _____ Year: _____

1. Fishes

Aquaculture Classification	Nature of Water	No of Establishments	No. of aquaculture facilities			Water Area (Ha.)	Harvest in quantity (MT)								
			Pen	Cage	?		Total	Yellow tail							
Yellow Tail Culture with cage	Marine	1,594		15,082		176	136,885	136,885							

The above will indicate roughly what is suggested, with statistics for Yellowtail Culture of Japan as an example. For the entry of species, spaces for recording 3 alpha codes would be required.

It is assumed that such a new form will be prepared for Fishes, Crustaceans, Molluscs and Seaweeds separately. Within each respective sheet, data on a single type of aquaculture, such as carp culture, eel culture, shrimp culture, oyster culture, etc. are recorded. The advantages from this revision would be as follows:

1. A reporting country will find it easier to record the information into FAO forms, as the survey and compilation of data for aquaculture are normally done for each type of aquaculture separately.
2. FAO will find it easier to compile aquaculture information for international comparison at least for major aquaculture species and systems such as salmon culture, shrimp culture, freshwater fish culture, etc. separately.
3. As referred earlier, international comparison with regard to various productivities will become possible.

For the above purposes, the establishment of national and international classification of aquaculture may have to be considered for Fishes, Crustaceans, Molluscs and Seaweeds separately. In light of above, FAO may wish to consider a tabulation program, by which an FAO Yearbook on Aquaculture is compiled.

The problem of a species name, which is reported at family or genus level, can be solved with the help of a national biologist.

Regarding the aquaculture production in value, FAO may wish to contact the Statistics Department of the UN (UNSD) in New York, requesting to divide "fishery" into "Capture" and "Aquaculture" in the International Standard Classification of All

Economic Activities (ISIC). Japan has already done it. There may be some other countries that have done such a division. In those countries, the production data of capture and aquaculture in value are available separately, and have reported them to the UNSD as part of their National Account data.

Another option is for FAO to request national fishery statisticians to contact an office in charge of the National Account to divide the total fishery production in value into “Capture” and “Aquaculture”. In this way, the production data in value of both capture and aquaculture will become available simultaneously. Such data may be more comparable and keep some consistency among countries.

Latin America regional synthesis: information for status and trends reporting on aquaculture¹⁰³

1 INTRODUCTION

The present review is the result of the integration of the National Reviews of Information for Status and Trends Reporting (NatRISTA) from Brazil, Chile, Cuba, Ecuador and Mexico.

The main objective of the present document is to describe the legal structure for aquaculture development and monitoring in these countries, as well as the overall strategy employed by their national aquaculture authorities for collection, processing and distribution of aquaculture statistics.

The information provided in this document derives from a series of revisions and analyses of aquaculture statistical reports and direct interviews with fisheries and aquaculture statistics personnel of national offices, compiled by the authors of the National Reviews.

It highlights the main problems associated with the collection of high quality, wide spectrum aquaculture information for policy and decision-making processes, and identifies the needs and opportunities for improving current information on the status and trends in the aforementioned countries which represent the most important aquaculture-producing nations of Latin America.

2 SUMMARY AND TRENDS FROM THE NATIONAL REVIEWS

2.1 The Setting

2.1.1 What is the national practice used to identify aquaculture separately from fisheries?

Although the NatRISTA of some of the countries included in this review do not incorporate a legal or technical definition for aquaculture or fisheries, it is possible to deduct from these documents that there are some common “key” words in defining aquaculture practices among these countries. Nonetheless, in the case of Cuba, there seems to be no clear distinction between aquaculture and fisheries, at least not in the legal statement regarding aquaculture practices.

Countries like Ecuador and Mexico have distinct legal frameworks for fisheries and aquaculture, which separates aquaculture legally and in practice from fisheries.

¹⁰³Prepared by Alejandro Flores-Nava (Center for Research and Advanced Studies, Merida, Yucatan, Mexico).

TABLE 1.
Summary of official and/or practical means of identifying aquaculture practices in Brazil, Chile, Cuba, Ecuador and Mexico.

Country	Legal definition of Aquaculture	Practical means of identifying aquaculture practices	Reported problems associated to undefined separation of aquaculture and fisheries	Source
Brazil	NS*	Official specific aquaculture statistics forms. Specific aquaculture licenses and permits.	Unclear boundaries regarding the legal attributes of different government offices in relation to aquaculture and fisheries	National Review of Information for Status and Trends Reporting in Aquaculture of Brazil, 2002
Chile	NS	Aquaculture farms have a legal obligation to register at a specific national aquaculture database. Official specific aquaculture statistics forms.	None reported	National Review of Information for Status and Trends Reporting in Aquaculture of Chile, 2002
Cuba	NS	Official specific aquaculture statistics forms.	None reported	National Review of Information for Status and Trends Reporting in Aquaculture of Cuba, 2002
Ecuador	"Cultivation of bioaquatic resources in captivity, stemming from the recollection of wild seed".	Official specific aquaculture statistics forms. Specific aquaculture licenses and permits.	None reported	Definitions provided by the National Review of Information for Status and Trends Reporting in Aquaculture of Ecuador, 2002.
Mexico	"The cultivation of species of aquatic flora and fauna through the use of methods and techniques for their controlled development in any phase of their biological cycle and in any aquatic environment"	Aquaculture farms have a legal obligation to register at a specific national aquaculture database. Official specific aquaculture statistics forms. Specific aquaculture licenses and permits.	Unclear separation of enhanced fisheries and aquaculture	The Fisheries Law of Mexico. Article 101. National Review of Information for Status and Trends Reporting in Aquaculture of Mexico, 2002

NS= Not specified.

Note that in the case of Ecuador, the aquaculture definition provided in the NatRISTA stresses that seed stems from the wild, which can be misleading or restrictive

2.1.2 Is there an administrative structure responsible for aquaculture development, monitoring and management?

The administrative structure responsible for aquaculture activities varies between countries in Latin America. Chile and Ecuador have a specific Under-secretary for fisheries; the former is dependent of the Ministry of the Economy, while the Ecuadorian entity is part of the Ministry of Foreign Trade.

In Mexico, the recently created (2000) National Commission of Fisheries and Aquaculture (CONAPESCA), is the entity responsible for aquaculture regulation and promotion. It also has a hierarchical level that equals an under-secretariat, which is subordinated to the Secretary of Agriculture, Animal Husbandry, Rural Development, Fisheries and Food (SAGARPA).

The Ministry of Fisheries (MIP) is the official entity responsible for coordinating and regulating the use of fishery and aquaculture resources in Cuba, through two state-owned enterprises: INDIPES, focused on inland aquaculture, and GEDECAM, specifically oriented to shrimp farming.

Brazil has recently created (2002) a Special Secretariat for Fisheries and Aquaculture (SEAP). This could well be the highest ranked official entity for aquaculture among all Latin American countries, since it falls directly under the responsibility of the President of the Republic.

Besides the main structures presented above, there are countries with confederated states, such as Brazil and Mexico, which also have strong provincial (state) aquaculture authorities whose main objectives are to foster local/state aquaculture development. Such state authorities function under the national (federal) framework for aquaculture. Moreover, they are supposed to work in close coordination with national aquaculture authorities in planning and monitoring aquaculture in their corresponding regions.

Of the reviewed countries, only two (Cuba and Ecuador) have different authorities for marine and inland aquaculture. In Cuba, the state-owned company INDIPES, is responsible for inland/freshwater aquaculture, including subsistence (rural) aquaculture, whilst coastal aquaculture (mainly shrimp farming) is managed exclusively through another state-owned enterprise, called GEDECAM.

In Ecuador, coastal aquaculture (which is by far the most important of the country by value and volume), is regulated by the Under-secretary of Fishery Resources, while freshwater aquaculture at all levels, is regulated by a multi-sectoral entity, the Environmental Management Commission, which is constituted by a number of government offices and resource users (i.e. farmers associations).

TABLE 2.
Summary of the administrative structures responsible for aquaculture development in Brazil, Chile, Cuba, Ecuador and Mexico.

Country	Ministry	Agency/Office directly responsible for aquaculture	Objectives/legal attributes	Decentralized offices
Brazil	Presidency of the Republic	Special Secretariat for Fisheries and Aquaculture	Advisory to the President for policy making regarding fisheries and aquaculture	No
	Brazilian Institute for the Environment and Natural Resources	Technical office for aquaculture permits	Assessing environmental impact and licensing.	Yes
Chile	Ministry of the Economy	Undersecretary of Fisheries	Policy making regarding fisheries and aquaculture	No
		National Fisheries Service	Fiscalization of aquaculture practices; law enforcement	Yes
Cuba	Ministry of the Fisheries Sector		Coordinating and regulating the use of fishery and aquaculture resources.	No
		INDIPES (Government-owned company)	Inland freshwater aquaculture production and commercialization.	Yes
		GEDECAM (Government-owned company)	Shrimp farming and commercialization.	Yes
Ecuador	Ministry of Foreign Trade	Undersecretary of Fishery Resources.	Coordinating and regulating the use of fishery and aquaculture resources. Licensing of coastal aquaculture operations.	Yes
		National Council for Fisheries Development	Planning, coordinating and regulating the aquaculture sector. Policy-making.	
		Regional Environmental Under-secretary.	Environmental information related to aquaculture operations.	
		Environmental Management Commission	Coordination of aquaculture efforts in inland waters	Yes
Mexico	Secretary of Agriculture, Animal Husbandry, Rural Development, Fisheries and Food.	National Commission for Fisheries and Aquaculture.	Aquaculture promotion, development, monitoring, and management. Policy making regarding the aquaculture sector.	Yes
		National Committee for Fisheries and Aquaculture	Advisory multisectoral organism.	

