



Information: A Must for Responsible Aquaculture

Aquaculture is expanding and its contribution to global food production is increasing at a significantly higher rate compared to other food producing sectors. It is poised to produce an additional 37.5 million tonnes by the year 2030, at least to maintain the current level of global fish consumption. The basis of all actions in support of creating an enabling environment for this great expectation is good information. Information serves many purposes. Information is knowledge, could be a message, a pattern, or a record, it may serve as an influence that could lead to transformation and betterment. Whatever the purpose may be, it has to be generated, collected, managed and analyzed appropriately, conveyed and disseminated accurately in a timely manner and used objectively and responsibly.

Trade in fish and aquaculture products has extended beyond national borders and reached the global market. As the governments' mandate in ensuring responsible production and trade is now carefully being scrutinized, governments are thus getting more involved in monitoring the effects of aquaculture to the environment and food safety and quality, as well as in assessing the impact of policies, or lack of it, and other sectoral developments. As a direct result of this, there is a significant improvement and increase in the policies, agreements, laws, rules, regulations, etc. and implementation and monitoring requirements, which are, thus, posing important information challenges.

Advancement in communication technologies are causing an information explosion. These technologies and systems provide powerful tools for aquaculture data and information management. The use of Internet has given the most remote locations access to a wealth of information from all over the world. The field of remote sensing continues to develop. With increased computing capabilities at a fraction of the cost experienced only a few years ago, remote sensing technology can be employed to gather data on resources, previously difficult to access, and to monitor the environment. Geographic information systems (GIS) are now routinely used to compile and process spatial information. We also witnessed how this massive explosion in information has empowered many and transformed them from passive to active participants in sectoral development; some good, some not so good.

In developing countries, where food production is the main source of employment and livelihood by a majority of the population, the attention of development planners has also evolved such that information and data needs refer not

only to issues relating to food production and contribution to the national economy, but also on issues relating to the welfare of the population dependent on this sector and food security of the population as a whole. Thus, there is now a general renewed interest in household surveys that integrate key food production and welfare information and data so that the impact of policies on the welfare of the populations (dependent on food production) can be examined.

The FAO Fisheries and Aquaculture Department is responding conscientiously to global aquaculture information needs. The departmental Web site (<http://www.fao.org/fi/>) has been improved providing instant on-line access to a number of web-based information systems (FAO STAT, NASO, NALO, CASIP, GISFISH, DIAS, AAPQIS, etc.) and many other relevant publications and information sources. With the mandate from the last session of the Committee on Fisheries, the Department is now attempting to develop a comprehensive strategy for improving information on aquaculture with the view to assist member countries in building their capacity to meet the growing demand for accurate information and data.

In today's world of excess, information is so abundant and easy to get and there are setbacks. For average individuals, information accumulates at a rate far faster than they can possibly be consumed. There are obstacles in managing such huge amount of information. In spite of this, having information is probably better than not having it. The most important is that it is here to serve us and we should be in control, rather than the other way around. We hope to address these and other challenges as they come.

FAN 37 presents four articles highlighting different aspects of information on inland fisheries and aquaculture (information sharing via aquatic commons, improving information on inland fisheries, global gateway to GIS/remote sensing/mapping and aquatic animal biosecurity information requirements).

FAN recognizes the need for accurate information in a timely manner. In keeping with this thrust, beginning 2008, FAN will have three issues, instead of two at present. We look forward to inform and enrich you with best information possible.

Rohana P. Subasinghe (Outgoing Chief Editor)
and
Melba B. Reantaso (Incoming Chief Editor)

Upper photos

Left: Buna River located near the village of Blagaj, southeast of Mostar, in Bosnia and Herzegovina, is one of the strongest and biggest water source in Europe with 43 000 l/sec of water flow (M Reantaso, FAO)

Right: Partial harvesting of fish from TCP/HAI/2903 project on poultry production and fish farming in Haiti (V Crespi, FAO)

Lower photos

Left: Myanmar, Ayerwaddy River - Inland fisheries in Myanmar are operated on a concession basis employing local people in the harvesting and processing of the fish (C Pongsr, Thailand)

Right: Small-scale marine cage culture farming in Hainan Island, China PR, collectively producing 100 000 tonnes of almost exclusively low value/trash fish fed high value marine finfish (S de Silva, NACA)

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Sea cucumber conservation and management

M. Verónica Toral-Granda¹ and Alessandro Lovatelli²

Sea cucumbers (Echinodermata: Holothuroidea) have been widely exploited for traditional food and medicinal purposes all over the world, which has led into a rapid decline of their natural populations. Traditional fishing grounds (i.e. Indo-Pacific) were heavily exploited and new fishing areas have been found in distant and remote areas (e.g. the Galapagos Islands, Ecuador). Their conservation and management are of paramount importance as they fulfill an important role in marine ecosystems and are a significant source of income to coastal communities. These fisheries currently involve almost 50 species, some of which remain under taxonomic uncertainties and with serious gaps in scientific knowledge such as reproductive biology, ecology, habitat distribution, larval ecology, amongst others.

The current population status of sea cucumbers worldwide to satisfy the *beche-de-mer* market has fueled debates, e.g. the FAO technical workshop "Advances in sea cucumber aquaculture and management – ASCAM" and the CITES technical workshop "Conservation of sea cucumbers in the families Holothuridae and Stichopodidae", both were aimed at providing the scientific tools to help in their conservation and sustainable management and exploitation.

With this in mind, FAO developed a project aimed at collating and disseminating information on the global status of commercially exploited sea cucumber stocks and to improve the capacity among all exploiting nations in the conservation and sustainable use of sea cucumbers. This project has three sub-components that include:

- review and analysis of the available information on the global status of commercially-exploited sea cucumber stocks and identification of 'hot spots' to develop and implement appropriate management approaches;
- preparation of an identification guide for commercial sea cucumbers, including the development of genetic markers and a
- technical workshop to draft the guidelines for their conservation and management.

REGIONAL REVIEW AND HOTSPOT ANALYSIS

To fully understand the current status of sea cucumber populations worldwide, the project will be undertaken focussing on five regions, namely: 1) Asia, 2) Australia and Pacific Island Nations (PINs), 3) North America (excluding Mexico), 4) Mexico, Central and South America and 5) Africa and Indian Ocean. In each region, the following 'hotspots' had been identified, namely Philippines, Papua New Guinea, the *Cucumaria frondosa* fishery in Newfoundland, Canada, Galápagos Islands and Seychelles, respectively. These regional reviews (RR) and hotspot (HTP) analyses are currently under preparation by well-known and respected sea cucumber scientists and will be the basis for discussion during the planned technical workshop that will take place in the Galapagos from 19 to 23 November 2007.

The main objective of the RR and HTP analyses is to review published and unpublished literature regarding the population status, fishing statistics, landing figures of commercially important sea cucumber species within all countries of each region and the designated hotspot. These documents will take into consideration, as far as possible, all relevant published (e.g. books, journal articles and widely disseminated reports) and grey literature (e.g. in-country reports) on sea cucumbers and incorporate, wherever possible, the activities undertaken by FAO and CITES on sea cucumbers.

IDENTIFICATION GUIDE FOR COMMERCIAL SEA CUCUMBERS INCLUDING GENETIC MARKERS

One of the major issues in the conservation of sea cucumbers is the proper taxonomic identification of the species entering the international market, especially after they have been processed. The lack of adequate tools to help enforcement officials and researchers has been one of the crucial points in any implementation of management actions on sea cucumber species.

The need for this tool, led to the development of a comprehensive guide which will include

photos of live and processed specimens and a photo of the calcareous spicules from the dorsal body wall, as a taxonomic character. Although the original idea for this FAO publication was a simple identification guide for major commercial sea cucumber species, further analysis concluded that it should include available scientific information on the biology, ecology, marketing and processing activities, as well as photos and descriptions of commercial species at different processing levels¹.

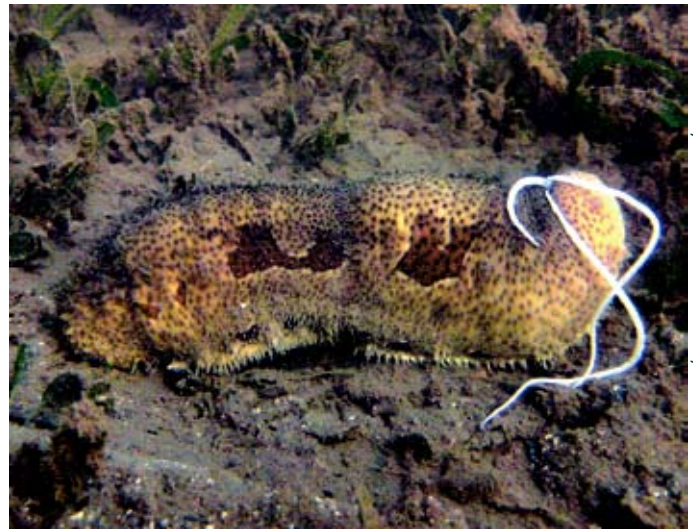
Currently this project has gathered information on 39 species, with information spanning over 20 countries, on management practices, scientific information available, main market, population status, type of fishery and main use.

As stated before, taxonomic uncertainties remain a key point in the conservation of holothurians, representing one of the greatest needs of those species of commercial interest. This project also includes the genetic bar-coding of commercial species aiming to provide yet another tool for the correct identification of sea cucumbers in the international market, as well as helping to understand the connectivity among holothurian populations, rendering information on how stocks should be managed to benefit sustainability of sea cucumber populations worldwide. This study is using the mitochondrial CO1 gene, which has been helpful in clearly distinguishing all holothurian species thus far investigated.

TECHNICAL WORKSHOP IN THE GALAPAGOS ISLANDS

This technical workshop intends to gather between 15 and 20 sea cucumber experts from all over the world, with the final goal of developing a set of guidelines for the conservation and management of sea cucumber populations. The workshop will have socio-economists, policy makers, managers and biologists who will discuss the conservation and management of sea cucumber populations worldwide. Their work will be based on the RR and HTP documents which will help identify problems and pinpoint management guidelines common to the different regions and those that need to be dealt with.

Upon completion of this project, there will be practical tools that will help managers, decision makers, politicians and biologists to take informed and appropriate decisions on the management of holothurian populations



Live specimen of Bohadschia similis



Live specimen of Bohadschia argus

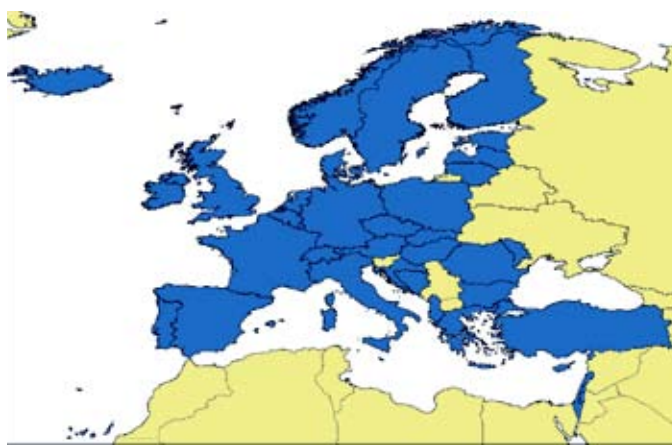
worldwide, hence helping to attain their conservation and supporting their sustainable exploitation.

¹For more information, please refer to the following publication: Toral-Granda M.V. 2006. Fact sheets and identification guide for commercial sea cucumber species. *SPC Beche-de-Mer* 24: 49-52.

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EIFAC symposium on interactions between social, economic and ecological objectives of inland commercial and recreational fisheries and aquaculture

Antalya, Turkey, 20-23 May 2008



The European Inland Fisheries Advisory Commission (EIFAC) is organizing an international symposium on "Interactions between social, economic and ecological objectives of inland commercial and recreational fisheries and aquaculture" between 20 and 23 May 2008 in connection with its 25th Session in Antalya, Turkey.

BACKGROUND

Sustainability is at the core of efforts to develop and manage inland fisheries (i.e. commercial and recreational) and aquaculture in Europe. Sustainability in this context includes social, economic and ecological (or more broadly, environmental) aspects, which are shaped by functioning governance structures and management institutions. Previous EIFAC symposia have shown that in many cases sustainability is not viewed from all these three aspects in an integrated manner.

The FAO Code of Conduct for Responsible Fisheries and the EU strategy for the sustainable development of European aquaculture and inland fisheries all recognize that the sector should take an approach where farming and fisheries technologies, social and economic issues, natural resource use, biodiversity conservation and governance are integrated to enhance sustainable management.

Interactions between social, economic and ecological objectives of inland fisheries and aquaculture are numerous and include amongst others:

- ◇ Improvement in ecological status of rivers, lakes and other water bodies
- ◇ (Re-)stocking for commercial and recreational fisheries

- ◇ Recovery and conservation of depleted/threatened stocks
- ◇ Collection of fish from the wild for aquaculture
- ◇ Harvesting by commercial and recreational fisheries for human consumption
- ◇ Catch-and-release recreational fishing
- ◇ Employment and income generation by capture fisheries and aquaculture
- ◇ Pollution of inland water bodies by aquaculture
- ◇ Escapes of fish from farms and introduction of alien species
- ◇ Increase of eutrophication through water discharge from farms or other sources
- ◇ Harvesting of protected species
- ◇ Conflicts between resource users, non-users and interest groups and competitiveness of the sector compared to other sectors
- ◇ The role of fisheries within society and in cultural and religious traditions and
- ◇ Enactment of new and enforcement of current policies and decisions on water use.

OBJECTIVES

The principal aims of the symposium are: (i) to provide a forum for those working on specific socio-economic and ecological aspects of inland fisheries and aquaculture in Europe (including researchers, natural and social scientists, environmental scientists, fisherfolk, aquaculturists, economists, planners, government officials, NGO representatives and other stakeholders) and (ii) to review the interactions between socio-economic and ecological objectives in fisheries and aquaculture, exchange experiences and discuss solutions to imbalances in sustainable development and management of the sector.

The **specific objectives** of the symposium will be:

1. To review the wide range of interactions in fisheries and aquaculture, with particular emphasis on socio-economic and ecological issues and the roles of various stakeholders with respect to these interactions.
2. To identify where future research should focus and propose measures to decrease interactions that compromise sustainable development and management and promote interactions that contribute to sustainability.
3. To provide information to policy and decision makers to contribute to the general awareness of trends in socio-economic and ecological interactions within and between the sector and other rural sectors.
4. To facilitate dialogue between scientists, researchers, fisherfolk, aquaculturists and policy and decision makers on the motives, interactions and interests of stakeholders.
5. To advise EIFAC on appropriate management and development measures and tools for inland fisheries and aquaculture in Europe.

THEMES

The symposium will examine interactions, in accordance with the following four thematic areas:

1. Ecological interactions
2. Economic interactions
3. Social interactions
4. Governance interactions

CALL FOR PAPERS

Written contributions and presentations are invited within any of these broad themes. Although the conference is related to experiences within EIFAC member countries, experiences from elsewhere in the world are encouraged to provide a broad overview of issues and solutions. Original research is also welcome as long as it focuses on interactions and integrated perspectives. Inter-active discussion during the symposium will lead to major statements embracing the entire context and the needs for future of research into the interactions between socio-economic and ecological objectives of inland capture fisheries and aquaculture in the EIFAC region and how it can influence policies in other regions. Anyone wishing to present a paper or poster should submit by e-mail or fax a title and abstract (not exceeding 150 words) by **30 October 2007** to the Technical Secretary of EIFAC Sub-Commission IV – Socio-economic issues, Sub-Regional Office for Central Asia (FAOSEC), FAO, Ankara,



D. BARTLEY, FAO

Studying native fishes in Austria

Turkey via e-mail: Raymon.vanAnrooy@fao.org or fax: (+90)-312-3271705.

Selected papers that address the theme of the symposium and are of an appropriate standard will be published in a special issue of the Blackwell Science journal *Fisheries Management and Ecology*. All presented papers will also be published in the new series of FAO Fisheries Proceedings, which will include a CD-ROM with PDF versions of the presentations at the symposium (after agreement from the author).

EIFAC does not have the financial means to fund travel and participation of those attending the symposium. However, through co-sponsorship and partnership with other organizations and institutions, the costs involved in attending the symposium will be kept to a minimum.

More information on the symposium may be obtained from the EIFAC website: (<http://www.fao.org/fi/eifac.htm>), or from the following people involved in the symposium organization:

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Participants in the EAA meeting in Palma de Mallorca

Building and consolidating a framework for an Ecosystem Approach to Aquaculture – Initial steps towards guidelines

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and Nathanael Hishamunda³

BACKGROUND

The 1992 Earth Summit in Rio de Janeiro raised the issue that, because of their sector based approach, environmental management policies, were not adequately covering the full impacts of human development and exploitation of the environment. This recognition led policy makers to adopt a more concerted move to incorporate a holistic approach to policy decision-making and interest in the “Ecosystem Approach” to development. In response to this move, the FAO Fisheries and Aquaculture Department started exploring the application of the Ecosystem Approach to Fisheries (EAF) in 2003¹.

The Ecosystem Approach may at first not seem so necessary for aquaculture since this activity has a long tradition in some parts of the world and there are many examples of well-integrated and ecologically-efficient aquaculture systems throughout Asia and in the Pacific Islands. The environmental impacts of these activities have been generally limited because they are usually small-scale and are low-input in nature, mostly relying

on locally produced inputs, often within larger agriculture farming systems. As aquaculture develops and moves towards more intensive and specialised commercial enterprises, some of these attributes change, which, often breaks traditional ecosystem linkages. It has therefore become timely to explore the application of the Ecosystem Approach to Aquaculture (EAA) and its implementation to current practices in aquaculture development.

Commercial intensive aquaculture invariably involves the expansion of cultivated areas, higher density of aquaculture installations, the use of feed resources produced outside of the immediate farm area, and other inputs, most of which are produced “off site”. With the use of such inputs, aquaculture ecosystem linkages have expanded considerably beyond the immediate vicinity of the farm. The use of alien species, the intensive use of formulated feeds and, in some systems, the requirements to use chemicals for the control or management of diseases all are potential sources of significant ecological risks. All of these practices have

implications for ecosystems where farms are located, and in some cases considerably beyond the farm boundaries. Impacts on ecosystems caused by aquaculture may also have implications for the livelihoods of local communities and other involved groups (for example feed and seed suppliers).

Some of the issues which may have implications for natural ecosystems include: (i) demands on fisheries for fish meal/oil and other major constituents of carnivorous/omnivorous species feeds, (ii) nutrient and organic enrichment of recipient waters resulting in risks of eutrophication and build-up of anoxic sediments, (iii) changes in benthic communities, (iv) eutrophication of lakes or coastal zones, (v) disruption and restructuring of biological and/or social environments, (vi) competition for, and in some cases depletion of resources (e.g. water) and (vii) negative effects from escaped farmed organisms on native species by competition, predation and/or by inducing genetic modifications on natural populations.

Such negative effects can have social implications, which in many cases are not known or poorly evaluated. Because humans are an important part of the ecosystem, equity can be a major issue, especially in commercial aquaculture if the benefits from it are retained by a small portion of the community and do not accrue to a larger spectrum. The effects of aquaculture on ecosystems can be considered in the short- and long-term. Of particular concern, for example, might be ecosystem changes that "jeopardize" the options for future generations to benefit from the full range of goods and services provided by natural ecosystems.

In light of this discussion and in response to the explicit request of the Third Session of the COFI Sub-Committee on Aquaculture as endorsed by the Committee of Fisheries (COFI) to improve the management and enhance the socio-economic impacts of aquaculture, the Aquaculture Management and Conservation Service (FIMA) initiated an effort to look into the development and application of the ecosystem approach to aquaculture production. This activity, which is funded under a Japanese Trust Fund Project (Towards Sustainable Aquaculture: Selected Issues and Guidelines), is conducted in collaboration with the Fisheries and Aquaculture Development and Planning Service (FIEP).



A. WAINBERG, BRAZIL

Integrated aquaculture systems in an organic farm in Northern Brazil (Natal area). Shrimp, oysters and sea horses (for aquarium) are produced here with an ecosystem perspective



D. SOTO, FAO

Salmon farming cages in a fjord in Southern Chile; the fjord arm can be considered the "water body scale"

The potential benefits of EAA include improvement of the acceptance of aquaculture by consumers through avoidance of ecosystem resilience² impairment and by offering new societal opportunities, including equity. The development of management principles and practices based on the EAA can also be beneficial to producers. For example, certification of aquaculture products which have been produced through ecosystem approaches can help farmers forge new market niches with premium prices.

EXPERT WORKSHOP

As an initial step towards the development of guidelines for an Ecosystem Approach to Aquaculture, FIMA, in collaboration with the University of Illes Balears, organized an Expert Workshop on "Building and consolidating a Framework for an Ecosystems Approach to Aquaculture – Initial steps for guidelines" from

7 to 11 of May 2007 in Palma de Mallorca, Spain. The workshop brought a group of 22 internationally-known experts with diverse regional and field background, including environmental scientists, ecological modellers, social scientists, NGO experts, policy makers and farmers. The purpose of the workshop was to: (i) agree on concepts, principles and scales of an Ecosystem Approach to Aquaculture, (ii) analyze present evidence, availability of knowledge and tools and (iii) to identify further work needed before guidelines for EAA can be elaborated.

The FAO Secretariat introduced the workshop by presenting an overview of sustainability approaches in aquaculture and a proposition for an initial EAA framework. Several presentations were made thereafter. They covered the EAA advances in coastal aquaculture and mariculture, and in freshwater aquaculture, the latter mostly focusing on Asia. Other papers covered the legal and policy implications of EAA by addressing national and international issues, economic and the social dimensions. Several other presentations highlighted some of the practices and tools for implementing EAA. These included reviews on integrated aquaculture in world temperate zones, in one enclosed ecosystem (the Mediterranean sea) and in tropical regions of the world. Other papers emphasized some tools which included the potential for geographic information systems (GIS) to support the implementation of an EAA and the role and practicality of sustainability indicators.

MAIN OUTCOMES

The workshop agreed on the following definition for EAA: *"An Ecosystem Approach for Aquaculture is a strategy for the integration of the activity within the wider ecosystem in such a way that it promotes sustainable development, equity, and resilience of interlinked social and ecological systems"*.

An EAA involves natural and social ecology, planning for community development, and concerns for the wider social, economic and environmental contexts of aquaculture. This is essentially applying the ecosystem-based management as proposed by the Convention on Biological Diversity (CBD) (UNEP/CBD/COP/5/23/ decision V/6, 103-106) to aquaculture and also following the provisions of the Code of Conduct for Responsible Fisheries (CCRF). [However, the Ecosystem Approach to Aquaculture shall go beyond these; a very](#)

[explicit inclusion of humans would contribute to a more operational implementation and development of an ecosystem-based management in the wider context of involvement of other sectors.](#)

Experts also agreed on the scales (both geographical and governance), principles and some practices which should lead to the development of guidelines in this area. They suggested that these mostly focus on policy-making and governance:

Scales: Experts identified four physical/geographical scales of EAA application: the farm; the water body and its watershed; the aquaculture zone or region; and the global, market-trade level.

Some of the EAA key principles proposed were:

- i. Aquaculture should be developed in the context of ecosystem functions and services including biodiversity with no degradation of these beyond their resilience capacity.
- ii. Aquaculture should improve human-well being and equity for all stakeholders.
- iii. Aquaculture should be developed in the context of (and integrated to) other sectors' policies and goals.

These principles will be further discussed and expanded through global case studies. For example, there is a need to define and agree on what can be considered a net loss for ecosystem functions and services, and at which geographical scale. It is equally important to discuss and agree on what constitutes "acceptable" negative impacts. These case-studies will shed light on how these issues have been dealt with in different regions and how they can be improved.

Other initiatives such as those of the Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP)³ have made important, similar propositions for sustainable coastal aquaculture development. However, the workshop experts felt that, given the complexity of different scales and the effects of globalization on the development of aquaculture, EAA should provide a more integrated, comprehensive but simple framework.

Additionally; experts identified some aquaculture practices which policy makers could use as good examples when promoting EAA. These include: integrated aquaculture; ecosystem-based approaches of mitigating negative impacts of aquaculture; inter-sectoral integration when appropriate; broadening stakeholders participation; use of appropriate incentives; use of local and other relevant knowledge; and promotion of EAA-specific research (e.g. estimate carrying capacity at farm level, at the level of the aquaculture zone, the region etc.).

At the end of the workshop, representatives of the public (policy-making) and private (farming) sectors were asked to provide their comments on the usefulness and applicability of workshop outcome. From the farmer's perspective, there was a need for much support and strengthening of governance in order to implement EAA. There was also a need for effective economic incentives for farmers. For the policy-making sector side, there are several requirements to the implementation of EAA. The implementation should start at the smallest scale possible, with a participatory framework toward addressing stakeholder interests, concerns and gaps, and in a climate of mutual trust. Thus, the building and implementation of EAA should be bottom-up.

THE WAY FORWARD

The EAA process will continue (Box 1) with the publication of the workshop report and proceedings. A second expert workshop including scientists, policymakers and farmers will be convened to draft guidelines for the implementation of EAA by policy-makers.

Further details on the workshop report and proceedings are available from Doris Soto at FIMA, e-mail: Doris.Soto@fao.org)

Box 1. Ecosystem Approach to Aquaculture Road Map

- △ Concept papers — July 2007
- △ Global reviews of integrated aquaculture to be published — July 2007
- △ Global reviews — August 2007
- △ FAO Fisheries Technical Paper publication containing the proceedings of the workshop including: global reviews, concept papers and recommendations/conclusions from workshop, and a revised road map for the development of EAA framework and future guidelines — November 2007.
- △ Draft of general guidelines for EAA based on Technical paper April 2008.
- △ Expert workshop to review and adopt EAA guidelines — 2008.

¹Ecosystem Approach to Fisheries (EAF). FAO *Technical Guidelines for Responsible Fisheries No. 4*, Suppl. 2. Rome, FAO. 2003. 112 pp (also available at <http://www.fao.org/DOCREP/005/Y4470E/Y4470E00.HTM>).

²Resilience is defined as the amount of disturbance that a system can withstand without changing self-organized processes and structures.

³GESAMP 2001. Planning and management for sustainable coastal aquaculture development. Rep. Std. GESAMP 68: 90 pp.

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Information Sharing via The Aquatic Commons

Jean Collins¹

Networks of libraries and information centres have for centuries shared the information and expertise of the individual units in order to provide better information services to their users. Developments in information and communication technologies (ICTs) are providing many new opportunities to share information online and to make it available globally to end users. One such new development is the **Aquatic Commons**, an **Open Access** digital repository for the aquatic sciences, including fisheries and aquaculture.

One of the characteristics of the literature of fisheries and aquaculture – in particular the practical and management rather than the scientific aspects – is that it does not easily find its way into commercial journals. The results of research and the development lessons learned are often lost because of inadequate opportunities to publish, especially but not only in developing countries. It is precisely this unique, locally produced and difficult to locate 'grey literature' which the **Aquatic Commons** intends to capture.

The lack of access to timely and accurate information has been identified by many countries as one of the constraints to the implementation of the 1995 FAO Code of Conduct for Responsible Fisheries. The **Aquatic Commons** is seen as an opportunity to achieve the improved capture, dissemination and preservation of fisheries and aquaculture information, based on the principles of equal ownership and resource sharing. Its specific aims include:

- improve sharing of information on fisheries and aquaculture management;
- facilitate the sharing of knowledge and lessons learned;
- ensure equal participation and coverage of the literature from developing and developed countries;
- empower managers and resource users to publish their findings;

- provide free and **Open Access** to information for all;
- enable the use and validation of research results and avoid costly and wasteful duplication of effort and
- ensure the preservation of information and its availability for future generations.