2.1.3 Is there a separate legal framework for aquaculture or is aquaculture included under a fishery law and does the law stipulate reporting responsibilities?

All of the countries reviewed possess general Fisheries Laws and regulations separate from their agricultural legal framework. All of these Fisheries Laws include specific chapters and regulations on aquaculture. The only country that explicitly includes aquaculture in the actual title of fisheries act is Chile, with its “General Law of Fisheries and Aquaculture”. Table 3 summarizes the main Constitutional Laws and Decrees that regulate aquaculture in the countries subject of the present document.

TABLE 3.
Summary of the legal frameworks for aquaculture in the countries subject of the present review.

Country	Country's constitutional law/act	Chapter/articles that mandate the provision of aquaculture statistics within the law.	Other regulations concerning aquaculture in the country.
Brazil	Special Secretariat for Fisheries and Aquaculture (SEAP) Decree No.221/67	NS	Decree No. 2.869/98 Gives legal attribute to SEAP for licensing aquaculture farms
Chile	General Law of Fisheries and Aquaculture (Supreme Decree No. 430)	Article 63	NS
Cuba	Constitutional Law No. 164. Use and Conservation of Marine and Freshwater Resources Act.	NS	NS
Ecuador	Law of Fishing and Fisheries Development No. 497.	Chapter II, Article No. 77.	Law of Environmental Management
Mexico	Federal Law of Fisheries	Part III, Chapter I, Articles 101-105.	Law of Waters; Federal Law of Environmental Protection.

NS = Not specified.

Chile, Ecuador and Mexico report having specific legal instruments allowing enforcement of the provision of aquaculture statistics by farmers or the facilitation of regular official inspection with such a purpose.

2.1.4 Is there linkage and coordination between entities responsible for monitoring, planning and management?

Brazil

The provision of aquaculture statistics in Brazil is not mandatory for farmers, and it is not clearly and legally defined which of the two aquaculture-regulating governmental entities (the Special Secretariat for Fisheries and Aquaculture and the Brazilian Institute for the Environment and Natural Resources) is responsible for the collection of aquaculture statistics. This makes linkage and coordination between monitoring and planning/management almost impossible.

The recently created SEAP is responsible for policy-making and planning of aquaculture in the country, and appears to have taken over the task of collecting some aquaculture statistics although not in a systematic and continuous manner. This entity is supposed to plan and promote aquaculture in coordination with the states' fisheries and aquaculture authorities. However, it is likely that planning takes place at a state level, through an effective coordination between regional farmers associations and the state authorities, with little influence from the central government.

Brazilian aquaculture farmers associations are generally well organized, have an important political weight, and there has traditionally been strong links between these organizations and state planning and management authorities.

Chile

Monitoring of aquaculture statistics in Chile is an official task of the National Fisheries Service (SNP), and planning and management is carried out by the Under-secretariat of Fisheries. Both entities work closely together, meet periodically and the aquaculture data are analyzed jointly.

Farmers associations play an important role in data collection and also participate in planning and policy-making processes.

Cuba

Planning at a national level is carried out by the Ministry of Fisheries of this country. Nonetheless, the organizational structure of the aquaculture sector, allows for local planning and management through Provincial and Basic Production Units (BPU's) which are ultimately responsible for data collection, data analysis and planning at the local level.

Coordination between the two state-owned companies responsible for aquaculture production INDIPES and GEDECAM seems to be insignificant, as they operate as completely separate enterprises.

Ecuador

Planning of aquaculture development in Ecuador is performed by the National Council for Fisheries Development (CNDP). This multi-sectoral entity includes staff of the Under-secretary of Fisheries, the Minister of the Environment, the Coastal Management Secretary, the Minister of Agriculture, a representative of the Navy and three representatives of the fisheries and aquaculture sectors: one from the Sea Fishermen Association, one from the Aquaculture Producers Association and one more from the Artisanal Fisherfolk Association.

Aquaculture data collection is carried out by both the CNDP and the Under-secretariat of Fisheries, through direct inspection visits to farmers on a regular basis. Since these two entities are also responsible for planning and management of aquaculture in the country, there is an effective link and coordination between monitoring and planning/management. Moreover, there seems to be a continuous information exchange between farmers and authorities through the CNDP which allows for participatory decision-making and planning.

Mexico

There is an official operational link between the statistics office and the aquaculture planning entity of the National Commission for Fisheries and Aquaculture of Mexico (CONAPESCA), given that the former is an administratively subordinated office of this planning office. However, the collected low-quality information is hardly used for planning and decision-making purposes.

Effective coordination between monitoring and planning entities is currently only evident in the most important aquaculture sub-sector of the country, the shrimp farming sector. Strict, systematic follow-up programs, especially those related to health and sanitation issues, are a continuous source of information for short-term decision-making and planning by CONAPESCA.

Mid to long-term, comprehensive, national aquaculture planning is conducted every six years, as a step in the process to elaborate the National and Regional Development Plans. Planning is a result of direct consultation and exchange of information between the newly-elected national and states governments, and key stakeholders of the national aquaculture industry (e.g. the National Chamber of Fisheries and Aquaculture Industry and the National Confederation of Fishermen Cooperatives).

The National Fisheries Institute of Mexico, is another official entity that participates in the planning, policy and decision-making processes made by CONAPESCA and ultimately by the Secretary of Agriculture, Animal Husbandry, Rural Development, Fisheries and Food. This research institution is responsible for carrying out scientific research on fishery and aquaculture resources, although that does not include aquaculture monitoring.

2.1.5 Are reports on status and trends of aquaculture routinely prepared for management purposes?

Apart from Cuba, where routinely aquaculture trends reports are issued for management purposes, no other country in this review does similarly.

There have been status and trends reports for specific aquaculture species in Brazil, although they have been the result of the initiative of either the academic or the private sector. These have included a ten-year national aquaculture status and trends report, carried out by aquaculture researchers and sponsored by the National Council for Research. Also, a number of status and trends reports for specific sub-sectors such as shrimp, trout and frog farming, have been sponsored by regional farmers associations and issued almost for their own member's exclusive use.

The aquaculture authorities of Chile, Ecuador and Mexico have assigned ad hoc status and trends reports on economically important aquaculture species (i.e. shrimp farming in Ecuador and Mexico, and Salmon and clam production in Chile) over time. These have been used directly for management purposes. Routine trend reporting is lacking, but under environmental or social pressure initiatives are employed on this issue.

2.1.6 What are the main aquaculture species produced and culture methods used?

Aquaculture has become, as in the rest of the world, the fastest growing food production sector in Latin America. Even though the overall production of aquaculture products of Latin America contributes less than 2 percent to the world's total aquaculture production (FAO, 2000¹⁰⁴), the economic importance of this sector to the countries included in this review is paramount.

Despite the wide spectrum of species cultured in these countries, Penaeid shrimps and tilapia dominate by volume and value, the aquaculture sector in Brazil, Cuba, Ecuador and Mexico. Salmonids are the most important cultured species of Chile. Table 4 presents the species cultured in the countries reviewed.

Most of the production is sold in international markets (e.g. shrimp, tilapia and salmon for the United States market). A wide range of other fish species are produced in small-scale farms and household ponds for household consumption and domestic market purposes (i.e. carps, largemouth bass and catfish in Cuba, Brazil and Mexico).

Culture methods and types of infrastructure are very diverse within and among countries. There are, however, some standardized culture techniques generally employed in all producing countries of the region, such as those used for marine shrimp, oysters, abalone tilapia and salmon. Annex 1 presents a summary of standard methods and types of facilities used for the cultivation of the main aquaculture species of the region. It is worth mentioning that a considerable amount of fish (tilapia, catfish bass) is produced under natural conditions in small dams and reservoirs. Hatchery-reared fingerlings are stocked in these water bodies and then harvested once they reach market size. This ranching practice is most likely reported as aquaculture production.

¹⁰⁴The State of World Fisheries and Aquaculture 2002, FAO, Rome, Italy, 2002.

TABLE 4.
Main aquaculture species of the countries included in the review.

Main culture species	Country				
	Brazil	Chile	Cuba	Ecuador	Mexico
<i>Litopenaeus vannamei</i>	+++	-	+++	+++	+++
<i>Salmo salar</i>	-	+++	-	-	-
<i>Onchorrhynchus mykiss</i>	+	+	-	-	+
<i>Cyprinus carpio</i>	+	-	++	-	+
Others Cyprinidae	+	-	+	-	+
<i>Mycropterus salmoides</i>	-	-	+	-	+
<i>Tunnus spp</i>	-	-	-	-	+
<i>Colossoma macropomum</i>	++	-	-	-	-
<i>Ictalurus punctatus</i>	-	-	+	-	+
<i>Scophthalmus maximus</i>	++	-	-	-	-
<i>Oreochromis spp</i>	+	-	+++	++	+++
<i>Crassostrea virginica</i>	-	-	-	-	+++
<i>Crassostrea gigas</i>	+	++	-	-	++
<i>Haliotis rufescens</i>	-	++	-	-	++
<i>Mytilus chilensis</i>	-	++	-	-	-
<i>Perna perna</i>	+	-	-	-	-
<i>Gracilaria spp</i>	-	++	-	+	-
<i>Cherax quadricarinatus</i>	-	-	+	+	+
<i>Rana catesbeiana</i>	++	-	-	+	+
<i>Anadara similis</i>	-	-	-	+	-
<i>Anadara tuberculosa</i>	-	-	-	+	-
<i>Pinctada mazatlanica</i>	-	-	-	+	+

+ = Few farms, small production (includes ranching); ++ = Medium-scale sub-sector, considerable production; +++ = Large scale, leading sector, very large production.