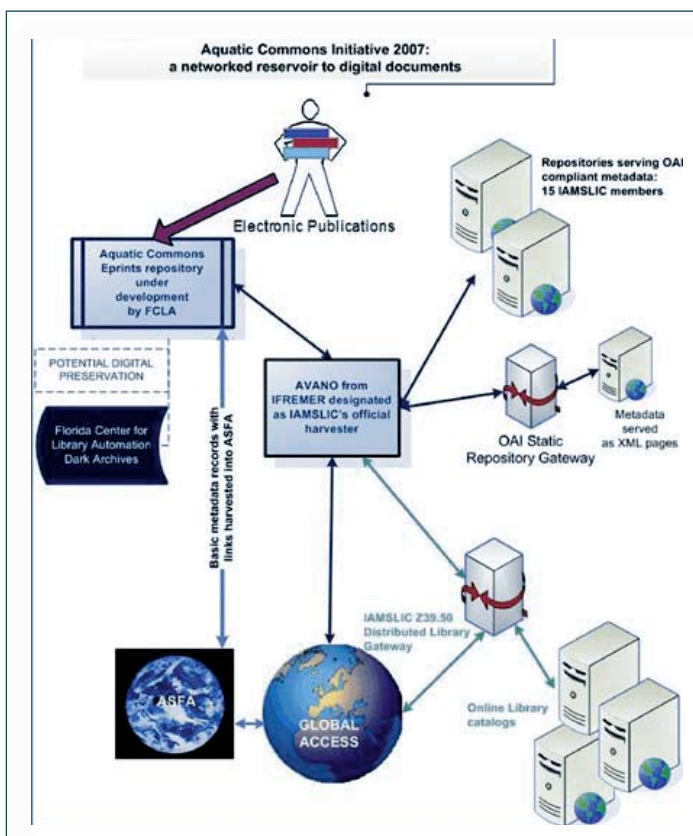
<http://aquacomm.fcla.edu/>



THE BASICS

The **Aquatic Commons** repository of the International Association of Aquatic and Marine Science Libraries and Information Centers (IAMS LIC) is in the final stage of tailoring before release. It is intended to facilitate the exchange of scientific research related to the marine/aquatic environments by providing a searchable, internet-accessible repository for digital documents. Initially, it will seek to build content based on born digital and legacy documents in PDF format. It is specifically mandated to offer repository services where local, stable ICT support is lacking. Future development will explore the serving of additional formats and alphabets. The **Aquatic Commons** is intended to complement institutional repositories and to collaborate with related subject repositories particularly in developing countries, such as the OceanDocs program of the Intergovernmental Oceanographic Commission.

A long-term goal will be to assist in providing access to legacy collections that have never been easily accessible to researchers and to provide access to the grey literature produced as the technical series of smaller research



needed to facilitate the sharing of information and other FAO bodies such as the Committee for Inland Fisheries of Africa (CIFA) and the Commission for Inland Fisheries of Latin America (COPESCAL) will also provide useful fora in which to promote the **Aquatic Commons**.

Related web sites:

Aquatic Commons: <http://aquacomm.fcla.edu/>
 EIFAC: <http://www.fao.org/fi/body/eifac/eifac.asp>
 EURASLIC: <http://www.euraslic.org/>
 IAMS LIC: <http://www.iamslc.org/>
 NACEE: <http://www.agrowebcee.net/subnetwork/nacee/>

More information may be obtained by writing to Ms Jean Collins.

The Network of Aquaculture Centres in Asia-Pacific (NACA) and the FAO Fisheries Library have collaborated on development of the **Aquatic Commons** and to produce guidelines specifically to assist institutions with limited ICT resources and expertise.

units in universities, governmental, and non-governmental agencies. The repository runs on the EPrints open access software created at the University of Southampton (UK) and is managed by contract with the Florida Center for Library Automation (FCLA) (USA). The repository is managed for IAMS LIC by an Aquatic Commons Board, which includes two FAO representatives.

The **Aquatic Commons** repository is part of a larger initiative intended to serve as an IAMS LIC infrastructure for resource sharing.

The 12th Biennial Conference of the European Regional Group of IAMS LIC

Fifty participants from 14 countries, attended this Conference in Crimea (Ukraine) from May 2 to 4, 2007, to discuss areas as diverse as digital repositories, consortia for access to e-journals and rare, historical library collections on the aquatic sciences. Armand Gribling from FAO Fisheries Library presented a poster to show how FAO is promoting the **Aquatic Commons** via FAO related bodies and networks. Of particular interest to this meeting were the European Inland Fisheries Advisory Commission (EIFAC) and the Network of Aquaculture Centres in Central and Eastern Europe (NACEE). National, regional and international partnerships are

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FAO entrusted to develop guidelines on Aquaculture Certification

Rohana P. Subasinghe¹

In March 2007, an Expert Workshop was held in Bangkok, Thailand with the view to bring stakeholders together to initiate a process of developing guidelines on aquaculture certification as requested by the FAO Committee on Fisheries, Sub-Committee on Aquaculture (COFI/AQ/III) during its third session. The Expert Workshop was jointly organized by FAO and the Network of Aquaculture Centres in Asia-Pacific (NACA) and was hosted by the Royal Government of Thailand.

The workshop was intended to assist in scoping the content of the certification guidelines and laying the groundwork for the programme of work on aquaculture certification. In addition, the workshop considered certification issues specific to the Asian region. This Expert Workshop complemented the regional analysis for Latin America which will be undertaken from 31 July to 03 August 2007 during the planned workshop in Fortaleza, Brazil.

The following are the main outputs of the workshop, driven by the discussions and perspectives of the participants:

- > Stakeholders brought together to initiate a process for developing guidelines for aquaculture certification as requested by the COFI/SCA
- > Key aquaculture certification issues examined
- > Consensus built and scoping of the contents of the certification guidelines
- > Groundwork laid for a programme of work on developing aquaculture certification guidelines and

- > Roadmap agreed for developing the guidelines.

Driven by concerns that some forms of aquaculture are environmentally unsustainable, socially inequitable and that products are not safe for consumers, over the years there have been attempts to respond to the consequent public perceptions and market requirements. Food safety standards have been elevated and international trade regulations tightened. Policy and regulations governing environmental sustainability have been put in place in many countries, requiring aquaculture producers to comply with more stringent environmental mitigation and protection measures. In some countries these changes were initiated by the aquaculture sector itself, usually within the more organized private industry sector to ensure its sustainability and to protect operations from poorly-managed activities. The private sector has made significant advances in the management of its activities and there are many examples of improved management of farming systems that have reduced environmental impacts and improved efficiency, including profitability, in all regions.

Owing to the need for responding to these environmental and consumer concerns on aquaculture production and in order to secure better market access, there is increasing interest in certification of aquaculture production systems, practices, processes and products from aquaculture. For example, recent legislation in both Europe and the US require mandatory certification to identify whether

aquatic products are produced from aquaculture or wild caught. These markets increasingly recognize that some form of certification is a way of assuring buyers, retailers and consumers that fishery products are safe to consume and that they originate from aquaculture farms or capture fisheries adopting responsible management practices. Certification has been introduced to capture fisheries for some time. Guidelines for eco-labelling of capture fishery products have been developed by FAO in 2005¹ and efforts are being made to develop eco-labelling guidelines for inland fisheries². There is a need for harmonization of fish quality and safety standards within aquaculture, implying increased development, thus wider use of internationally agreed, scientifically-based standards has become necessary.



In several countries, aquaculture producers are introducing environmental certification of aquaculture products, either individually or in a coordinated manner, in order to credibly demonstrate that their production practices are non-polluting, non-disease transmitting and/or non-ecologically threatening^{3,4}. Some countries are attempting to introduce state-mediated certification procedures to certify that aquaculture products are safe to consume and farmed in accordance with certain environmental standards⁵. Most of the work done on improved management has been on salmon and shrimp, mainly due to their high commodity value, cost absorption capacity and the importance attached as the most important internationally traded products.

During the Expert Workshop, a series of orientation presentations were made, outlining the general issues facing the development of aquaculture certification guidelines and some guidance on the global state of aquaculture certification and relevant agreements and standards. There were 13 presentations made by participants at the workshop covering their national or institutional experiences on different forms of certification schemes.

The Expert Workshop was attended by 72 participants from 20 countries, including several major aquaculture producing and consuming nations. The participants included experts from government agencies, private business, experts involved in certification schemes and food safety and non-government organizations.

It is expected that the first draft of the Guidelines on Aquaculture Certification will be tabled during the workshop in Fortaleza, Brazil in July 2007.

Further details on the process of developing guidelines on aquaculture certification and all relevant technical documents are available at www.enaca.org/certification

Further information can be obtained from:

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¹FAO. 2005. Guidelines for Ecolabelling of Fish and Fishery Products from Marine Capture Fisheries. Rome. FAO. 2005. 90p.

²Expert Consultation - Guidelines on Ecolabelling of Fish and Fishery Products from Inland Fisheries Rome, Italy. 23 May 2006- 26 May 2006

³ABCC. 2004. "Código de conduta para desenvolvimento sustentável e responsável da carcinicultura brasileira". ABCC - Association of shrimp growers of Brazil.

⁴FAO. 2006. The state of world aquaculture 2006. FAO Fisheries Technical Paper. No. 500. Rome, FAO. 2006. 134p.

⁵FAO TCP/CHI/3002 Certification of the compliance of the environmental regulations by the aquaculture industry in Chile.

Development of international guidelines on the use of wild fish for aquaculture production

Alessandro Lovatelli¹

The project “*Towards sustainable aquaculture: selected issues and guidelines*” implemented by FAO and funded by the Government of Japan, through a Trust Fund arrangement, aims at addressing selected key issues of sustainability in present global aquaculture practices and development. In recognition of the recommendations of FAO’s Committee on Fisheries/Sub-Committee on Aquaculture (COFI/SCA) during its first two sessions, a thematic area on the ‘*use of wild fish and fishery resources for aquaculture production*’ had been identified as a priority for targeted action.

A project to develop international guidelines on the use of wild fish for aquaculture production is being implemented. The project is aimed at collating and synthesizing available information on the above thematic area as basis for generating potential management regimes and other options (both generic and specific contexts) for feasible and affordable targeted response measures pertaining to the specific issue of concern. The outputs to be generated by this project will assist FAO Member Countries in the promotion and implementation of the provisions of the Code of Conduct for Responsible Fisheries (CCRF).

Aquaculture, as a diverse sector, uses many strategies to increase production. One such strategy is the harvesting of wild individuals, either as broodstock whose eggs will hatch and develop under culture in ponds or cages, or as early life-history stages for on-growing under confined and controlled conditions. This system of aquaculture production may be termed *capture-based aquaculture* and is practiced worldwide on a variety of marine and freshwater species¹.

Capture-based aquaculture has certain advantages and disadvantages compared to aquaculture that controls the full breeding cycle of farmed species. The primary advantage is that the system does not rely on controlling the reproduction and breeding of farmed species.

Thus, species with high market value or that are readily available naturally can be farmed without the necessity to develop hatcheries or breeding programmes. However, the lack of domestication potential for wild-caught species has also its disadvantages including the fact that there will be no genetic improvement possible, even in the long-term.

Capture-based aquaculture is practiced on high value marine finfish species such as tuna that require high protein diets and sturdy culture facilities. However, it is also used on low-value fish species that may be farmed in small ponds or inexpensive farming systems with minimal inputs. The former provides economic opportunity, but requires substantial infrastructure and investment, whereas the latter provides food security and modest additional income to rural communities. However, both need to be evaluated in terms of economic viability, wise use of resources and environmental impact.

The scale of such practices is difficult to quantify, but it is estimated that about 20 percent of marine aquaculture production comes from capture-based aquaculture with a value of US\$1.7 billion. The culture of many freshwater species also relies partly or fully on fry caught from the wild because the supply from hatcheries is not adequate to meet the demand, or because the quality of hatchery produced seed is perceived as inferior to wild caught by the farmers. The main concern related to such farming practices is whether they have negative impacts on wild stocks of the targeted species as well as on non-targeted species. Although there is generally little data in support of these claims, some countries have tried to ban or somewhat restrict these fisheries.

As in all aquaculture, there are environmental concerns that need to be addressed with harvesting wild resources. In most fishery management laws, there are minimum sizes on harvested species and often restrictions on the

harvest of spawning adults. However, early life history stages and adults ready to spawn are the target individuals in wild-caught farming. The impact on natural populations that are "targeted" for this type of aquaculture needs to be addressed to determine the sustainability of the practice.

The longer-term development objective of this project component is to contribute to improved and effective fish farming and conservation of natural aquatic populations at the global level, with minimum disruption to responsible fisheries and livelihoods through successful implementation of ecosystem approaches in fisheries. The project will result in an assessment and a review of the use of wild fish/fishery resources for aquaculture production as well as consider the socio-economic and environmental impacts of this practice. It will therefore serve to guide policy-makers in potentially developing policies and practices that take into account both the use and conservation of aquatic resources.

Through the project, a number of review papers have been commissioned which include both marine and freshwater examples and cover ecological, socio-economic and livelihood impacts. The list of commercial species and related geographical coverage under review are the following: Atlantic and southern bluefin tunas (Mediterranean/Australia); European eel (Europe); mud crab (Southeast Asia); groupers (Southeast Asia); yellowtail (Japan); cod (North Sea); oysters (Korea Rep.); snakehead and pangasiid catfish (Mekong region); carps (Gange Delta); *Clarias* catfish (Africa/Cameroon); and mullets (Egypt). Two main thematic reviews have also been commissioned: (1) environment and biodiversity issues and (2) socio-economic issues related to the exploitation/use of wild fish/fishery resources for aquaculture.

A technical workshop will be organized in Viet Nam in October 2007 to synthesize and review the materials produced and to lay the foundation for the production of a set of technical guidelines on the responsible use of wild fish and fisheries resources for aquaculture production. The workshop proceedings will be published together with the review papers along with the guidelines when finalized.

More information about the project may be obtained by e-mail from Mr Alessandro Lovatelli, Lead Technical Officer of the project.



NACA, BANGKOK

Farmed grouper sold in a Thai market



SUZUKI, JAPAN

Farmed bluefin tunas on sale in the Tokyo Fish wholesale market

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Note: In 2004, FAO published a technical review document entitled "Capture-based aquaculture: The fattening of eels, groupers, tunas and yellowtails" authored by Ottolenghi, F., Silvestri, C., Giordano, P., Lovatelli, A. and M.B. New. (see FAN issue July 2004, No. 31 - page 43).