2.2 Current status of national aquaculture data collection and compilation of statistics

2.2.1 Are aquaculture production data currently collected?

Three administrative data collection schemes are identified in the countries reviewed: 1) farmers are obliged to produce statistical (e.g. production and harvest value) information to aquaculture authorities using officially distributed printed forms. This is the case of Mexico and Chile; 2) Data are collected through direct inspection by both aquaculture and environmental authorities, as in Ecuador; and 3) In Cuba basic aquaculture units (farms) are responsible for the collection of data, which are then transferred to state-owned aquaculture enterprises for management purposes. Collection of aquaculture statistics seems not to be mandatory or systematic in Brazil. Mexico and Chile have a specific office devoted to structuring, storing and distributing aquaculture statistics within the Aquaculture authority structure.

2.2.2 How often are data collected and on what time basis?

The frequency of collection of aquaculture statistics varies among the reviewed countries.

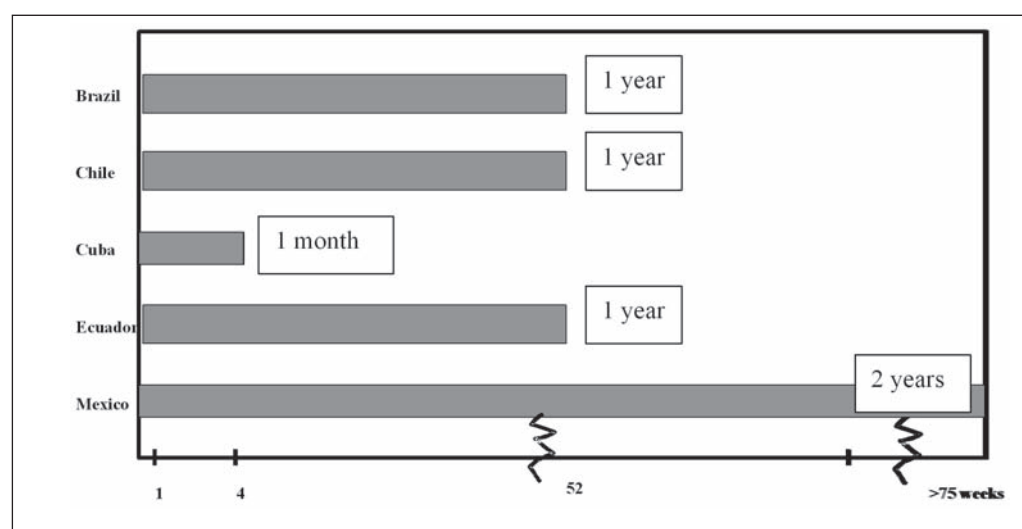
TABLE 5.
Administrative structure and frequency of collection of aquaculture statistics in countries of the region.

Country	Official entity responsible for aquaculture production statistics data collection.	Frequency of data collection	Official statistics report	Remarks
Brazil	Legally not defined. Currently collected by the Special Secretariat of Fisheries and Aquaculture	Not defined	Annual Fisheries Bulletin	Data sources are indirect, mostly farmers associations.
Chile	Department of Fisheries Statistics of the National Fisheries Service	Monthly	"Aquaculture in Numbers" Bulletin.	Data collected by farmers and transferred to NFS offices
Cuba	Basic Production Units/ Official government aquaculture enterprises INDIPEs and GEDECAM	Daily, weekly and monthly.	Not Specified	Daily and weekly reports are part of a local feedback mechanism for management purposes. Monthly reports are prepared for the Ministry of the Fisheries Sector.
Ecuador	Regional Environmental Under-Secretariat and the Under-secretariat of Fisheries Resources.	Annually	Not Specified	Ad-hoc technical reports are issued upon request of a new aquaculture permit.
Mexico	Fisheries Statistics Directorate of CONAPESCA. National Fisheries Institute	Monthly Bi-annual	Annual Fisheries Report National Fisheries Chart	Data collected by farmers and transferred to regional fisheries offices. Data collected by the National Fisheries Institute.

2.2.3 What is the average time between data collection and data availability?

The timeframe between data collection and data availability varies from country to country. While Cuba reports to have an almost real-time, accurate database for internal management purposes, there are countries like Mexico where the time period from collection to the actual publication of the information can be as long as two years.

FIGURE 1.
Timeline between data acquisition and public availability of aquaculture statistics in the countries reviewed.



2.2.4 What parameters are collected as part of the aquaculture statistics?

Two types of information are collected in the countries reviewed: a) general technical legal and socio-economic information regarding individual farms, collected as a part of their licensing process, and b) production (e.g. species, harvest weight and value) and market parameters collected in most cases with a pre-determined frequency for aquaculture statistics purposes.

Figure 2 shows a modified version of the registration form that all new aquaculture farmers are legally obliged to fill and submit to the aquaculture authorities in Mexico. The data obtained are incorporated into the National Fisheries Database. It illustrates the type of general information collected at the start of a new operation.

TABLE 6.

Summary of the most commonly collected parameters for aquaculture statistics purposes in Latin American countries.

Country	PARAMETERS								
	Species	Harvest weight	Harvest value	Stage of life cycle	No. of seed	Culture area (Ha)	Type of culture	Culture facility	Target market
Brazil	+	+	-	NS	NS		+	+	-
Chile	+	+	-	+	+	NS	+	+	+
Cuba	+	+	-	+	+	+	+	+	-
Ecuador	+	+	+	+	+	+	+	+	-
Mexico	+	+	+	+	+	+	+	+	+

Ecuador reports the collection of a number of other parameters from shrimp farms, which can be useful to construct competitiveness indicators (e.g. unit production costs, feed conversion ratios, survival rates, etc).

The actual terminology and estimation methods employed in the region regarding yields, surface areas and level of intensification (e.g. extensive, semi-intensive and intensive) is similar in the reviewed countries. This also applies to general aquaculture terminology (i.e. farm, pond, tank, cage culture, etc).

2.2.5 Who are the users of aquaculture statistics information?

With the apparent exception of Cuba, where detailed aquaculture statistics are used internally by the official aquaculture enterprises for management purposes and production figures are transferred to the Ministry of Fisheries for statistical records, all other countries in this review compile and make available the information to the general public.

The NatRISTAs of Chile and Mexico explicitly state the availability of open access web sites and electronic and printed reports, therefore targeting a wide spectrum of users. Nonetheless, farmers and other sectoral stakeholders are the primary users of this information.

2.2.6 What methodology is used for aquaculture data collection?

Most NatRISTAs lack detailed information on the actual methods for data collection. Generally speaking, the main sources of aquaculture statistics are the farmers themselves through official forms provided by the aquaculture authorities, as previously mentioned. Such is the case of Chile and Mexico, which could be taken as monthly censuses.

In Cuba, there seems to be a more accurate approach, since routine samplings in farms, especially those devoted to shrimp farming, are a regular source of information for weekly and monthly reports.

In other cases, the indirect and infrequent nature of data collection, like in the case of Brazil, does not allow for any standardization. Here, farmers associations compile the information provided by their members, who provide the data directly from their harvest reports.

TABLE 7.

Summary of aquaculture data collection methodology and sources of aquaculture statistics information in countries of the region.

Country	Official/Standard Method of data collection	Source of information
Brazil	There is not an official method the Special Secretariat of Fisheries and Aquaculture compiles information available in farmers associations.	Association farmers, which concentrate the production statistics provided by their members. Data are primarily obtained through farmers harvest reports.
Chile	Official forms are provided to farmers, which report all harvest activities of the farm	Farmers monthly reports
Cuba	Routine samplings in farms, as well as censuses at harvests.	Basic Production Units (farm managers)
Ecuador	Cyclical inspection and review of log books by the national aquaculture authority staff.	Farmers log books
Mexico	Official forms are provided to farmers, which report all harvest activities of the farm	Farmers monthly reports

2.3 DATA QUALITY, PROCESSING AND ANALYSIS

2.3.1 What are the key problems in collecting high quality statistical data on aquaculture?

A number of common problems are identified regarding the collection of high quality statistical data on aquaculture in the region. Difficulty in reaching remote areas and farms seems to be the common denominator for voids in the monthly reports of all countries.

The lack of an effective on-site data validation mechanism in Brazil, Chile and Mexico, as well as the lack of a legal framework and definition of data collection duties within the federal government of Brazil, makes the quality of the data unreliable in most cases.

Strong economic aquaculture sub-sectors such as the shrimp farming sector of Ecuador, Mexico and Brazil, and the salmon farming sector of Chile, are backed by well organized farmers associations whose members are more aware of the importance of trends monitoring, thus devoting efforts and financial resources to such a purpose. Some of these farmers' organizations possess more detailed, up-to-date, high quality statistics, particularly of their corresponding sub-sector, than governmental offices.

Apart from Cuba, where target users of aquaculture statistics are the aquaculture companies themselves, (and data collection is thus a routine management procedure), the allocated budget of reviewed countries for data collection is generally too low. This only allows for low quality, often imprecise or biased information provided by farmers, accentuated by the inability of the aquaculture authorities to corroborate it through physical inspection. In this regard, only Ecuador reports that it is mandatory for farmers to allow cyclical (annual) inspections and revision of their log books by the national aquaculture authorities. The frequency of inspections, however, may limit the scope of trends analysis.

In Chile, a cross-checking of information between farm harvests reports and input/output reports from processing plants is carried out. This allows for some sort of validation of the accuracy of the information provided by the farmers.

TABLE 8.

Summary of the reported problems in collecting aquaculture statistics in the region.

Country	Reported problems
Brazil	<ul style="list-style-type: none"> • Inconsistency of data collection. Authorities depend on good will of farmers association. Lack of budget and trained staff for statistics data collection. • Problems to compare aquaculture statistics over time, due to a wide variety of sources and methods used for collection. • Lack of staff for in situ corroboration of statistics provided by farmers.
Chile	<ul style="list-style-type: none"> • Low interest and low importance given by farmers of some sub-sectors, to aquaculture monitoring, resulting in inconsistent provision of data. • Lack of staff for in situ corroboration of statistics provided by farmers.
Cuba	<ul style="list-style-type: none"> • Time gaps and voids due to geographic inaccessibility of a number of inland farms.
Ecuador	<ul style="list-style-type: none"> • Scarcity of funds for data collection, only allows for annual inspection of farms and collection of production reports from farmers.
Mexico	<ul style="list-style-type: none"> • Lack of staff for in situ corroboration of statistics provided by farmers. • Lack of a mechanism to update technical, socio-economical and dimensional information of individual farms.

2.3.2 Processing, storage, compilation and distribution of statistical data – is it distributed to the users identified in the previous section, how and in what form?

Brazil

Aquaculture statistics in Brazil have traditionally been compiled on an annual basis by the Brazilian Institute of the Environment and Natural Resources (IBAMA). However, the recently created Special Secretary of Fisheries and Aquaculture, has taken over this task. Gross statistics of production (species, harvest weight and value) are obtained mostly from regional (state) farmers associations, which send them once in a while to IBAMA. Data processing only includes sorting by species and region. Sorted data are stored electronically although no specific data base seems to be available. Data are tabulated and presented annually in the Annual Fisheries Bulletin, which until recently was also published by IBAMA.

Chile

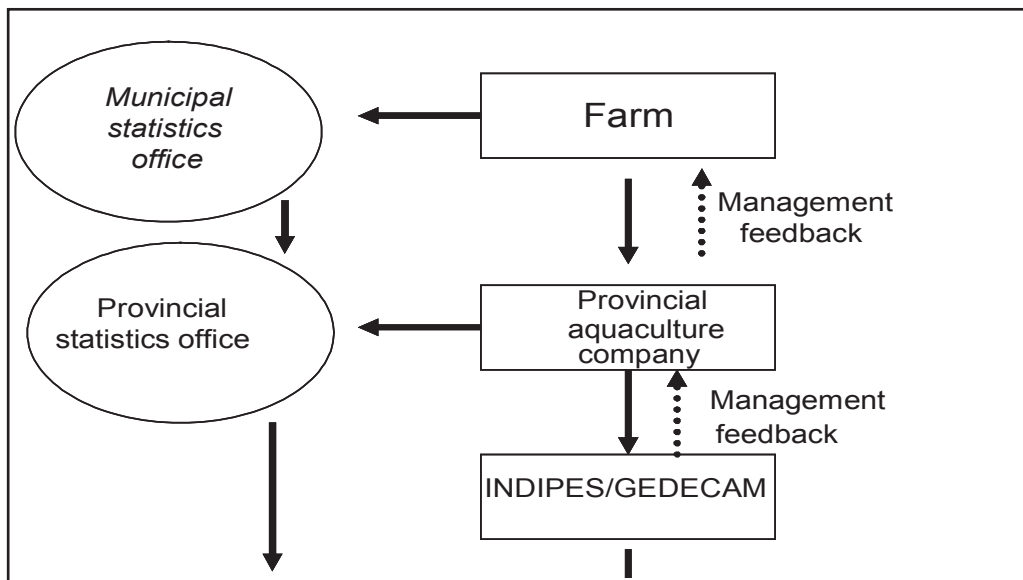
Farmers are obliged to collect the official statistics forms provided by the National Fisheries Service through their regional offices. Forms have to be filled and handed to the nearest NFS regional office within the first five days of each month. Recently an electronic form has been made available to farmers for them to report directly. The data collected are brought together by the Department of Fisheries Statistics of the National Fisheries Service, who is responsible for sorting, tabulating and publishing the data. There is a new, parallel publication that also uses the data collected officially by the NFS, as well as other useful data regarding culture surface area licensed, number of new permits issued, quantity and species exported, etc. This is published by the Department of Fisheries Management of the NFS, through the bulletin *Aquaculture in Numbers*, which is issued every six months.

Cuba

There is a two-way path in the process of transferring the information to target users. Both start with the collection of data directly by the farms through their routine sampling and censuses. The first path includes the concentration of statistical information by the Provincial Aquaculture Company, which manages a number of farms in each region of the country. Each Provincial Company transfers the statistical information to the National headquarters of INDIPES or GEDECAM, depending on whether it cultures fish or shrimp. Finally the information is transferred to the Director of Planning and Finances of the Ministry of the Economy. Processing includes structuring by species,

farm, region, overall production weight (if it corresponds to grow-out facilities), and number of allevins or post-larvae produced (in the case of hatcheries). The second path involves statistical information (e.g. production weight by species) generated by farms and sent through a series of administrative offices to the National Statistics Office (Figure 3).

FIGURE 3.
Aquaculture statistics pathways in Cuba



Ecuador

Aquaculture statistics collected by staff of both the Under-secretariat of Fisheries and the Regional Under-secretariat of Environment are distributed to the government and producers associations that constitute the National Council for Fisheries Development. Each member of this Council uses the information for their own purposes, therefore data processing and storing is carried out in different ways by each user, including farmers associations.

Mexico

All fisherfolks and aquaculturists in Mexico are legally obliged to register at the National Fisheries Database (RNP), as a condition to obtain their operation permits (Figure 4). The RNP is a centralized database which collects information of two types:

- a) Technical information (type and dimensions of the infrastructure of the farm).
- b) Basic economic and legal information of the permit holder (i.e. company, public institution or cooperative).

This information, as well as the monthly reports of harvests and larval production from each farm, are sent via e-mail (no intranet), to be introduced in the Integrated Fisheries and Aquaculture Operations Database (SIROPA), managed by the office of the Director of Fisheries Statistics, in the city of Mazatlan, Sinaloa, headquarters of CONAPESCA. This database is not accessible to public users, although specific information can be obtained through online request.

All ponds/tanks/cages, etc harvested in one day, are reported in a single form (harvest or production form). Farmers have a legal obligation to submit all forms of the monthly period on the last day of each month. Forms are directly taken by farmers to any regional fisheries offices, coordinated by the fisheries deputy delegate of the corresponding state.

Staff of the regional fisheries offices concentrates the information in two reports:

- The *monthly production report*, where all harvest volumes are added up and labeled as “culture”, as opposed to “capture”.
- DROP30 form, which basically provides the aquaculture statistics by species, presentation and farm.

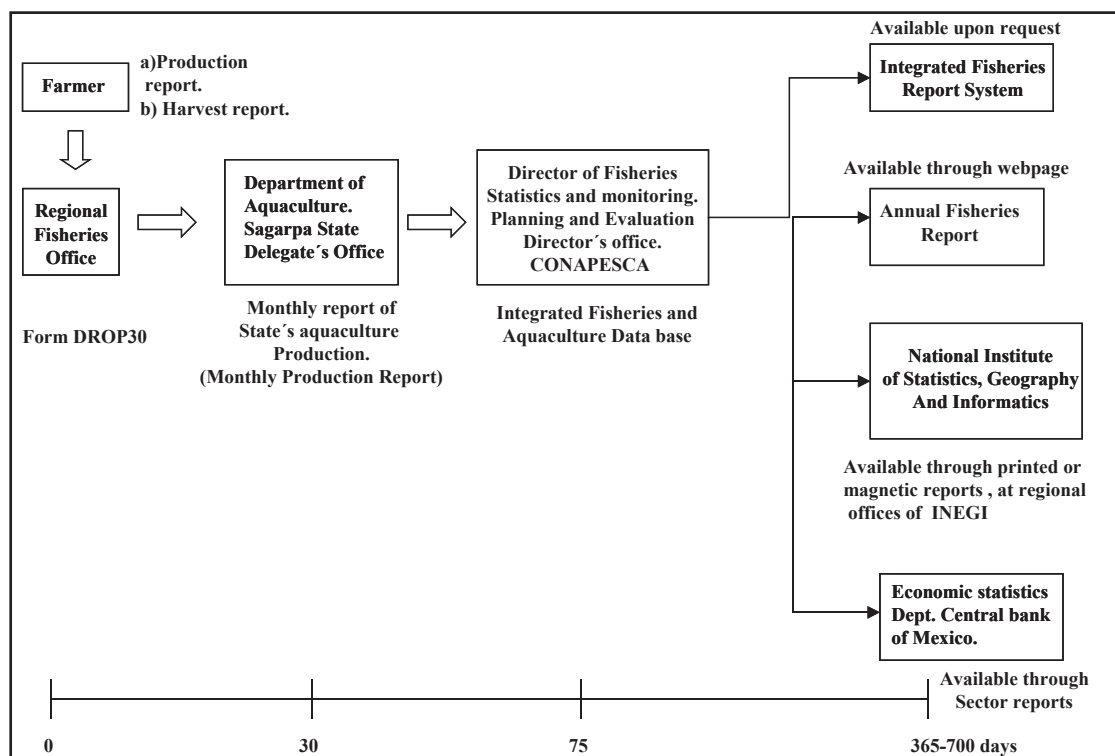
Information is passed-on to the Aquaculture Department of the corresponding state Fisheries Deputy Delegate’s Office. Both the monthly production and the DROP30 forms, are also sent via e-mail to the Director of Fisheries Statistics Office of CONAPESCA in Mazatlan, Sinaloa. All technical, legal and economic information of newly opened farms is added to the SIROPA database. Production statistics from all states of the country (Monthly Production Reports), as well as regional DROP30 reports are processed through two simple steps: i) separation of production and harvest value by individual farm through its RNP registration number, and ii) structuring production statistics by species, state, and by purpose of production (i.e. commercial or household consumption).