Support to the implementation of the “diversification” component of the FAO Special Programme for Food Security (PSSA) through the development of poultry production and fish farming

Valerio Crespi¹ and Emmanuelle GuerneBleich²

INTRODUCTION

This article presents the results of a Trust Fund project associated with the FAO Special Programme for Food Security (PSSA) in Haiti.

The economy of the Republic of Haiti is essentially based on the agricultural sector which generates employment for more than 60 percent of the active workforce and contributes towards 32 percent of the Gross Interior Product (GIP). Unfortunately, political instability and technical and structural constraints (low level of agricultural production, terrain with steep slopes, loss of forest cover, etc.) have had negative impacts on the agricultural sector. In fact, the national agricultural production has strongly decreased over the last 20 years.

In areas where the PSSA has been implemented, the basic diet is mostly made of cereals. However, this type of diet should be enriched with sources of proteins of animal origin that has high level of nutritional value.

Development of poultry production and fish farming could rapidly contribute to the improvement of the local diet. Such activities could also generate additional revenues for rural households. In addition to this, the implementation of the “Diversification” component of the PSSA would lead to the integration at the farm level of the various agriculture and animal production activities to improve diet variety.

This “diversification” component has been implemented in Haiti since 2003, financed over the years through the following:

- An FAO Technical Cooperation Programme (TCP/HAI/2903) from January 2003 to October 2005; and
- The Organization of Petroleum Exporting Countries (OPEC) through a project GCP/HAI/017/OPF from July 2005 to December 2006.

PROJECT OBJECTIVES

The main objective of the project was to increase income and food security and to improve access to a variety of local diets through the development of poultry husbandry and fish farming in rural areas of the country. More specific objectives were:

- construction of fishponds (60 earthen ponds with an average area of 150 m² per pond), and of hen house with an average size of 15 m² (500 hen houses);
- improvement of the local production and the distribution of 3 000 local chickens ready to lay eggs, as well as 500 roosters, including 420 introduced superior roosters to 500 producers;
- transport of 40 000 fingerlings and their distribution to the various fishponds;
- strengthening of farmer capacities and of their respective associations in order to ensure the project implementation and the follow-up of poultry and fish production activities;
- learning of best practices in fish farming management; and
- improving synergies and participation of different partners (financial partners, NGOs, Cooperation Agencies etc) and project stakeholders.

The strategy used by the project has been the strengthening the technical capabilities of the beneficiaries, tested and defined during the pilot phase of the project (TCP/HAI/2903).

AREA OF INTERVENTION

The main areas of implementation were the Southern and Artibonite Department. The activities of the project were carried out in 16 localities, with the cooperation of more than 40 farmers, as indicated hereforth:

- Savanette, Béraud, Boury, Monvil, Marchand Dessalines, Plassac, Crête à Pins, mainly for poultry production.
- Charlette, Torbeck, Foscave, Tolière, Guillème, Dantan, for fish farming.
- Bassin, Platon, Houck for areas including both types of activities from the main component.

RESULTS

Fish farming component

Training. Training represented the main element of the fish farming component. Its objective was to strengthen the sustainability of the results achieved so far, and future results, as well as to increase the local skills of the stakeholders involved. The training/seminars organized by the project involved a total of 112 producers from the project sites. Training of the technicians and field extension officers represented an important part of the implementation process. The country does not actually possess a wide pool of trained managers and experienced technicians; therefore, support to the beneficiaries requires adequate training of the local personnel who will have to directly and indirectly intervene. Several training sessions and advanced courses were organized for both technicians and field extensionists.

Equipment. Some equipments and materials were donated to the beneficiaries through the farmers' associations who controlled the day-to-day implementation of this specific component. The materials distributed in its final session consist of fishing nets for sampling and fish harvesting. The project also provided to the beneficiaries fingerlings produced at the Pont Sonde Hatchery and the fish farm of Vilna at Verrettes. In total, 61 fishponds received some 30 350 fingerlings with a mean weight of 3 to 5 grams per fingerling, and a seeding density of 1-2 fingerlings per square meter. The cultured species used during the project were Nile tilapia (*Oreochromis niloticus*) and common carp (*Cyprinus carpio*).

Pond digging. Considerable work was devoted to the digging and rehabilitation of a certain number of earthen ponds for fish production. At the conclusion of the programme, 56 fishponds with an average area of 150 m² were built.

Fish farming production system. The farming system used in this project was a polyculture fish



Partial fish harvesting in a pond built through the assistance of the project

production system using common carp and Nile tilapia. This system allowed the adoption of a production cycle of 6 to 8 months with the use of organic fertilization (i.e. compost). In terms of feed, production/transformation units (mills provided by the project) were installed in each project site using agricultural by-products (rice bran, corn, sorghum byproducts, cattle blood, etc). This contributed to reduce and in some cases eliminate the acquisition of expensive commercial feeds.

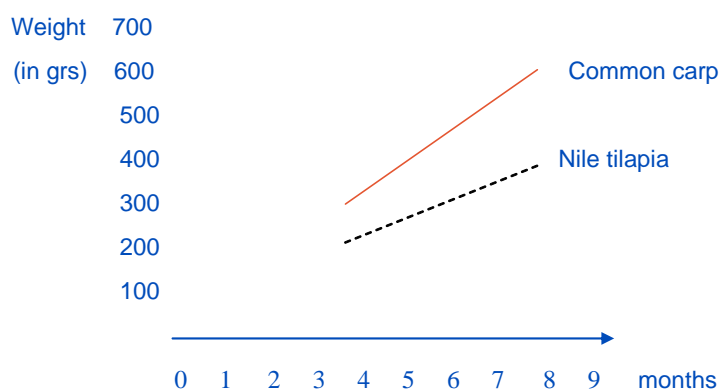
Partnership with Integrated Rural Development (IRD). To facilitate regular supply of fingerlings in the southern sites, the project signed an agreement with IRD, an NGO installed close to the city of Les Cayes, in order to rehabilitate their raceways and to develop a hatchery for the production of fingerlings. This centre is now functional and ready to sell and distribute fingerlings to the Southern producers at a cost of 3 gourdes/fingerling (0.085 \$US).

Table 1. Digging and stocking of the fishponds in the different project sites

Sites	Number of producers	Total number of fish ponds dug	Total areas (in m ²)	Number of stocked fish ponds	Average number of fingerlings /pond	Total number of fingerlings	Species
Torbeck Commune	35	35	525	24	225	5400	Carp, Tilapia
Marmelade Commune	21	21	315	14	225	2850	Carp, Tilapia
Total	56	56	840	38	-	8250	-

Growth rate of cultured species. According to samplings carried out after three months and a half in selected fishponds, the fish presented a very satisfying growth rate of 275 grams of live weight for the common carp and 142 grams for Nile tilapia. These numbers can be translated into a daily growth of 2.5 and 1.34 grams, respectively, for carp and tilapia. Figure 1 presents the growth rate of the fish respectively after 3.5 and 8 months. Daily weight gained by carp and tilapia confirms that the fishponds are rich in organic nutrients which are well exploited and consumed by the cultured species.

Figure 1. Growth rates of common carp and Nile tilapia



POULTRY PRODUCTION COMPONENT

Training and Monitoring & Evaluation (M&E) Activities. One important activity during the test phase entailed preparing training materials, including technical leaflets and M&E tools to be used in the extension phase. The technical leaflets deal with topics such as:

- supporting training documentation for technicians, Avian Health Agents (AHA), and for pilot producers;
- preparing and leading vaccination campaigns against Newcastle disease (ND) and Controlling internal parasites; and
- monitoring poultry farming activities.

Training activities targeting the project Extension Staff and farmers. Training sessions have gathered the Extension Staff, with particular emphasis on poultry and fish producers. The developed topics focused on issues such as:

- major endemic pathologies in the country: diagnostic and prevention tools/methods;
- organizing/leading vaccination campaigns; and
- improved poultry production.

These sessions provided good opportunities for the technical refreshment of the project team.

Construction and Equipment of Chicken coops. The overall objective of the poultry component is to improve the local poultry production. Therefore, among other considerations, the activities focused on protection through confinement and management/handling abilities, including the adoption and dissemination of improved models of poultry coops, built in locally available materials.

Vaccinating poultry and controlling internal parasites. The epizootic character of the Newcastle Diseases in Haiti is responsible for the poultry's high mortality rate (up to 80 percent) in that country, making this disease the main constraint facing poultry producers. In order to address this situation, a particular emphasis was put on promoting activities for the vaccination against that plague, including other initiatives aiming to control infestation by internal parasites in poultry.

Distribution of breeder roosters. The roosters were mainly selected from the Plymouth and Rhode Island breeds. Four hundred and twenty breeders aged 3-4 months were selected and distributed to motivated and trained farmers. An additional group of 80 beneficiaries was identified and received 80 locally selected breed roosters.

Implementation and qualitative results. The socio-political situation prevailing in Haiti during the implementation phase led to some delays in the execution of the programme, as funding from OPEC was not concluded before December 31, 2006. Nevertheless, some activities have been undertaken and results could be summarized as follows:

- 500 farmers, including a majority of women were identified, selected and updated with skills pertaining to improved traditional poultry husbandry practices;
- 500 medium-sized chicken coops were built, incorporating a brooding area for each. Over 90 percent of these newly built coops are functional;
- 6 field extension agents from the commune of Marmelade and one extension agent from PSSA at Marchand were equipped with new understandings in the field of production techniques, and M&E systems of poultry production;
- 40 farmer-leaders, of which 16 women were trained and updated in their roles as Avian Health Agents (AHA);
- 3 000 hens and 80 improved roosters were identified and selected from the local flocks;

- 420 roosters from Plymouth and Rhode Island Red breeds were purchased and distributed to the beneficiaries;
- availability to beneficiaries of veterinary products including other farm inputs such as pesticides, poultry farm equipments was enhanced; and
- over 25 000 chickens were vaccinated and implementing Newcastle Disease vaccination became a reality.

From a qualitative point of view, many positive aspects have been observed and among other considerations, it was observed that improved management of domestic flocks resulted in enhanced flock control, good follow-up of vaccination programmes and improved mastery of crop protection at planting time. Similarly, improving poultry management led to more easy flock handling and adequate protection against adverse weather conditions and predators. From a practical perspective, it was pleasant to learn that farmers have improved their expertise to deal with the prevention and the control of Newcastle Disease, and that this had positively impacted their neighbors in terms of experience sharing.

Quantitative results. The delay in setting up poultry pens led to the delay of production, thus production parameters could not be obtained on time. Poultry production was fully operational as of June 2006. However, one could observe that:

- the conjunction of each vaccination campaign with internal deworming allows to reduce the mortality rate from 80 to 20 percent;
- the mortality of the young chicks could now be contained as low as 25 percent. (70 percent mortality containment at the beginning), and
- the hatching rates reached a high level of 78 percent and could still be significantly improved.

CONCLUSION

The implementation of the "diversification" component of the PSSA project has now reached the end of the first extension phase funded by OPEC. The "diversification" component has been executed in an outstanding manner, in terms of the pre-defined implementation strategy. This project has allowed to better understand the existing or potential synergies amongst various activities; the compost contributed to the improvement of the fishponds and recycled manure was generated by all available short-growth cycle animals such as poultry, small animals, pigs, etc. as well as by-products of agriculture. The water from the fishponds also allowed the irrigation of cultivated

fields. The hen houses allowed for a better control of agricultural crops thanks to the confinement of the birds in a restricted area. The fish wastes (either dead fish collected during the production cycle and other waste byproducts) were used as a part of the chicken feed. Such integration was more clearly understood by farmers, who in turn benefitted equally from the various information exchanges and awareness activities amongst producers. Farmers have explicitly expressed that these activities are mutually profitable and must be combined.

Although the execution of the project was delayed, the partial results observed indicate that these activities have been fully integrated in the new exploitation sites, with support from FAO and the Ministry of Agriculture. The level of motivation and fulfillment throughout the duration of the programme has been outstanding and a new agricultural integration synergy is now being developed. It must be noted that, even with the determination and the full involvement of the main project stakeholders, the current socio-political situation in the country has affected somewhat the normal execution of the project. In order to consolidate the successes of this project, and allow other rural farmers to benefit from the programmes' activities, it is necessary that the programme should be extended.

We would like to thank Antoine Monizi, Bambi Bela, Yawo Biova Badje, FAO International Consultant as well as Jean Parnell Dimanche and Pierre Anonce Presulme, FAO National Consultant for their valuable contribution to this article. Special thanks to the FAO Representation in Haiti, particularly Mr Amadou Moustapha Kamara and Mr Volny Paultre for their valuable support during the project.

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Improving information on inland fisheries: lessons from Southeast Asia

David Lymer¹, Simon Funge-Smith², Shunji Sugiyama³, Theo Ebberts⁴ and Chumnarn Pongsr⁵

The countries of Southeast Asia are endowed with rich inland water resources provided by extensive river and lake systems, floodplains, swamps and reservoirs. These systems continue to provide rich sources of fish and other aquatic organisms. Despite this abundance, surprisingly, little is really known about the current status of inland water resources and freshwater fisheries in Southeast Asia. There are notable exceptions in cases where intensive studies have been undertaken (such as in the Mekong Basin through the work of the Mekong River Commission). But other basins such as the Irrawaddy system in Myanmar and the extensive inland waters of Indonesia remain poorly covered.

Inland waters and fisheries resources occupy only a marginal space in the public consciousness. Thus, it does not come as a surprise that little reliable information is available about the current status of these resources and the role they play in the lives of rural people. Is it because these resources and their importance for people are simply overlooked, or is it the lack of coverage because they are already exhausted? For the people of the region dependent upon these rivers, lakes, reservoirs, ponds and other inland water bodies, the functions and services of the resources are a given. As part of the backdrop to their daily lives they are often taken for granted, but few, if any, would suggest that these resources are not in decline.