Once processed, the information is also stored in the Integrated Fisheries and Aquaculture Operations Database (SIROPA) of CONAPESCA.

Aquaculture statistics are tabulated and sent to three government entities:

- The National System for Agricultural and Fish Food Statistics of SAGARPA.
- The Economic Statistics Office of the Central Bank of Mexico.
- The National Institute of Statistics, Geography and Informatics.

FIGURE 4.
Aquaculture statistics and related information pathway in Mexico



2.4 NON-STATISTICAL INFORMATION

2.4.1 Is non-statistical information used to supplement the statistical data for status and trends reporting?

Even though non-statistical information seems to be gradually increasing in aquaculture statistics reports of the region, there is not a structured, systematic and coordinated program for direct collection of this information within the aquaculture sector of the countries reviewed.

Non-statistical information is only used to complement aquaculture information in ad hoc trends and sectors analysis are usually carried out by the academic institutions.

The sources of non-statistical information are also diverse, although most information comes from government offices such as General Statistics entities, central banks offices at Ministerial level, universities and research centers.

In order to illustrate the type and sources of non-statistical information used or with potentially useful information for analysis and trends monitoring of aquaculture sectors in the region, a list of Mexican entities whose databases contain relevant information.

TABLE 9.
Mexican non-statistical information/dataBases hat ontain useful information for aquaculture trends analysis.

Report/Data base	Type of information	Agency/office	Target users	Accessibility
National programme of Fisheries and aquaculture (2001-2006)	Policies, specific programs, mid-term goals and structural changes for the aquaculture sector for the next six years.	Secretary of Agriculture, animal husbandry, rural development, fisheries and food.	All economic sectors	Free access through Internet
States' programmes of coastal zone management	Coastal zoning. Spatial information on zones for aquaculture development.	States governments	Social and economic sectors that are users of coastal zones	Limited. Most still under elaboration.
States' programmes of fisheries and aquaculture development	Regional programs for fostering aquaculture development. Financing.	States governments	Fishermen, aquaculturists and related economic sectors.	Limited. Available upon official request.
Mexican Official Norms (NOM's)	Norms and regulations related to aquaculture operations.	Secretary of the Environment and Natural Resources (SEMARNAT)	All sectors involved in aquaculture.	Free access through internet, and printed brochures from SEMARNAT.
National system of market information	Market trends. Price tendencies both nationally and internationally. Thematic data bases.	Secretary of the Economy	All economic sectors	Free access through internet
Bulletin of export opportunities	Information on volume and frequency of demand of specific aquaculture products.	Mexican Exports Bank	All economic sectors	Free access through internet and monthly bulletins

2.5 DATA NEEDS AND OPPORTUNITIES FOR IMPROVING INFORMATION ON STATUS AND TRENDS

2.5.1 *What are the perceived national priority needs in terms of aquaculture information and why are they needed?*

There is much to be improved as far as the quantity, type and quality of the information needed for adequate status and trends analysis in Latin America.

2.5.2 *Are there additional information requirements? If yes, which ones?*

The number of key variables collected from individual farms should be expanded in order to create indicators to evaluate the competitiveness between individual farms, regions or countries. Also, the relative competitiveness of a nation's aquaculture sector (i.e. shrimp farming) in relation to the world industry, could be monitored through such indicators.

Technical variables including fish growth, survival, food consumption and stocking densities, can and should be collected and reported on a routine basis, either using farmers' culture log books, or directly through on-pond population samplings, or a combination of both. Assisting those farmers that do not have the knowledge/capacity to do so, this would allow for better inter-farm comparison of performance, thus generating regional and national reference values.

Other farm-generated information relevant to management purposes, include energy consumption and environment related variables such as water volume/exchange and chemical characteristics of wastewater.

Relevant supplementary information for planning and management in the aquaculture sector should include the following variables:

- i) Price fluctuations of cultured species in regional, national and international markets.
- ii) Supply and demand trends.
- iii) General and specific market forecasts.
- iv) Consumer preferences and new products (i.e. commodity presentations).
- v) Trends and price forecasts of production inputs (i.e. feeds, fertilizers, seed, energy).
- vi) Technological progresses in aquaculture, especially low environmental impact culture techniques.
- vii) Local and national environmental regulations.
- viii) International trade and sanitary regulations to aquaculture products.
- ix) Socially equitable aquaculture production schemes.
- x) Impact of aquaculture on rural livelihoods.
- xi) Compatibility of aquaculture with other economic sector.

2.5.3 *What are opportunities for improving the quality aspects of the information (statistical and non-statistical)?*

The following is a list of opportunities for improvement which certainly would strengthen the ability to assess, analyze, plan and make decisions for a more sustainable aquaculture sector in each country of the region:

Opportunities for improvement:

- It is important to stress that aquaculture monitoring programs have to be given a certain level of priority, and consequently budget should be allocated, if they are to provide sufficient, useful, high quality information for management and decision-making processes.

- Increasing the number of trained staff in regional aquaculture offices would expand geographical coverage, thus reaching all farms including those that are operating unregistered.
- Improving computer-based connectivity throughout all steps of the information path, would allow for frequent, even real time reporting.
- The use of participatory approaches for data collection and monitoring, can be of great value. Farmers should be consulted in relation to frequency, parameters and even methods for data collection, since it is them, together with the planning authorities that are the ultimate users of the information.
- Continuous training on statistical methods, sampling design and informatics and permanent interaction between all the sources of statistical and non-statistical information should both be prioritized.

2.6 PLANNED IMPROVEMENTS OF INFORMATION ON STATUS AND TRENDS

2.6.1 What are the specific plans and actions if any to improve current information?

There seems to be an overall regional awareness of the relevance of improving the quality and the quantity of aquaculture statistics for status and trends analyses. Consequently a series of plans seems to be underway.

Brazil's newly created Special Secretary of Fisheries and Aquaculture has expressed intentions to implement a more robust and systematic structure for regular high quality data collection.

Chile's Fisheries Authorities have announced plans for improving the computer-based information systems, as well as to improve information exchange between different sources.

Mexico's CONAPESCA is planning to implement an intranet and expand the geographical coverage of computer-based connectivity, which will allow for more timely transference of aquaculture statistics as well as to update other farm-related technical information in the national databases.

It seems, however, that such awareness and plans stem directly from the entities responsible for data collection and distribution, that is, if these offices do not manage to convince decision makers at the top level to allocate the appropriate funding, the viability of these plans may be at risk.

2.7 FAO AQUACULTURE QUESTIONNAIRE (FISHSTAT AQ)

2.7.1 Are there specific problems in providing to FAO the information requested in the questionnaire, and any reasons for these problems?

There are no major problems reported in relation to the clarity and adequacy of the questionnaire and its information sheet.

2.7.2 Are there suggestions for solving any problems in relation to the FISHSTAT AQ?

One suggestion is to develop an electronic version of the questionnaire, to facilitate filling it in and to shorten the response-time.

Annex 1

SUMMARY OF STANDARD CULTURE METHODS AND FACILITIES EMPLOYED IN THE REGION

	Name	Culture method	Culture facilities	Stocking density	Feed	Larvae
<i>Litopenaeus vannamei</i>	White shrimp	Extensive	5-80 ha ponds with tidal or minimum water exchange (<5%.d ⁻¹), stocked with wild PL's. No nursery stage and low input monitoring and management.	1-5 /m ²	Inorganic fertilization sometimes complemented with low quality shrimp feed .	Mostly seasonally caught from the wild.
		Semi-intensive	2-25 Ha ponds with pumped water exchange (5-30%. d ⁻¹), stocked mostly with hatchery-produced PL's. Nursery stage. Weekly monitoring for management decision making.	6-25 /m ²	Initial inorganic fertilization. Supplementary shrimp feed throughout the culture period.	Hatchery-produced. Mostly bought to external hatcheries.
		Intensive	0.1-2 Ha ponds with pumped high water exchange (30-100%/day). Acclimation period of PL's in pvc-lined or fiberglass aerated raceways, nursery stage (2-3 weeks) in 0.01-0.1 earthen aerated ponds. Heavily aerated on growing ponds.	25-150 /m ²	100% high quality shrimp feed. Use of probiotics is increasingly common.	Most intensive farms have hatcheries and produce their own postlarvae.
<i>Oreochromis spp</i>	Tilapia	Cage culture	Two types: 56 m ³ (7x4x2m) used in northern states, and 18 m ³ (3x3x2m), employed in southern states. Nylon, 0.75-1.5"- meshed bag with pvc frame and floats and mooring devices. Two stages: initial (10-50g) and terminal (50-450+g) on growing stage.	Initial stage: 80-100/m ³ . Final stage: 50-75/m ³	100% tilapia feed.	Hatchery-produced, sex-reversed fingerlings. Most farms buy them from external sources.

		Semi-intensive Pond culture	<p>Breeding 0.1-0.2 Ha earthen ponds. In-pond incubation. Sex-reversal "happas" or tanks</p> <p>nursery ponds (0.1-0.5 Ha) (from 0.1-10g). Transferred to initial on growing ponds (0.1-0.75 Ha) (from 10-40g). Transferred to final on growing ponds (40-300g)</p> <p>Pumped water exchange (10-25 lps/Ha).</p>	<p>Broodstock: 1-2/m²</p> <p>Sex reversal: 2,000 /m³.</p> <p>Nursery: 120-150/m².</p> <p>initial stage on-growing: 20-25/m².</p> <p>Final stage:5-10/m²</p>	Initial inorganic fertilization in nursery stage. Tilapia feed from nursery through to harvest.	Hatchery-produced, sex-reversed fingerlings. Most farms buy them from external sources.
		Intensive pond/tank	<p>Breeding 0.1-0.2 Ha earthen ponds. Egg collection and indoor incubation. Sex-reversal tanks (0.025 Ha).</p> <p>nursery ponds (0.1-0.5 Ha) (from 0.1-10g). Transferred to initial on growing ponds (0.1-0.75 Ha) (from 10-40g). Transferred to intermediate ponds or raceways (0.1-0.15 Ha) (40-150g).</p> <p>Transferred to final stage ponds or raceways (0.1 Ha)</p> <p>100-400%/day water exchange.</p>	<p>Broodstock: 1-2/m²</p> <p>Sex reversal: 2,000-2,500/m³.</p> <p>Nursery: 120-300/m².</p> <p>initial stage on growing: 80-60/m².</p> <p>intermediate stage: 40/m²</p> <p>final stage: 25/m².</p>	High quality tilapia feed.	Hatchery-produced, sex-reversed fingerlings. All intensive farms produce their own seed.
<i>Crassostrea gigas</i>	Japanese oyster	Intensive raft/long line	<p>Hatcheries mass produce spat in controlled environment: broodstock thermally-induced to spawn. High (>150,000 cels/ml) algal counts are maintained in 5 m³-fiberglass round tanks. Larvae fixed on crushed or whole shells. Spat (3-4mm) transferred to shallow, productive coastal lagoons in either <i>Nestier</i> boxes or hanging ropes with shells in floating rafts.</p>	<p>Larval culture: 1-3 larvae/ml.</p> <p><i>Nestier</i> boxes: Initial :3 000 juveniles/box. Culled down to 80/box at harvest.</p> <p>Bags: 600/bag, culled down to 60/bag at harvest.</p>	Larval culture: Axenic culture of phytoplankton. Grow out: natural productivity.	Exclusively from hatchery
<i>Salmo salar</i>	Atlantic salmon	Intensive Tank/cages	<p>Hatcheries mass produce fry. Reared in outdoor round tanks in freshwater until smoltification, then transferred to marine or estuarine cages for grow-out.</p>	Not Specified	High quality salmon feed.	Exclusively from hatchery

Annex 2

LIST OF ABBREVIATIONS

BPU	Basic Production Unit (Cuba)
CNDP	Comisión Nacional para el Desarrollo de la Pesca (Ecuador)
CONAPESCA	Comisión Nacional de Pesca e Acuicultura (Mexico)
IBAMA	Brazilian Institute of the Environment and Natural Resources
MIP	Ministerio de Pesca (Cuba)
NatRISTA	National Reviews of Information for Status and Trends Reporting
NFS	National Fisheries Service (Chile)
RNP	National Fisheries Database (Mexico)
SAGARPA	Secretary of Agriculture, Animal Husbandry, Rural Development, Fisheries and Food (Mexico)
SEAP	Special Secretariat for Fisheries and Aquaculture (Brazil)
SIROPA	Integrated Fisheries and Aquaculture Operations Database (Mexico)

Summary and excerpts from the Africa regional synthesis: information for status and trends reporting on aquaculture¹⁰⁵

1 INTRODUCTION

For this review, national information was collected using a survey instrument that was either self-administered or was filled out during an interview with FAO-RAF staff. Surveys were completed by representatives of the following countries: Cameroon, The Democratic Republic of Congo, Ghana, Kenya, Madagascar, Malawi, Nigeria, South Africa, Uganda and Zambia.

2 AQUACULTURE DATA COLLECTION

In all of the countries surveyed there was a clear definition of aquaculture separating it from fisheries. Most countries reported a designated aquaculture service – usually as part of the Department of Fisheries. Some countries had development plans in place but reported poor linkage between monitoring activities and planning and management activities.

Currently, statistical data for aquaculture are collected by Ghana, Kenya, Madagascar, Malawi, Nigeria, South Africa and Uganda. Cameroon and the Democratic Republic of Congo do not and Zambia did not respond.

Generally, collection of aquaculture statistical information starts at the producer level through censuses, sampling surveys, and administration of questionnaires by field staff, farmers, and extension agents. The information is passed on to districts, sub-national and national levels through designated committees on fisheries, fisheries producers associations, and fisheries officers at the district level. Then the information is submitted to the national levels to fisheries statisticians, development planning committees, and finally to Directors of Fisheries/Aquaculture and to government ministers. In most cases, the time needed to complete the cycle of data collection, collation, and dissemination is about a year. The majority of nations produce annual reports.

All countries reported that they do not have different methods of estimation from different production systems, with the exception of Madagascar, which has a separate method for estimating shrimp production. None of the countries described data collection methodologies for the specific production systems.

From the table below, note that most countries rank the quality of statistics currently produced for aquaculture to be poor, especially with regard to issues of comparability and consistency.

¹⁰⁵ Prepared by M. Entsua-Mensah (for the FAO Regional Office for Africa, Accra, Ghana) and summarized by FAO staff.

3 SELF-ASSESSMENT OF QUALITY OF STATISTICAL DATA COLLECTED BY THE COUNTRIES:

Comparisons	Good	Fair	Poor	Not answered
Comparability between regions and typologies	1	2	7	0
Comparability over time.	1	2	7	0
Comparability with related data sets	2	0	7	1
Completeness	1	4	5	0
Consistency of definitions and clarifications	2	1	6	1

Numbers indicate the number of countries responding under each category.

4 CONSTRAINTS

The most cited problems hindering reliable data collections for aquaculture were:

- poor logistical support
- inadequate financial and human resources
- inadequate training of data collectors or data reporters (e.g. within producer organizations)
- lack of a clearly defined agency responsible for data collection
- lack of rational aquaculture development plans and lack of national aquaculture databases
- poor maintenance of accurate records
- no collection of socio-economic data, environmental data, and utilization.
- aquaculture is not a priority in most of these countries

5 PERCEIVED INFORMATION NEEDS

At the **national** level, the priority data needs for aquaculture were perceived to be:

- environmental data
- stocking data
- economic data
- market data
- metadata
- utilization data

There is the need to increase the awareness both of public institutions and of the general public concerning aquaculture and its similarities with agriculture. This could be achieved by collaborative efforts between aquaculturists, authorities, media, and non-governmental initiatives.

At the **regional** level, several needs have been identified:

- Informative guidelines or manuals needed to collect data should be produced. These should be harmonious with the countries in the region.
- Regional databases for aquaculture statistics should be established.
- There should be greater exchange of information and experience on development of rural aquaculture (including development of associated statistical systems), through regional and inter-regional networks and collaboration between countries. Exchange of socio-economic and environmental data, especially between countries which share water bodies, is particularly vital.

At the **international** level, FAO plays a unique role in global aquaculture statistics and the preparation of information on the global trends of the aquaculture sector. Such reports are important in alerting regional organizations, national policy makers and advisors, industry, NGOs, and the general public to the global aquaculture situation and to global issues than can have effects at the regional and national levels.

FAO should work to develop unified standards and guidelines for data collection. There is a need to identify and elaborate the most appropriate methodologies for each type of production system. FAO can help train farmers, extension workers, and technical staff in data storage, data collection, and data analysis. The quality of FAO aquaculture statistics is affected by incomplete and sub-standard reporting.

6 RECOMMENDATIONS AND IMPROVEMENTS

Recommendations that seek to address these issues are:

- improving methodologies and procedures for statistical data collection, processing, analysis, storage, and dissemination;
- removing constraints to accurate and timely information;
- improving coordination with national sources;
- integrating information sources;
- improving how information is used in management of the sector; and
- striving to meet specific national needs in terms of aquaculture information.

Europe and Near East regional synthesis: information for status and trends reporting on aquaculture¹⁰⁶

1 THE SETTING

1.1 National practice used to identify aquaculture separately from fisheries

Fisheries legislation framework makes a distinction between fisheries and aquaculture. There are different legal framework regard fisheries and aquaculture. In the relevant authority of the state administration within the directorate of fisheries there are usually separate subdepartments for the two sectors.

1.2 Administrative structure

The head of the administrative structure is the Ministry of Agriculture and Fisheries (exact names: Ministry of Agriculture and Forestry – Croatia; Ministry of Agriculture and Rural Development – Hungary; Royal Ministry of Fisheries – Norway; Ministry of Agriculture, Fisheries and Food – Spain; Ministry of Agriculture – Greece). A special department within the ministry is responsible for the aquaculture development, monitoring and management except Spain, where the Ministry of Agriculture, Fisheries and Food has only general functions of coordination and representation at international organisations and where the Autonomous Regions keep the jurisdiction in the management of aquaculture. The ministry has local offices in the administrative units of the country (autonomous regions, county offices etc.) where the local officers perform the administrative and controlling duties of aquaculture administration.