The lack of proper recognition of inland fisheries is a worldwide problem recognized in a number of international fora, but stirring agencies to action to address the needs of this sector proves difficult. Inland fisheries rarely involve international political and territorial disputes, in contrast to some marine fisheries. The multi-stakeholder issues surrounding freshwater use (for power, irrigation, leisure, etc.) also means that fisheries services may not be valued highly and as a consequence, little effort and resource has been allocated to information gathering in

and management of inland fisheries. There is a growing awareness that, in certain parts of the world, inland fisheries can be a major source of protein and livelihoods which sparked recent interest in these fisheries. Southeast Asia has vast inland resources and a great number of people depend on these rivers, lakes, floodplains, swamps and reservoirs. However, the lack of information constrains effective advocacy and decision making regarding these resources, upon which the well-being of so many rural people depend.

An FAO Regional Technical Cooperation Project TCP/RAS/3013 "Addressing the Quality of Information on Inland Fisheries" (AQUIIF)¹ has been implemented as part of an effort by FAO to try to assess the needs for information gathering and managing of inland fisheries and assist five Southeast Asian countries to more effectively address the information and management needs which they face in their inland fisheries resources. The long term goal of the AQUIFF project was to assist participating countries to formulate appropriate policies and interventions for living aquatic resource management in inland areas that are based on quality information, and to implement them effectively. The immediate objective was to strengthen the capacity of the participating countries for the sustainable production of quality information on inland fisheries and aquatic resources that are more relevant to current policies. An over-riding principle of the project was to be sensitive to the constraints on increased financing and the need to be applicable to the different contexts and needs of each country and fishery.

A detailed review of existing information and description of the inland fisheries subsector in five participating countries² of the project revealed that all had different challenges facing their information systems in inland fisheries³ and that they differed widely in their level of reporting and approaches used for information and data gathering systems. The diversity of

management challenges, inland water types and status of development or impact on the resources means that there is no 'template' answer to improving information. The national systems of information prevent even simple indications of whether fisheries were over- or under-exploited, or if catch trends were declining or increasing. Generally, a gap that all countries shared was the lack of inclusion of small-scale fishing activities of part-time and recreational fishers. Hence, inland fishery statistics on catch and the number of people involved in fishing activities are most likely underreported in this region. Further, in most countries, the official catch from inland fisheries is almost systematically under-valued.

The AQUIF project further looked at management and policy issues facing this region. All countries have rules and regulations covering inland fisheries. These cover issuance of permits and licences and the use of specific gear. These rules and regulations are, however, seldom prioritized and therefore not enforced at a high degree. Most countries lack a comprehensive national policy for management and development of inland fisheries. National reviews show that existing policies were directed towards increasing landing and production, mostly through increase in aquaculture production volume or area. Hence, not surprisingly, there are no clear visions of inland capture fisheries, which could be used as a guiding principle for both the management and the collection of relevant data and information of the sector.

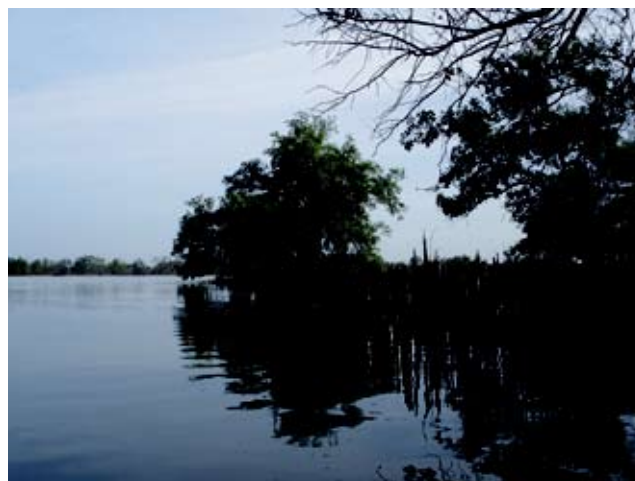
The approaches and objectives of the national pilot activities implemented in the participating countries were highly varied. This gave a wide range of experiences to draw from as well as an excellent range of recommendations for good practice:

- > **Indonesia** – Participatory data collection through fisheries co-management groups to improve the quality of information in a large volcanic lake with multiple uses (hydro-power, aquaculture, tourism, fisheries)
- > **Malaysia** – Establishment of systematic field data collection in demonstration sites where inland fisheries play an economically and socially important role (through model development and implementation of a management plan for the endangered Red/Gold Arowana species in an irrigation reservoir to comply with requirements for international trade under CITES)
- > **Myanmar** – Better understanding of the factors and issues that influence production and viability of leasable fisheries by



C. PONGSR, THAILAND

Myanmar, Ayerwaddy River - Inland fisheries in Myanmar are operated on a concession basis employing local people in the harvesting and processing of the fish



C. PONGSR, THAILAND

Thailand, Songkhla Lake - Tropical inland fisheries are resilient to fishing pressure but very sensitive to environmental changes

improved data collection in two inland fisheries concessions (one permanent water body, the other - a draw-down floodplain fishery).

- > **Philippines** – To achieve an improved integration of authorities and institutions in managing a lake and the fishery activities of the lake by drafting of "Unified Rules and Regulations" and introduction and testing of a Fisherfolk Registration. The lake is established as a protected area, but still has fisheries activities and requires resolution between sustainable exploitation and conservation of habitats for wild birds.
- > **Thailand** – To review, qualify and apply available data/information from relevant agencies for fisheries management improvement at Pasak Jolasid Reservoir (a large hydro-electric/irrigation reservoir), an established fishery that has issues relating to the seasonal migration of fishers and the lack of formal management planning for the fishery.



West Sumatra - Maninjau Lake - Estimating the contribution of inland fisheries is difficult - many families fish occasionally and often all members of the family are involved in one or more activities. Is the contribution of the fishery significant and are these families dependent for their livelihood - these are key questions

The project aimed to work with members at identifying key management information needs and address these through national pilot activities. The selected pilot sites were in almost all cases restricted to large water bodies⁴. This was partly because the boundaries of a water body make identification of the zone, the stakeholders and the issues somewhat more straight forward. The participating countries recognized that there are significant challenges to addressing information needs in the 'open fisheries' such as floodplain fisheries, rice-field ecosystems, rivers and wetlands. The Myanmar case study does cover one draw-down floodplain fishery (in the Ayerwaddy delta); although in this case there is still a single unit under consideration (which is a concessional fishery).

The challenge in the future will be to take the learning processes started through the AQUIIF project and apply this to these different fishery types.

The end output was the development of national strategies which was intended to mainstream the lessons learned and different approaches into a nationwide way of working. All participating countries developed, at a minimum, a draft national strategy for inland fishery statistics. In all cases, there is clear evidence of increasing recognition of the role and value of inland fisheries and that there is an apparent need for more effective management, typically through decentralized systems of local resource management. It was also recognized that inland fisheries cannot be dealt with effectively in a 'stand alone manner' and that it is critical to engage other users

and stakeholders in the inland water sector in order to achieve real understanding and compromise to ensure that inland fisheries are not simply minor inconveniences when promoting agricultural development, drainage, flood mitigation, hydropower and road development.

A draft set of general guidelines for improving information on inland fisheries has been developed as a final joint output by the participating technical resource persons of the project. These guidelines were based on the synthesis of lessons learned and experiences gained by participating countries. The guidelines are aimed at providing a practical guiding framework for national fishery agencies for generating quality information on inland fisheries. Specific conditions and requirements of different types of water bodies are addressed by the guidelines by taking tailor made approaches for each water body type. FAO, through its global strategy for improving information on status and trends of capture fisheries will continue to work on these guidelines.

In conclusion, it is important to look outwards from the fishery sector to engage with other stakeholders in aquatic resources management. The reality of the inland fisheries sectors in Asia is that it is generally ignored or overlooked by other more (economically) powerful sectors. There is great room for advocacy on the important role of inland fisheries and pushing for adequate resources and recognition, since there is the undeniable fact that there are still significant numbers of rural people who are still reliant on the wild fisheries resources in the region.

More information about this project can be obtained by writing to Mr David Lymer via e-mail at David.Lymer@fao.org.

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RECENT CHANGES IN POLICY AND MANAGEMENT OF INLAND FISHERIES IN PARTICIPATING COUNTRIES

COUNTRY	RECENT CHANGE	INDICATORS/EVIDENCE OF CHANGE
Indonesia	<p>Change in management regime for inland fisheries</p> <p>More attention to inland capture fisheries on national level</p> <p>Improve national inland fisheries statistics</p> <p>National committee of stock assessment issues guidance for improved information and management in inland fisheries</p>	<ul style="list-style-type: none"> - Introduction of Act No 31/2004 on Fisheries - Establishment of a national annual forum on inland fisheries - Creation of a specialized inland fisheries unit in Directorate-General Capture Fisheries - Shortening of processing time of data and information (from 2 to 1 year) - More specific and complete information on inland fisheries for some key environments and especially for aquaculture - Introduce concept of "Inland fisheries management area" as part of implementation of national guidelines for fisheries management - Development of national guidelines for introduction of inland fisheries management plans
Malaysia	<p>Government formal recognition of inland fisheries</p> <p>Increase of awareness by the government on endangered fish species</p> <p>More state governments to formulate new enactment on inland fisheries</p>	<ul style="list-style-type: none"> - Inland fisheries management is included in 9th Malaysian plan (2006-2010), with budget allocation - Establishment of Inland Fisheries Section in DOF in 2004 - Establishment of demonstration site for endangered inland fish species - International regulation by UNDP for Friends of Sungai Nengiri on Mahseer (<i>Tor spp.</i>) conservation - Sabah (2003) - Selangor (Draft) - Increase number of Tagals from 200 to > 300 - 400 by 2010 (Sabah)
Myanmar	<p>Changing management regime</p> <p>Continuation/extension of pilot project in other areas</p>	<ul style="list-style-type: none"> - Appropriate "TOR" for lease owners issued by DG/Minister: longer term leases (3 – 9 years) if habitats are managed - An increasing number of leasable fisheries are changed to culture-based fisheries (as a mandatory requirement for obtaining longer-term concession) - Due to these changes there is no severe competition for leases - Value now recognized and Government interest to monitor an additional 800 water bodies in the coming years
Philippines	<p>More emphasis on inland fisheries and aquaculture</p>	<ul style="list-style-type: none"> - Government recognition of inland fisheries and aquaculture - AQUIIF objectives and strategy to be adopted into national policy - Recognition that aquaculture must be integrated in wider ecosystem and quality information is essential to this process - Thrust to strengthen co-management of aquaculture and inland fisheries
Thailand	<p>Greater integration among concerned agencies for inland fisheries information collection</p> <p>Improved information realized at the policy makers level</p> <p>Greater awareness of the need and methods for improved information collection among stakeholders</p>	<ul style="list-style-type: none"> - Inter-agency cooperation on fisheries and environmental management of Songkhram river basin - Using bottom-up approach to management in Songkhram River basin - Local authorities are willing to cooperate in information collection - DOF Five year plan for routine data collection in inland fisheries across a range of habitats approved - Capacity building activity at national level for fisheries officers - Recognition of socio-economic data as important part of inland fisheries management

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¹Addressing the Quality of Information on Inland Fisheries, started in 2005 and concluded in 2007

²Indonesia, Malaysia, Myanmar, Philippines, and Thailand

³Ebberts, T. & Funge-Smith, S. 2006. Inland fisheries resources: treasures already lost or simply over-looked? FAO TCP/RAS/3013, Field Document 12. FAORAP, Bangkok, Thailand. 9 pp.

⁴Funge-Smith, S. Sugiyama, S., Ebberts, T. Pongsri, C. & Lymer, D. 2007. Report of the Third Regional Workshop. FAO TCP/RAS/3013, Field Document 21, FAORAP, Bangkok, Thailand. 48 pp.



National Focal Points attending the 3rd Meeting of the RECOFI Working Group on Aquaculture (WGA) and FAO Secretariat

Third Meeting of the RECOFI Working Group on Aquaculture

Brief report on major outputs and recommendations

Alessandro Lovatelli¹ and
Dawood Suleiman Al-Yahyai²

The permanent Working Group on Aquaculture (WGA) established under the Regional Fisheries Commission (RECOFI)³ held their Third Meeting in Jeddah, Kingdom of Saudi Arabia, from 5 to 6 May 2007. At this meeting, the WGA Focal Points exchanged information on the status of the aquaculture sector, its current constraints and development opportunities. The participants discussed progress of on-going regional activities and agreed on a number of priority actions to be presented to the Commission for endorsement. The Commission held its Fourth Session from 7 to 9 May 2007.

Regional Aquaculture Information System (RAIS)

The establishment of the RECOFI Regional Aquaculture Information System (RAIS) was approved by the Commission at its Third Session (Doha, Qatar, 9 to 11 May 2005) when it requested the FAO Department of Fisheries and Aquaculture to develop the system with the funds generously contributed by the Government of Kuwait. During the Third Meeting of the WGA, the Focal Points endorsed the work achieved by the Secretariat in the preparation of the first version of RAIS and provided their feedback to allow the developers to improve the layout and functionalities in order to better respond to national and regional requirements.

Among the various proposals made, the WGA agreed to enable private companies to advertise on the site and to use the funds generated to support further development of the system on one hand, and finance information activities of regional interest such as production statistics analysis, marketing studies, regional aquaculture reviews, on the other. This proposal was endorsed by the Commission.

The WGA finally agreed on the next steps that would lead to the finalization of the RAIS including activities and timeframes. The date of the official launching of RAIS and promotional strategy will be decided in Kuwait in October 2007 during the handing-over of the system to the RAIS Regional Centre which will be located in the premises of the Public Authority for Agriculture and Fish Resources (PAAFR).

For more information on the development of the RAIS please contact Mr Valerio Crespi (E-mail: valerio.crespi@fao.org).

Aquaculture legal and policy framework project proposal

The implementation of a regional project proposal to strengthen the legal and policy framework for aquaculture in the RECOFI Member countries, presented and endorsed by the Commission during its Third Session (Qatar 2005), has been delayed due to the difficulties in securing the necessary funds. At the Third Meeting of the WGA, four Commission Members

reported that their Governments had agreed to contribute to the budget of this regional project. At the Fourth Session of the Commission, Member countries that had yet to report their position agreed to do so by the end of August 2007. The financial support to this activity from all the RECOFI Members is envisaged and the project may well commence its activities by the end of this year or early 2008.