Aquaculture is regulated at national level by different acts (Marine Fisheries Act, Freshwater Fisheries Act – Croatia; Act on Fishing and Angling – Hungary; Aquaculture Act – Norway; Act of Coast, Act of Marine Cultures – Spain) and in Croatia and Hungary the acts stipulate reporting responsibilities. In Spain there is a difference between the legislation at national and autonomic level and in Croatia the control of activities within the sector of fisheries is within the scope of activities of the State Inspectorate and Maritime Police. The state inspectorate's duty is to control the implementation of the law and regulations. At present, there is no legal framework which imposes the collection of statistical data for Aquaculture at a national level in Greece.

The General Authority for Fish Resources Development (GAFRD) has the overall responsibility for development and conservation of fishery resources (except those in Lake Nasser), and is in charge of the main administrative services dealing with fisheries and aquaculture (Egypt). Enforcement of regulations, collection of data, training and extension are also among the responsibilities of the authority. Constructing aquaculture

¹⁰⁶ Prepared by the Research Institute for Fisheries, Aquaculture and Irrigation (HAKI), Szarvas, Hungary and James Shapiro (Department of Fisheries, Ministry of Agriculture, Tiberias, Israel).

enterprises is strictly forbidden until a licence from the Ministry of Agriculture is obtained. Furthermore, permission must be obtained from the Ministry of Public Work and Water Resources denoting the source and quantity of water used and importation of fish from other countries. The GAFRD issues a statistical yearbook which includes information on: the trend of aquaculture production, the cultivated area by the governorates, species, location, public and private sector farms and farming systems used. Such information can be used to prepare reports for management purposes.

The Israel Department of Fisheries, a part of the Ministry of Agriculture and Rural Development, has separated the growing or production of aquatic organisms into two branches - Aquaculture (freshwater organisms) and Mariculture (salt or brackish water organisms). The Aquaculture section or branch of the Department of Fisheries and Aquaculture is ultimately responsible for the monitoring and management of freshwater or inland culturing of fish and other aquatic life (i.e. shrimps, shellfish, and macro-flora). The Mariculture branch is responsible for the monitoring and management of brackish water and marine culturing. For purposes of this report both mariculture and aquaculture will be placed under the heading of Aquaculture (Israel).

1.3 Aquaculture practice and purpose

Different culture methods and systems are used depending on the fish species and aquatic environment. The principal purpose of aquaculture is commercial but it also aims at restocking of natural waters in some countries.

2 CURRENT STATUS OF NATIONAL AQUACULTURE DATA COLLECTION AND COMPILATION OF STATISTICS

Statistical data are regularly collected, and the time basis of the aquaculture statistics is the calendar year. The only exception is Croatia where in freshwater aquaculture the producers have to fill in a questionnaire twice a year, for the periods from the 1st of January to the 30th of June and for the whole calendar year. The data are collected from the end of January till March and after processing and completion of database it is ready for use by the end of April in Croatia, Hungary and Spain, and by the end of September in Greece. However in Norway there are five steps of quality checks and reminders to non-received questionnaires and the final figures are ready only in October-November.

In Egypt, statistics of aquaculture production are collected annually. A statistical form is used to collect these data and published within a maximum period of six months. This form includes the following parameters: fish farming area, Type of aquaculture (extension, intensive and semi-intensive), species production, number of captured or produced fingerlings or fry per species, quantity of used fertilizers and its price per ton, quantity of fish feed used and the ratio of protein concentration and the price per ton, source of fry and fingerlings (GAFRD or the Private Sector) and average of production per species in tons, marketing system. Furthermore information about the number of hatcheries, their production and their location are included in the statistical yearbook. However, the number of people employed is not included in the statistics.

GAFRD collects data by only one means, and does not use different methods for data collection from different types of fish farms. Data is collected in licensed fish farms by using census-type-data collection system, while a sampling program is applied for unlicensed ones.

In Israel, several parameters are used: number of farms, pond area, yield (by species and area), gross value (both local and dollar), fry production, and consumer prices. Comparisons and trend graphics show differences and changes in growth of aquaculture, land and water use, new species. Statistics concerning the ornamental fish branch are published as fry numbers and their value. The Department of Fisheries uses

the data collected to publish an annual journal, "The Fisheries and Aquaculture of Israel". This journal is available on line (at the Fisheries web site- www.mop-zafon.org.il/fish) on CD-ROM and as a published pamphlet to all interested parties (scientists, fish growers, and the governmental statistic office).

There are four different questionnaires in Norway: (1) production of salmon and rainbow trout (seawater production), (2) production of salmon and rainbow trout (freshwater production) and production of roe and juveniles, (3a) production of other species than salmon and trout and (3b) production of other species than salmon and trout (hatcheries), and (4) production of shellfish (seawater). In Spain information are gathered about the species, way of culture and production volume.

2.1 Data clients

Data clients are the producers and companies who give statistical data on aquaculture production and the main target users are the ministry and its departments, research and information institutes, planners, other authorities, scientists and fish farmers. A part of data is also available for other data users like students, potential investors etc.

2.2 Data collection authorities and methods

The responsibility for data collection is not uniform. There are different methods of estimation for different production systems. Data are collected separately between marine and inland aquaculture in Croatia, Norway and Spain. In Hungary, where only freshwater aquaculture exists, there are separate databases for ponds and intensive systems. Data from marine and inland aquaculture are shown in different tables, numerical and graphical information.

The methodology for data collection is very similar in all countries. The organization that is responsible for data collection provides a questionnaire that has to be filled in by all the producers and licence holders not regarding to the type of production systems. If a company has several licences in different regions the company should report a questionnaire for each region (Croatia, Hungary, Norway).

In Greece, the questionnaires are examined at the regional office of fisheries for the completeness and accuracy of the stated data and signed both by the producer and the fishery inspector. The questionnaires are then forwarded to the Ministry of Agriculture (Directorate of Aquaculture and Inland Waters), where they are collected and stored. There, the data are analyzed and summarized per Prefecture, per Culture method, per species and per employment. Some of the results of the data analysis are available on the Internet. More detailed results can also be obtained from the Service following a specific request. It is important to mention that primary data are confidential.

2.3 Definitions used for data collection

Definitions used in the data collection are some what similar and appears to be compatible with FAO definitions.

Data quality, processing and analysis

Problems may occur in collecting high quality statistical data in every country according to the followings:

There are difficulties in obtaining data from the data suppliers (Norway, Spain);

The information is incomplete in many cases;

The data clients' number is low thus individual inaccuracies may have significant effect on the overall database. The appropriateness of data should be often clarified (Hungary);

The analysis and the quality control of data are carried out by different organizations therefore some inconsistencies may occur (Croatia).

Statistical data are *collected and published* on a yearly basis, and it provides the comparability over time. Data are also comparable between administrative units

(regions, counties etc.) and between production systems because data are collected and analysed on these categories. The databases are complete and the definitions and classifications are consistent (Hungary, Norway) but the comparability with related data sets does not always work (Hungary). In the background there can be legislative problems or the fact that separate databases handled by different organizations are not always compatible.

The *processing* of the statistical data is the duty of institutions of the agricultural and fisheries ministry or the ministry itself. By name: JACUMAR (Spain), Research and Information Institute for Agricultural Economics (Hungary), Directorate of Fisheries of the Ministry of Agriculture and Forestry (Croatia) and Statistics Norway/Directorate of Fisheries (Norway). After getting data from the responsible organization of the administrative unit and processing them, the organization distributes the data to various users. Almost every organization that process data has an own website so one way of the distribution is the Internet. One of the major problems in some countries is the low number of Internet access (Hungary, Spain), so besides the Internet the statistical data are published in statistical yearbooks, yearly reports, professional journals, scientific and expert magazines or trade bulletins that contain tables with summarized data. In Norway one can register to a subscription list and can get the statistical report automatically by mail and the fish farmers also get these reports automatically, free of charge. The responsible institutions not only process but also store the statistical data. As far as the method of the storage is concerned, there is no available information from Croatia and Spain, but in Hungary and Norway data are stored both traditional (paper) and electronic form.

In Hungary data also analysed with the participation of the ministry's department in charge of aquaculture. If the information is collected till the end of January it is analysed and ready for use in April (except Norway as it was mentioned before). In Spain, a new system is being implemented; "Information System of Input, Control and Analysis of Aquaculture data" in all Prefectures (regional offices of fisheries) and the Directorate of Aquaculture and Inland Waters of the Ministry of Agriculture.

In Egypt, receiving high quality data is problematic due the number of fish farms scattered among vast areas in the Delta Region as well as in the desert. A significant number of these desert farms are not licensed. Feed, fertilizers and stocking species norms vary from one farm to another making it difficult to obtain proper quality of data. The statistical data is comparable between regions (Governorates), time and shows the trend of aquaculture production. There is a shortage in some parameters such as man power data and the initial price of the fish production. *GAFRD* is the main and sole authority for collecting these data. The Statistical yearbook illustrates bare data and has no statistical analysis or diagnostic measures such as the arithmetic mean, standard deviation... etc. The statistical data are not analyzed nor packaged to provide information for management purposes which can be used by managers and policymakers. There are no data available, such as methodological notes, other sources of data, data collection manuals and catalogue of commercially important species.