WGA future activities

The WGA discussed a number of aquaculture activities of regional importance and agreed to include the following two as part of its proposed work plan for the next inter-sessional period (2007-2008). The activities were endorsed by the Commission.

- *Regional strategy on aquatic animal health.* The following activities will initiate the process of developing a regional strategy: (i) assessment of institutional and human resource capacities on aquatic animal health at national level which will form the basis for a regional synthesis and (ii) organization of a regional inception workshop to present the result of (i), to brainstorm and develop a further proposal and, conduct a technical seminar as part of capacity building to raise awareness on the various issues and concepts concerning aquatic animal health management.
- *Regional workshop on sustainable marine cage aquaculture development.* The following activity was endorsed in view of the growing importance and interest of this aquaculture sub-sector across the region. The outputs of the workshop will include, among others, a regional status review of cage culture, policy guidelines and regulatory framework recommendations, standardized licensing procedures, site selection criteria, best management practices and a common Environmental Impact Assessment (EIA) methodology.

The countries hosting the workshops on aquatic animal health and marine cage aquaculture will be the Kingdom of Saudi Arabia and Sultanate of Oman, respectively.

The new WGA Chairman

The meeting participants nominated the Focal Point of Oman, Mr Dawood Suleiman Al-Yahyai, as the new WGA Chairman and unanimously acknowledged the excellent work carried by the outgoing Chairman, Mr Abdulredha J. Shams (E-mail: ajshams@batelco.com.bh), in

launching the WGA. The address and contact details of Mr Al-Yahyai are provided below:

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³RECOFI Member countries: Bahrain, Iran IR, Iraq, Kuwait, Oman, Qatar, Saudi Arabia, United Arab Emirates



A. LOVATELLI, FAO

Outgoing WGA Chairman, Mr Abdulredha J. Shams (Bahrain - left) and newly appointed chairman Mr Dawood Suleiman Al-Yahyai (Oman - right)



V. CRESPI, FAO

Visit to the Fish Farming Centre in Jeddah - Tilapia tank

FIMA-organized meetings/workshops/

FEBRUARY 2007

FAO Workshop on Information Requirements for Maintaining Aquatic Animal Biosecurity, 15-17 February 2007, Cebu City, Philippines (Responsible Officer: M Reantaso)

MARCH 2007

FAO Expert Workshop on Aquaculture Certification, 27-30 March 2007, Bangkok, Thailand (Responsible Officer: R Subasinghe)

APRIL 2007

Scoping Meeting of GESAMP WG36 Ecosystem Approach to Offshore Aquaculture, 9-10 April 2007, New York, USA (Responsible Officer: D Soto)

TCP/BiH/3101: 2nd Project Workshop and Training on National Aquatic Animal Health Strategy Development, 16-19 April 2007, Mrakovica, Bosnia and Herzegovina (Responsible Officer: M Reantaso)

MAY 2007

Third Meeting of the RECOFI Working Group on Aquaculture, 5-6 May 2007, Jeddah, Kingdom of Saudi Arabia (Responsible Officers: A Lovatelli/V Crespi)

FAO Expert Workshop on "Building and consolidating a framework for an Ecosystems Approach to Aquaculture – Initial steps for guidelines", 7-11 May 2007, Palma de Mallorca, Spain (Responsible Officer: D Soto)

FAO/AAHRI/NACA/Botswana DWNP Emergency Disease Investigation Task Force on a Serious Fish Disease Outbreak in the Chobe-Zambezi River System, 18-26 May 2007, Botswana (Responsible Officers: R Subasinghe/M Reantaso)

JUNE 2007

FAO Expert Workshop on Understanding and Applying Risk Analysis in Aquaculture Production, 7-11 June 2007, Rayong, Thailand (Responsible Officers: R Subasinghe/M Reantaso)

FAO Molluscan Health Management Phase III Training/Workshop, 12-17 June 2007, Bangkok, Thailand (Responsible Officer: M Reantaso)



MB REANTASO, FAO

Molluscan Health Phase III Training/Workshop, participants doing microscopy work and preparing for PCR

training courses/task force in 2007



D. SOTO, FAO

Training course on managerial and marketing capacities for rural aquaculture farmers in Venustiano-Carranza (Michoacan State, Mexico)



A. MÁRTIR MENDOZA, MEXICO

Rural aquaculture farmers on a Training course on managerial and marketing capacities in Villa Madero, (Michoacan State, Mexico)

UTF/Mex/067: Training course on developing aquaculture management capacities for small farmers in Michoacan State Mexico, 16-29 June 2007, Michoacan, Mexico (Responsible Officers: J AguilarManjarrez/D Soto/H Josupeit)

JULY-AUGUST 2007

FAO Expert Workshop on Aquaculture Certification, 31 July-1 August 2007, Fortaleza, Brazil (Responsible Officer: R Subasinghe)

FAO Regional Workshop on Bivalve Aquaculture in the Latin American Countries, 20-24 August 2007, Puerto Montt, Chile (Responsible Officer: A Lovatelli)

SEPTEMBER 2007

TCP/BiH/3101: 3rd Project Workshop and Training on Food Safety and Quality Assurance, Disease Diagnostics, Surveillance and Reporting, 17-19 September 2007, Bihac, Bosnia and Herzegovina (Responsible Officers: M Reantaso/I Karunasagar)

First Meeting of GESAMP WG36 Ecosystem Approach to Offshore Aquaculture, 23-27 September 2007, Heraklion, Greece (Responsible Officer: D Soto)

Fourth Meeting of Directors of the Network of Aquaculture Centres in Central-Eastern Europe (NACEE), 27-29 September 2007, Galati, Romania (Responsible Officer: U Barg)

OCTOBER 2007

FAO Workshop on Responsible Use of Wild Fish and Fisheries Resources for Capture-Based Aquaculture Production, 8-12 October 2007, Hanoi, Viet Nam (Responsible Officer: A Lovatelli)

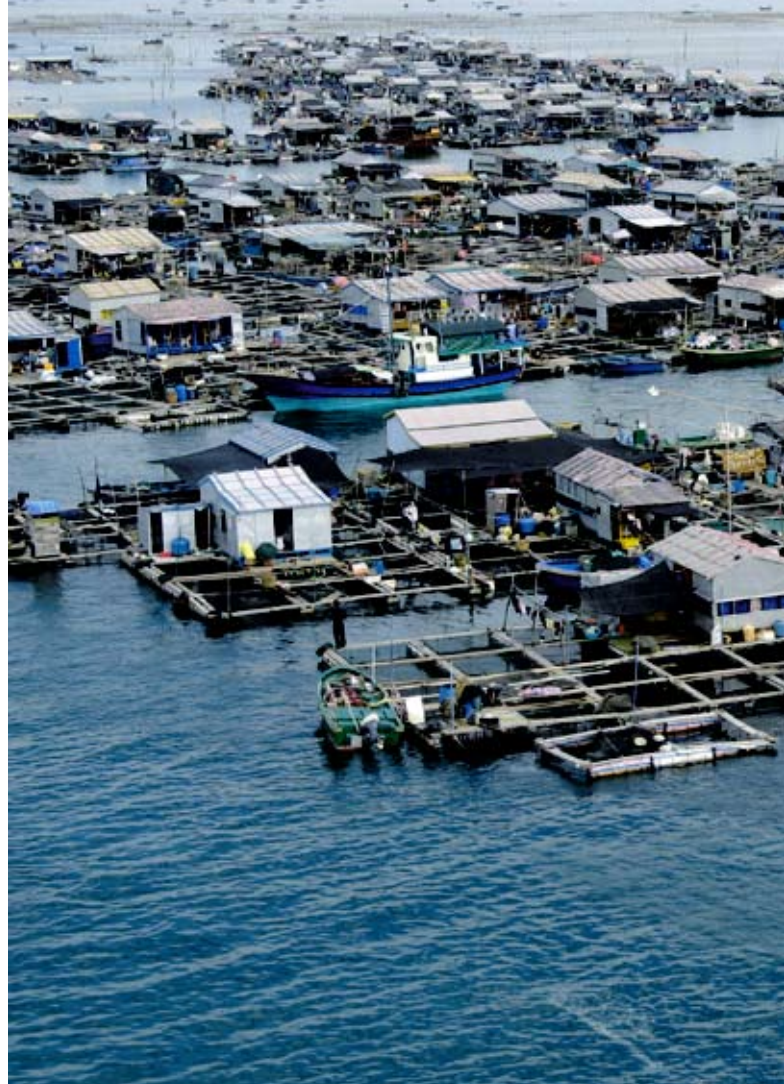
TCP/BiH/3101: 4th Project Workshop and Training on Risk Analysis (TCP/BiH/3101), October 2007, Bosnia and Herzegovina (Responsible Officer: M Reantaso)

NOVEMBER 2007

FAO Expert Workshop on Use of Wild Fish and/or other Aquatic Species to Feed Cultured Fish and its Implications to Food Security and Poverty Alleviation, 16-18 November 2007, Kochi, India (Responsible Officer: M Halwart/M Hasan)

In 2005, the global aquaculture production (including aquatic plants) has been estimated at 62.96 million tonnes and valued at US\$70.38 billion (FAO, 2007)². In 2005, about 28.2 million tonnes or 44.8 percent of total global aquaculture production (exclude filter feeding fish species) was dependent upon direct use of feed either in the form of single dietary ingredient, farm-made aquafeed or by the use of industrially manufactured compounded aquafeeds (Tacon, pers. comm.). Fishmeal and fish oil are two major dietary ingredients used in compounded aquafeeds. It is estimated that in 2006 the aquaculture sector consumed about 3.06 million tonnes or 56.0 percent of world fishmeal production and 0.78 million tonnes or 87.0 percent of total fish oil production (Tacon, 2007)³, while aquaculture's share of global industrial feed output was only four percent (Gill, 2007)⁴. In 2006, total global industrial feed output exceeded 635 million tonnes (Gill, 2007). In addition to fishmeal and fish oil, the so-called low value fish or 'trash fish' are used in different parts of the world as a complete or supplementary feed for farmed fish, crustaceans and a few mollusc species. It is generally estimated that an approximate 5 to 6 million tonnes of low value/trash fish As used as direct feed in aquaculture (Tacon, Hasan and Subasinghe, 2006)⁵.

Even if capture fisheries has contributed significantly to the growth of aquaculture production, questions are often raised about its long-term sustainability and whether it is ethically correct to feed fish with fish when these are considered to be suitable for direct human consumption. From the information generated in Asia and Africa, it is seen that small-pelagic fish are an important component of the diet of lakeside and coastal communities. In several countries for which examples could be found, the increasing demand for pelagic fish by the animal feed industry is reducing the availability of fresh fish for poor communities and this has a negative impact on food security. Nevertheless, it has also been shown that reduction fisheries and downstream animal production activities contributes to employment generation and eventually lead to improved living standards and food security (Hecht and Jones, 2007)⁶. The situation in Europe and Americas, however, is very different from that in Africa and Asia. The various reduction fisheries targeted for fishmeal and fish oil in Europe have little alternative uses (Huntington, 2007)⁷. Further, there are issues related to the long-term ecological sustainability of reduction fisheries.



An aerial view of cage culture practices in XinCun Bay, Hainan Island, China. Each cage, although small, collectively produces over 100 000 kg of low value fish/trash fish

FAO Expert V use of wild fish and/or other aquatic its implications to food secu

Kochi, India, 16-1

Mohammad

With funding from the Government of Japan, the Aquaculture Management and Conservation Service (FIMA) is implementing a project *Towards Sustainable Aquaculture: Selected Issues and Guidelines* (GCP/INT/936/JPN). Of the five key thematic areas identified for targeted action under the above project, Component 4 of the project is addressing the issue of "Use of wild fish and/or other aquatic species to feed cultured fish and its implications to food security and poverty alleviation".

Under this component, four regional reviews (Latin America and North America, Europe, Africa and the Near East and Asia and Oceania)



S. DE SILVA, NACA

land, PR China, where 570 families conduct marine cage farming, tonnes of high value marine finfish, almost all of which are fed

Workshop on ic species to feed cultured fish and urity and poverty alleviation

8 November 2007

I R. Hasan¹

and a number of country-specific case studies have been carried out in Asia and Latin America. The reviews and case studies have specifically addressed the role to which reduction fisheries and feed fish (fish and other aquatic species as fishmeal, fish oil and low value/trash fish) may play on food security and poverty alleviation in these four regions and elsewhere including sustainability of these finite resources and the environmental implication of direct use of fish as feed.

To broaden the horizon of the consultative process and to review and analyze critical issues related to the use of wild fish to feed

aquaculture species, a targeted workshop on "Use of wild fish and/or other aquatic species to feed cultured fish and its implications to food security and poverty alleviation" is being organized in Kochi, India, 16-18 November 2007 preceding the 8th Asian Fisheries Forum, 20-23 November 2007. The objectives of the workshop are: (i) to review and analyze the status and trends of reduction fisheries and low value/trash fish in aquaculture production (with particular reference to fish and crustacean species that feed on aquafeeds) and (ii) to identify key issues and challenges on sustainability of these fisheries in relation to food security, poverty alleviation, long-term ecological sustainability and environmental impacts.

The workshop will consists of selected presentations of regional reviews and case studies. A global synthesis prepared on the basis of four regional reviews and five case studies will be presented to analyze the status, trends, issues and challenges on a global perspective. The workshop will address the following thematic areas and other issues of significance emerging from the regional reviews and case studies:

- ◇ ecological sustainability of feed/reduction fisheries
- ◇ alternative use of feed/reduction fisheries and the related impact on food security and poverty alleviation
- ◇ impact of reduction fisheries and low value/trash fish use in aquaculture
- ◇ low value/trash fish circle in Asian mariculture and the way forward.

Based on the review and analyses, the workshop will identify relevant management options/ measures to address these issues and recommend strategies and policy guidelines to implement the management options/ measures. It is expected that the outputs thus generated will eventually facilitate and enable policy makers at the global and regional levels to develop and implement improved aquaculture systems using wild-caught aquatic resources when appropriate and optimize social and economic benefits derived from utilization of aquatic ecosystems. The workshop proceedings including the working group discussions and recommendations, regional reviews, case studies and global synthesis will form the basis of two major documents:

- ◇ FAO Fisheries Technical Paper "Fish as feed inputs for aquaculture and its implication



Soft shell crab farm in Myanmar showing individual holding facilities and preparation of low value/trash fish to be fed. It is generally estimated that globally an approximate 5 to 6 million tonnes of low value/trash fish are used as direct feed in aquaculture and many of the low value/trash fish used in aquaculture are often of food-grade and are generally suitable for human consumption



- for food security and poverty alleviation” including guidelines/recommendations and
- ◇ Technical Guidelines on “Use of wild fish and other aquatic species to feed cultured fish”.

The workshop will bring together acknowledged international experts in relevant fields including authors of regional reviews, case studies, global synthesis and experts from international and regional organizations. FAO has limited funds to support selected experts and authors who are directly involved in the process. Invitation is, however, open to self-funded participants who are interested to attend the workshop and willing to contribute to the process.

Further details about the workshop can be obtained from FIMA Officers via e-mail, Matthias Halwart at e-mail: Matthias.Halwart@fao.org or Mohammad R. Hasan at e-mail: Mohammad.Hasan@fao.org

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²FAO. 2007. FAO Fisheries Department, Fishery Information, Data and Statistics Unit. Fishstat Plus: Vers. 2.30 (available at www.fao.org/fi/statist/FISOFT/FISHPLUS.asp)

³Tacon, A.G.J. 2007. Meeting the Feed Supply Challenges. Paper presented FAO Globefish Global Trade Conference on Aquaculture, Qingdao, China, 29 – 31 May 2007.

⁴Gill, C. 2007. World feed panorama: bigger cities, more feed. *Feed International*, 28 (1): 5-9.

⁵Tacon, A.G.J., Hasan, M.R. & Subasinghe, R.P. 2006. Use of fishery resources as feed inputs for aquaculture development: trends and policy implications. FAO Fisheries Circular. No. 1018. Rome, 99 pp.

⁶Hecht, T. & Jones, C.L.W. 2007. The use of wild fish as feed in aquaculture and the implications for food security and poverty alleviation in Africa and the Near East. Review prepared for FAO Rome, FAO. 66 pp.

⁷Huntington, T. 2007. Regional Review for Europe: Use of wild fish and/or other aquatic species to feed cultured fish and its implications to food security and poverty alleviation, Review prepared for FAO Rome, FAO. 66 pp.

Global Gateway to Geographic Information Systems (GIS), Remote Sensing and Mapping for Aquaculture and Inland Fisheries



José Aguilar-Manjarrez¹ and James McDaid Kapetksy²

GISFish is a brand new, "one stop" Internet site from which to obtain the depth and breadth of the global experience in GIS, remote sensing and mapping and their applications to aquaculture and inland fisheries. The target audience are GIS practitioners and fisheries and aquaculture professionals in developing countries.

It is evident that there are many opportunities to use GIS, remote sensing and mapping to improve the sustainability of aquaculture and inland fisheries. However, the widespread use of these tools is impeded by limited awareness of their benefits and lack of access to experiences on how they can be deployed. GISFish was created to overcome these impediments.

GISFish sets out the spatial issues addressed most frequently in aquaculture and inland fisheries (such as "Suitability of site and zoning" and "Habitat Quality and Quantity Linked to Plant and Animal Abundance and Distribution" respectively), and demonstrates the benefits of using GIS, remote sensing and mapping to resolve them.

The global experience provided by GISFish is captured in Issues, Publications, Activities, Training, Data and Tools, Contacts, Discussions, News and events. Past experiences are packaged as searchable databases of applications published in both mainstream and grey literature which may be in form of case studies, abstracts, and often, downloadable full publications. Sharing of current experience is promoted through discussions and posting of on-going projects.

Resource materials in GISFish are constantly updated and expanded. Future improvements will include increased coverage of abstracts and of full papers. Additional links to Cultured Aquatic Species fact sheets will also be made available for each GISFish publication record in which scientific names of plants and animals are mentioned.

Becoming a GISFish member is easy. Simply fill in the online form and click on Submit. GISFish editors will email you shortly with confirmation and a password. Once you have your password,

you can login, subscribe to topics, participate in discussions and suggest new topics. You can remove yourself from the system at any time you wish.

Development of GISFish is carried out under the guidance of FAO's Aquaculture Management and Conservation Service (FIMA) and a number of collaborating institutions.

Please help us improve the GISFish gateway by sending your feedback and comments to GISFish-Comments@fao.org

FIMA continuously seeks opportunities to actively cooperate with other organizations in the realm of GIS, remote sensing and mapping, particularly in the area of training to improve the sustainability of aquaculture and inland fisheries. To explore cooperative activities, please contact GISFish Programme Coordinators: José Aguilar-Manjarrez (FIMA) or James McDaid Kapetksy (FIMA-Retired).

GISFish Home Page:
<http://www.fao.org/fi/gisfish>



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Enabling small aquafarmers access to insurance

FAO, NACA and APRACA propose a hybrid approach between insurers and government

Reported by Pedro Bueno¹ and Raymon Van Anrooy²

FAO estimates the number of aquaculturists in Asia at nearly 11 million of which about 4 500 are believed to be insured for their aquaculture crops. That is less than 1 percent of aquaculture farmers insured. Only some large-scale aquaculture enterprises are insured and small-scale entrepreneurs have no access to the service yet. Aquaculture has been growing more rapidly than all other animal food producing sectors. Asia contributes about 91 percent to the world production in volume terms. This prompts the need for risk management strategies, including insurance. A recent review of world aquaculture insurance carried out by FAO indicated a high demand for aquaculture insurance. It pointed out that the gap between the demand for and supply of aquaculture insurance in Asia is increasing.

Aquatic animal health problems are the major cause of losses in Asian shrimp and fish farms. They impact seriously on the profitability of both the farmers and the insurers of aquaculture in Asia. Since the start of the new millennium, the underwriting experiences have been improving and aquaculture insurance is becoming economically attractive to both farmers and insurers. Unfortunately, current insurers involved in aquaculture in Asia limit their coverage to a small number of traditional aquaculture species and are hesitant to include "new" species and culture systems. Mutual insurance schemes in aquaculture are rare. The lack of enabling policy and regulatory frameworks for aquaculture and fisheries insurance is also limiting the development of insurance services for the sector.

In response to this regional need, the FAO in collaboration with the Indonesian Directorate General for Aquaculture, the Network of Aquaculture Centres in Asia-Pacific (NACA) and the Asia-Pacific Rural and Agricultural Credit Association (APRACA) organized the "Regional Workshop on the Promotion of Aquaculture Insurance in Asia". This aquaculture insurance workshop, the first of its kind in Asia, was attended by 50 participants from over 15

countries in Asia and experts from other regions. It was held on 30 April-2 May 2007 in Bali, Indonesia.

Workshop recommends a "hybrid" approach that would enable small aquaculture farmers access to insurance. The insurers and re-insurers in the workshop noted the importance of organized farmer groups adopting better management practices (BMPs) in contributing to the insurance-worthiness of small aquaculture farmers.

The workshop proposed a "hybrid approach" to aquaculture insurance. Broadly, this consists of working with well-established groups of small-scale farmers that apply better management principles (BMPs) in aquaculture and, as such, work towards reducing or mitigating risks. Through mutual schemes developed with groups of farmers, individual farmers would receive compensation when losses occur. The cost of damages from large scale disasters (such as cyclones, flooding or disease epidemics) would be spread through arrangements with insurance brokers, insurers, re-insurers, loss adjusters and risk management experts in collaboration with the government. This approach will be tested in the next few years in selected countries in Asia with support from FAO, NACA and APRACA together with commercial insurance companies. This would enable poor and small-scale aquaculture farmers in Asia to have access to aquaculture insurance service - a service which will help them to recover faster from disasters, restart their business and resume their livelihoods.

Below is the full text of the workshop conclusions and recommendations:

Conclusions and Recommendations

The Asian region represents the largest number of aquaculture farmers in the world (nearly 11 million) and of these - the predominant number are small- and medium-scale operators. In

2004, 90 percent of the world's total aquaculture production in volume was generated in Asia. The value of Asian aquaculture production in the same year was estimated at nearly US\$57 billion. The Asian aquaculture sector showed average annual growth rates of 7.7 percent in value terms.

The Regional Workshop on the Promotion of Aquaculture Insurance in Asia, held in Bali, Indonesia, 30 April -2 May 2007, recognized that aquaculture insurance is likely to be attractive to farmers whose aquaculture operations are the principal form of livelihood and in which the family/operator has invested significant livelihood assets (time, labour, infrastructure, financial investment). It was also noted that aquaculture insurance schemes in Asia do not cover small-scale aquaculture at present. There is currently high uncertainty over the viability of aquaculture insurance in the small-scale aquaculture sector. In this regard, the workshop concluded that a "Hybrid Approach"¹ involving partnerships between governments, insurers, and private- and public sector organizations would be the most suitable approach for the region to develop schemes accessible to groups or clusters of medium- and small-scale aquaculture producers.

In recognition of this, the participants endorsed the following recommendations of the Regional Workshop:

Governments in the Region are encouraged to:

- Contribute to the establishment of aquaculture insurance schemes in the region by providing an enabling environment (legal and policy frameworks) and consider appropriate social coverage for risks that cannot be covered by the insurance sector.
- Engage with insurance industry, other public- and private bodies and clusters/groups of small-scale farmers in the development and implementation of a "Hybrid Approach", which is considered as a better approach for aquaculture insurance development in support of small-scale aquaculture in the region.
- Continue to provide an enabling environment for increasing the degree of adoption of Better Management Practices in aquaculture to facilitate sustainability and reduce production related risks.

- Work closely with the aquaculture sector in quantifying risks and developing effective mechanisms for their mitigation.

The Insurance sector² is encouraged to:

- Initiate the establishment of an Asian Aquaculture Insurance Pool (A.A.I.P)³ which will serve as a market facility for the provision of aquaculture insurance services to the region.
- Assist in the creation of awareness and in facilitating capacity building for the establishment of mutual and other insurance schemes. Such schemes would spread the risks related to "smaller" disasters that affect some, but not all, participants in the scheme.
- Pro-actively engage with governments in seeking ways to implement the "Hybrid Approach" to aquaculture insurance that can address the needs of medium- and small-scale aquaculture operations.

The workshop recognized the need for FAO, intergovernmental organizations such as NACA and other relevant international or regional agencies and development banks to continue to support, participate and invest in the development of insurance for small-scale aquaculture in Asia.

Further information about the workshop outcomes may be obtained via e-mail from Mr Raymon Van Anrooy.

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¹The "Hybrid approach" is laid out in detail in a document produced by the Regional Workshop titled: "Guidelines for action to meeting insurance and risk management needs in developing aquaculture in Asia".

²The sector comprises direct and re-insurers, brokers, risk management experts and loss adjusters, etc.

³The nature and purpose of the A.A.I.P. is broadly discussed in the "Guidelines for action to meeting insurance and risk management needs in developing aquaculture in Asia", being redrafted to incorporate relevant information from the workshop.



TCP/BiH/3101

Strengthening Aquaculture Health Management in Bosnia and Herzegovina

J. Richard Arthur¹ and Melba B. Reantaso²

BACKGROUND

Bosnia and Herzegovina (BiH), formerly one of the six federal units constituting the Socialist Federal Republic of Yugoslavia, declared its independence in 1992 during the Yugoslav wars of 1991–1995. It is located on the central part of Balkan Peninsula, which encompasses the eight countries of the former Yugoslavia, at 44°N latitude and 18°E longitude. With a total area of 51 209 km² and 1 538 km of land boundaries, it is bordered on the west, north and south by Croatia and on the east by Serbia and Montenegro. On the south, it also has a small coastal area of about 20 km providing access to the Adriatic Sea. The country's total population is estimated at around 4 million, of which about 600 000 live in the capital city of Sarajevo.

BiH has a temperate climate that is described as being moderate continental and agriculture is an important part of the national economy, employing 18 percent of the workforce and contributing 12 percent to the GDP. Politically, the State is comprised of two Entities, the Federation of Bosnia and Herzegovina and the Republic of Srpska, which are responsible for the implementation of State policy and law.

The country has abundant aquatic resources in the form of lakes and rivers and thus has a long history of freshwater aquaculture. Modern fish farming in BiH dates back more than a century. The culture of rainbow trout (*Oncorhynchus mykiss*) was begun at the fish farm "Vrelo Bosne" near Ilidza in 1894, while the farming of common carp (*Cyprinus carpio carpio*) was established near Prijedor in 1902 (FAO National aquaculture sector overview – Bosnia and Herzegovina www.fao.org/fi/). Between 1946 and 1982, a more intensive system of salmonid culture was developed in reservoirs and lakes using floating cages and pelleted feeds. At the same time, cyprinid culture was expanded with the introduction of exotic herbivorous species such as grass carp (*Ctenopharyngodon idella*) and bighead carp (*Aristichthys nobilis*).

By 1964, BiH had 13 trout farms occupying a total area of 38 000 m² and by 1990, total aquaculture production had risen to some 3 000 tonnes. However, much of the country's aquaculture infrastructure was destroyed during the war of 1991–1995 and many skilled workers abandoned the industry. As a result, BiH has been faced with the task of rebuilding its aquaculture subsector, as well as the necessary public and private-sector expertise, supporting agencies, regulatory mechanisms, etc. needed to re-establish and expand aquaculture in a modern and sustainable manner.

Unofficial estimates suggest that the country's aquaculture subsector produced 6 344 tonnes of fish and shellfish in 2004, having a value of some US\$15.2 million. The bulk of production is derived from the farming of two species: rainbow trout, which accounted for slightly more than half of total production (53.3 percent, 3 380 tonnes) and common carp (37.2 percent, 2 363 tonnes). Other species cultured in small quantities include other salmonids (brown trout and brook trout), other cyprinids (grass carp and bighead carp) and wels catfish and zander in fresh water, and gilthead seabream, European seabass and Mediterranean mussel in coastal waters.

There are two fish processing plants in BiH, one in Salakovac and another in Banja Luka, with a combined annual capacity of some 3 000 tonnes. Most aquaculture produce (65 percent) is sold domestically, while the remainder (35 percent) is exported to the neighboring countries of Serbia, Montenegro and Croatia. Domestic consumption of fish is estimated at 1.4 kg per capita, indicating significant potential for market expansion.