In Israel, the Department of Fisheries cooperates closely with the Fish Growers Union (an organization mostly made up of cooperative villages – kibbutzim). This includes quality data collection. The *FGU* provides natural disaster insurance for its member farms, In order to provide complete coverage; the union requires accurate monthly information on stock size, production of each farm, fry production, the number of active farms on a monthly basis. Since the members include up to 90 percent of all the fish farms in Israel, this supplies statistically significant data. A telephone survey of non-member farms completes the data collection. Statistical analysis includes: time series of yields, value per ton, dollar value, pond areas, farm number, yield per area, by species, and prices per kilogram per person. Statistics are illustrated graphically and by tables.

3 NON-STATISTICAL INFORMATION

Some countries use some non-statistical information to supplement statistical data. Though this chapter in the national reviews is incomplete, the authors of the regional review know of some non-statistical information which have not been mentioned, e.g. Aquaculture in Norway published by the Norwegian Fish Farmers' Association; "White Book" published by the Hungarian Fish Farmers' Association. Some non-statistical information is accessible through different channels like the Internet, e-mails, periodic bulletins or professional journals of the industry. Information sometimes is also available via newspapers, CD-ROMs or broadcasted by radio programmes. Usually the website of the ministry and the statistical office provide access to several aquaculture sites. The main sources of non-statistical information are the ministries and the institutions of the ministry, national or international organizations or other statistical institutes. It has been reported from Spain that the information disseminated by the Internet is frequently updated.

Although some problems are mentioned regarding non-statistical information, in some cases these are also relevant to statistical information. The long time from information supply to final dissemination and the slow update of the information are one of the key problems. Besides this Croatia mentioned that the collection is not regulated by any legal obligations, and according to Spain publishing is often restrained and gives only general information because of confidentiality of statistical data.

No non-Statistical information is used in Egypt and Israel. Not much of these information are available, however the individual research stations do publish yearly reports which present research plans, expansion needs, and new species investigations. The Fish Growers Union does publish its own publication.

3.1 Data needs and opportunities for improving current information on status and trends

The national priority in terms of aquaculture statistics is to supply accurate information about the trends of aquaculture development and that information supply should be user-friendly. There are many strengths and weaknesses in this process. They are given in Table 1.

Table 1. Strengths and weaknesses of the present methodology of collecting, processing and disseminating the statistical data

Strengths	Weaknesses
<ul style="list-style-type: none"> • Systems for collecting, processing and disseminating are available • These systems provide comparability over time • Data are regularly collected • Statistical and non-statistical information are widely distributed through different channels • The source of primary data is the producer • Consistency of definitions and classifications • Wide range of data is gathered 	<ul style="list-style-type: none"> • Various databases related to aquaculture are not always compatible • There is limited access to Internet users • Data processing and updating are often slow • Limited use of non-statistical data • Poor sampling methods

3.2 Planned improvements of information on status and trends

Each country mentioned certain level of development in the national reviews e.g. to establish new statistical databases (Croatia); to improve the accuracy of data management, and to make the connection or the integration of the relevant databases so as to get more complex information (Hungary); to make electronic report system (Norway). In Spain the JACUMAR has recently begun to develop a shellfish statistic and designed the “aquabarometer” that represents different studies referred to the aquaculture sector. Another way of to improve the accessibility of the information is to organise seminars, workshops and training courses. In Greece new data collection system is being established which hopefully will improve the status and trends data.

Egypt is planning to introduce ARTFISH Statistical Software which is developed by FAO. An FAO TCP project has been proposed for this objective.

In Israel, several ideas have been proposed which could improve data collection. Direct data links between fish farms and the FGU and/or the Department of Fisheries would significantly improve data collection. The future might bring an increase in non member (FGU) farms in more remote areas of Israel. Direct data links would eliminate time consuming surveys. Reward incentives, such as low cost loans, grants could significantly improve data availability by increasing competition between farms to “volunteer” information.

4 THE FAO AQUACULTURE QUESTIONNAIRE, FISHSTAT AQ

Regarding data supply to FAO there is a difference in the EU member and the other countries. In the EU member countries since 1996 the statistical service of the ministry provides all the statistical data to Eurostat that send the information to FAO. Concerning the other countries they give their statistical report directly to FAO. There have been two comments on FISHSTAT AQ from Hungary and Norway. Hungary suggested that it should be clarified in the instruction sheet which price to use (price with or without VAT) when filling the questionnaire. Norway would prefer to have a later deadline for reporting to FAO, because the final report of aquaculture statistics is ready only in October.

In Greece, the system of data collection makes data available in September each year. In Greece, statistical data on Aquaculture are collected by the Ministry of Agriculture as described above. The National Statistical Service also collects data on Aquaculture using different sources. It is understood that FAO, for some reasons, publishes the data obtained by the National Statistical Office of Greece and not the data submitted by the Ministry. Unfortunately, in some cases the data of the two Services deviate from each other.

FISHSTAT AQ is not applied in Egypt to some unknown reasons. The major national constraint in obtaining information would appear to be the large number of farms (many of them non-licensed) spread over large areas in the desert and the Nile Delta. Solving this basic problem would dramatically improve data collection. While the future might bring about increased use of direct data links, perhaps a more immediate solution would be to make data transfer a more attractive and profitable task to the individual farm. Trade offs such as low cost loans or grants in exchange for data might increase information availability.

Israel continues to provide information to FAO as requested. However in many cases, cooperation could be influenced by what some might perceive as a complicated form. Perhaps simplifying and shortening the form, without losing information would be possible. Maybe in a more peaceful future, a triangle of direct data links between the FAO and the member countries and the fish farms themselves could be established. International and regional constraints would be alleviated by increasing international cooperation within organizations such as FAO and COPEMED.

As non members (Fish Growers Union), fish farms increase and their production increases, the national aquaculture statistics will decrease in accuracy. More effort must be made in increase and improve data collection to take them (the non union farms) into account. As mentioned previously (Egypt), making information sharing a profitable venture, would increase data collection. Regional efforts for data collection and sharing remain in limbo and probably will stay that way as long as the political situation in the Middle East remains in flux. International cooperation is dependant upon organizations, such as FAO and probably will continue to be in the near future.

4.1 Constraints

Due to unknown circumstances, FISHSTAT AQ is not being used in Egypt, according to the Egyptian country review. Therefore before any difficulties are encountered it is imperative to send the form to the proper authorities. While there have no difficulties in providing information for FISHSTAT AQ by Israel, delays in filing the questionnaire have occurred. The very nature of data acquisition is probably responsible for them (delays). The use of a middleman, in this case the Fish Growers Union, inserts another bureaucratic step in the information ladder. The best solution would have the farms send their information directly to the Department of Fisheries.

5 CONCLUSIONS

It can be concluded that, in several countries relatively well-developed systems are available for the collection, processing and analyses of aquaculture data. Although the collection of statistical data and other information on aquaculture is a relatively new activity in many countries, the national reviews indicate that good progress has been made towards the establishment of reliable database on aquaculture.

However, the use of data and other available information has not been fully exploited during the formulation of policies and development plans in aquaculture and the current activities on data collection and processing focus on “status” rather than “trends”.

Databases contain mainly basic information on production of various species in different systems and environment. The databases should be completed with relevant socio-economic data.

There is uncertainty concerning, what databases are intended to be provided to specific target groups such as policy makers, aquaculture producers, service providers and consumers. The collection of non-statistical information, the processing, analysis and dissemination of such information is less developed. There is also a need to establish databases which are comparable and/or compatible with other databases (e.g. on fisheries, water resources, production of non-fish food commodities).

Aquaculture includes the use of various types of systems, which operate at different management level in different environments. Aquaculture data however, do not reflect the diversity of aquaculture, and sometimes only summarise the data available for products, which are originated from very different sources. This is a major constraint if data to be used for detailed analysis of status and trends.

There have been good initiatives, for example the separation of databases for extensive pond systems and intensive tank systems, however this is a very recent and rather rear event.

Definitions for the classification of terms used for data collection should also be clarified and unified. Some definitions may be unambiguous and well applicable within a country; however, they may be confusing in international context. This problem perhaps derived from inaccurate translation from local language to English.

There appears to be a commitment and there are initiatives to improve current national reporting on aquaculture. This process should be encouraged and promoted.

National aquaculture institutions with expertise in data collection and analysis may also be involved in the reporting on aquaculture status and trends on national level.

Producer's Associations should also play role in the improvement of aquaculture statistical systems and procedures by educating members and emphasising the benefits of better reporting on aquaculture.

In EU member countries, EUROSTAT provides a good framework for such improvement; however non-EU countries may need external assistance. Specific symposiums and training courses, written and electronic materials can also contribute to the improvement of collection, processing and analysis of aquaculture data. It seems that a multi-language dictionary (written and electronic) of major aquaculture terms used for statistical reports in aquaculture would be a useful tool to improve reporting on aquaculture on international level.

There were two comments in the national reviews regarding FAO questionnaire FISHSTAT AQ; (a) need for clarification if price includes VAT, and (b) request for a later deadline for the completion of the questionnaire in order to provide more complete data.

The separation of categories; "ponds" and "tanks" in FISHSTAT AQ Form should be considered.

Besides having the national reports as major source of data for "FISHSTAT", and making efforts to complete and verify information using other sources, it would also be useful to identify focal points (e.g. competent institutions) in countries with major aquaculture industry in order to check and verify data, and collaborate with FAO on a regular basis.

In recent years the demand for reliable data and information and for reporting on aquaculture has greatly increased, driven not only by the need to formulate and monitor sound policies and development plans but also by new information and reporting requirements of international agreements and initiatives, and by the increasing public demand for transparency and accountability. In order to address this need, FAO convened an expert consultation in 2004. This document presents the outcome of the expert consultation, including a draft strategy and outline plan for improving information on status and trends of aquaculture.