The aquaculture subsector in BiH has many strengths that can lead to its rapid revitalization. These include the country's abundant natural aquatic resources, a strongly motivated and well-organized private sector and a highly competent network of veterinary officers, inspectors and researchers within the State Veterinary Office (SVO), Entity veterinary services and the universities. However, aquaculture faces some hurdles that must be overcome to ensure its development in an environmentally, economically and socially sustainable manner. These include lack of a national planning for aquaculture development (including environmental impact assessment), the need for appropriate expertise in both government and private sector and the need for appropriate supporting legislation, mechanisms for coordination between responsible agencies and improved extension services and stakeholder consultation.

The Government of BiH strongly supports the further expansion of the aquaculture as a means to increase access to animal protein, particularly by the poorer segments of the population, as an important tool for development and income generation in rural areas and as source of foreign exchange earnings through trade, especially with the European Union (EU).

While in the process of negotiating an export license to the EU, the competent authorities,



Participants of the Inception Planning Workshop, October 2006

in particular the SVO and other stakeholders recognized the lack of capacity in fulfilling some of the EU requirements on issues related to aquatic animal health management and food safety.

In order to fill this gap, the Government of BiH therefore requested FAO's assistance through a Technical Cooperation Project. An official visit of BiH officials to FAO HQ on 27–28 April 2005 was followed by a request from the SVO that lead to an Inception Mission undertaken by MB Reantaso from 10–17 July 2005 to assist in the preparation of a TCP proposal. The project "Strengthening capacity on aquaculture health management" was officially approved on 14 June 2006 with a project budget of US\$388 000 and an implementation period of 20 months.

OBJECTIVES

The project's development objective is to increase the effectiveness and efficiency of the SVO in aquatic animal health management to support sustainable and healthy aquaculture production. This will enable the country to improve the value and efficiency of the subsector through the implementation of international animal health and food safety standards, especially those of its trading partners in Europe.

The TCP will increase the capacity of the SVO and other actors to support sustainable and healthy aquaculture production, both for domestic consumption and for trade, through the implementation of the same international animal health and food safety requirements that apply to its trading partners. Specifically, the project will develop national policies in the areas

of biosecurity, aquatic health management and disease control and will strengthen the capacity of the veterinary administration, inspectors, laboratories and producers to comply with international health, food safety and quality requirements. The project will also disseminate the lessons learned to neighboring trading partners in order to promote future regional cooperation in aquaculture and aquatic animal health management.

The project provides the services of three international consultants, four national consultants and FAO technical support from FIMA, FIEP, FIIU and LEGN. In addition, laboratory equipment and supplies, official international and in-country travel, several training courses and workshops and operating expenses are included.

WORK ACCOMPLISHED

The National Project Coordinator (NPC), Nihad Fejzić, was appointed in September 2006. The first major activity was a two-day Inception Planning Workshop (30–31 October 2006) and a one-day Training Workshop on Policy and Strategy Development in Aquaculture (1 November 2006). The Workshop and Training was held in the historic city of Mostar and was attended by a total of 30 participants including staff of the SVO, other concerned State and Entity agencies (primarily Entity Veterinary Inspectors), the universities and the private sector, with technical support being provided by MB Reantaso (Fisheries Resources Officer and Lead Technical Officer of the TCP), RP Subasinghe (Senior Fisheries Resources Officer) and R Van Anrooy (Aquaculture Economist) of FAO.

The 2nd Project Workshop and Training on National Aquatic Animal Health Strategy Development was held in Mrakovica, from 16–19 April 2007 and was attended by 31 participants, with technical support being provided by MB Reantaso and JR Arthur (International Consultant on Aquatic Animal Health Management). The workshop advanced national planning by developing and adopting a framework for a National Aquatic Animal Health (NAAH) Strategy, initiating a review of veterinary legislation as related to aquatic animal health management and drafting a diagnostics manual, an extension manual and other publications.



FUTURE ACTIVITIES

During the Workshop, planning for the 3rd Project Workshop, to be held in September in Bihać, was also accomplished. The next workshop will further develop the NAAH Strategy, focussing on EU trading and reporting requirements; disease diagnostics; surveillance and reporting; food safety and quality assurance (HACCP, antibiotic analytical techniques and laboratory accreditation). A 4th Project Workshop and Training, to be held in early October, will focus on risks in aquaculture and will develop national capacity in risk analysis for introductions and transfers of live aquatic animals.

Interim activities include work by committees on the review of State and Entity veterinary legislation and on the drafting of diagnostics and veterinary inspection manuals and brochures, upgrading of the National Reference Laboratory for fish virology, study tours for SVO staff and further development of the NAAH Strategy. The project is also developing a proposal for a study to assess marketing opportunities for BiH's aquaculture produce, possibly through a TCP facility.

The project will conclude in a Regional Workshop to be held in March 2008 that will involve participants from neighboring countries to disseminate the outcomes of the TCP and to explore the possibility of developing a regional proposal.

More detailed information may be obtained by writing to Melba B. Reantaso of FIMA at e-mail below:

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TCP/URU/3101 "Plan Nacional de Desarrollo de la Acuicultura"

In March 2007, TCP/URU/3101 "Planning for aquaculture development" organized 3 national-level participatory workshops and a meeting of the Project Management Board. All key stakeholders of the Uruguayan aquaculture sector attended these project activities. This project, which has as main objective to help the Government of Uruguay, through its Dirección Nacional de Recursos Acuáticos (DINARA), to increase the institutional and human capacity of DINARA by means of an integrated planning process for the sector and some targeted skills development interventions organized since the beginning of September 2006.



Australian red claw crayfish from Acuicultura Punta Negra, served at restaurant Trattoria del Piero in Piriapolis

Two workshops to formulate, in a participatory manner, a national plan for sustainable aquaculture development - managed to draft a long-term policy and a mid-term strategy for aquaculture development and management. A third workshop to develop the short-term national plan will take place in June 2008. In assistance of the strategy, 3 programmes were prepared:

- National programme for aquatic animal health, bio-security and food safety
- National programme for aquaculture research and technology and
- National programme for education and capacity building in aquaculture.

International experts were flown in to assist DINARA in the preparation of these essential programmes.

The project, with support from the Centre for Marketing Information and Advisory Services for Fishery Products in Latin America and the Caribbean (INFOPECA), conducted a SWOT (Strengths, Weaknesses, Opportunities and Threats) analysis of the sector. National con-

sultants have carried out an analysis of suitable species for aquaculture development in the country and prepared extension and training materials to assist farmers to conduct an economic analysis of their farming activities. The analysis of species showed that in the short-term the most promising aquaculture species for production in the country are the following: sturgeon (*Acipenser baeri*), Australian freshwater red claw crayfish (*Cherax quadricarinatus*), bull frog (*Rana catesbeiana*), black catfish (*Rhamdia quelen*), mollusks (*Mytilus edulis*), Pejerrey (*Odontheistes bonariensis*), tilapia (*Oreochromis niloticus*) and goldfish (*Carassius auratus*). Adding to these, promising species for integrated aquaculture might also include common carp (*Cyprinus carpio*) and mullet (*Mugil platanus*).

DINARA aims to present the final draft policy and strategy to the Government by the end of July, while the national plan should be ready by October. The practical training and capacity building activities of the project will continue at field level until December 2007 when the project is likely to end. The project will also support Uruguay's 2007 celebration of Heart Week (24-28 September) and World Food Day (16 October). 'Promoting fish consumption as a preventive measure against cardiovascular diseases' is one of the main topics in these events.

The FAO-DINARA TCP project, financed by FAO with US\$260 000, will be continued through a larger project on fisheries management (Proyecto de Gestión Pesquera) of DINARA. This project has been assigned US\$5.8 million by the Government of Uruguay and will be implemented as a Unilateral Trust Fund (UTF) Project; a collaboration between DINARA and FAO. The aquaculture component of the project has a budget of US\$700 000 which will



Australian red claw crayfish produced by Acuicultura Punta Negra, Uruguay



Working group discussions during the development of the national strategy for aquaculture development

be used for the implementation of the National Plan for Aquaculture Development of Uruguay, the national strategy and its component programmes.

Draft planning documents as well as studies, presentations during the workshops and workshop reports are made available at the DINARA website: <http://www.dinara.gub.uy/> under the heading "Proyecto Acuicultura".

For more information on this project, please contact:

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FAO Aquaculture Newsletter (FAN) moves on ...

FAN 36 (December 2006 issue) retrospectively looked at the evolution of FAN since the release of its first issue, 15 years ago, in June 1992. There are a few changes in this issue of FAN 37. Firstly, the new Editorial Team now consists of the following: Chief Editor (MB Reantaso), Members (J Jia, R Subasinghe, D Bartley, A Lem and N Hishamunda) and Layout & Production (S Borghesi). R Subasinghe is gratefully acknowledged for his untiring efforts as Chief Editor for FAN 24 until FAN 36. Secondly, the cover will use a plain background with fill effect. We expect one more issue to be released before end of the year. Beginning 2008, there will be 3-4 issues with lesser number of pages. The topics will also be expanded to include socio-economic, food safety and trade related articles and events. We will continuously strive to bring our readers up-to-date information on the various activities/events and projects both from FAO normative work and field programmes as well as significant developments and emerging issues affecting the aquaculture sector.

Un taller sobre el cultivo de bivalvos en los países latinoamericanos

Alessandro Lovatelli¹ e Iker Uriarte²

English Abstract

The Department of Fisheries and Aquaculture of the Food and Agriculture Organization of the United Nations (FAO) and the Universidad Austral de Chile (UACH) are in the process of organizing a regional workshop on bivalve aquaculture in the Latin American countries. The workshop will be attended by experts and representatives from those countries in the continent where bivalve aquaculture is a player in the local aquaculture industry or currently expanding. The main purpose of the workshop is to develop recommendations aimed at the sustainable development and growth of bivalve aquaculture in the region. The workshop will be held in the coastal city of Puerto Montt in southern Chile from 20 to 24 August 2007.

La acuicultura en los países latino americanos se ha extendido de manera continua desde hace dos década, particularmente algunas especies de camarones seleccionados y peces. Los moluscos, y en particular los bivalvos, son actualmente el tercer grupo más importante de los organismos marinos en términos de la producción de acuicultura. En 2005, de acuerdo con los informes estadísticos suministrados por la Organización de las Naciones Unidas para la Agricultura y la Alimentación (FAO), se han producido aproximadamente 130 000 toneladas de moluscos en esta región. Esta producción, se ha duplicado desde el inicio de la década (la producción en el año 2 000 fue de alrededor de 65 000 toneladas). El interés por cultivar una variedad de especies de bivalvos de importancia comercial está aumentando entre los industriales del sector. En efecto, los bivalvos se alimentan en el primer labón de la cadena de trófica y por lo tanto, son una fuente relativamente económica de proteína animal saludable comparada con peces y crustáceos. El aumento de la demanda de tales productos puede ayudar al sector de la acuicultura para su expansión y proporcionar oportunidades de empleo y de negocio.

Para promover la expansión y el desarrollo sostenible de los cultivos de bivalvos en la región desde los puntos de vista técnicos, socio-económicos y ambientales, y con respecto a

otras modalidades de cultivos, se debe ayudar y fomentar el diálogo regional entre los expertos.

Durante la pasada sesión del Comité de Pesca de la FAO (COFI) y el Sub-Comité de Acuicultura (COFI-SCA), los países miembros han solicitado a la FAO que busque asuntos relacionados con el desarrollo sostenible de la acuicultura de costas y en particular la maricultura. A tal fin la FAO está organizando un taller regional en Puerto Montt (20-24 agosto 2007) sobre el cultivo de bivalvos titulado "Estado actual del cultivo y manejo de moluscos bivalvos y su proyección futura: factores que afectan su sustentabilidad en Latinoamérica (ACUIBIVA)" junto a la Universidad Austral de Chile, localizada en la décima Región de Chile, que es la región que desembarca el 77 por ciento de los moluscos bivalvos del país, y produce 91 000 toneladas año de bivalvos cultivados.

El propósito de este Taller sobre la maricultura de moluscos bivalvos es reunir expertos de los países con mayor producción en la región para discutir argumentos técnicos y socio-económicos relacionados con los cultivos de bivalvos. Es también importante identificar el desarrollo futuro e inmediato, las necesidades de investigación y generar estrategias para aprovechar las oportunidades y superar las amenazas. Otros objetivos del Taller son la recomendación de actuación para la sustentabilidad de la industria. Se espera que tales recomendaciones sean llevadas a cabo por agencias de desarrollo/agentes del estado/grupos I&D nacionales, latino americanos e internacionales que tienen interés en sostener el crecimiento de este sub-sector de la acuicultura.

Para ulterior informacion contactar:

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FAO/NACA Workshop on “Information Requirements for Maintaining Aquatic Animal Biosecurity”

15-17 February 2007, Parklane Hotel, Cebu City, Philippines

Melba B. Reantaso¹

BACKGROUND TO THE WORKSHOP

The workshop on “Information Requirements for Maintaining Aquatic Animal Biosecurity” held from 15-17 February 2007 was organized jointly by FAO and NACA and hosted by the Philippine Bureau of Fisheries and Aquatic Resources (BFAR).

This activity is one part of the Aquatic Animal Biosecurity Project, funded under Strategic Objective D-1 “Integrated Management of Land, Water, Fisheries, Forest and Genetic Resources” of FAO’s New Cooperation Agreement with Norway (PCA) focussing on Indicator No. 3 on Field and policy activities to strengthen national capacities to promote an integrated (*Biosecurity*) approach to the following:

- plant health systems, including pesticide risk reduction
- food safety, in particular fish product safety and fish health systems including aquaculture
- domestic animal health systems.

The over-all objective of the Project is to assist FAO member governments in implementing some elements (risk analysis, information systems, quarantine, surveillance and emergency preparedness and contingency planning) of FAO’s Technical Guidelines on Responsible Fisheries: Health Management for the Responsible Movement of Live Aquatic Organisms through provision of essential information requirements and capacity and awareness building activities specifically through:

1. preparation of an Aquatic Animal Quarantine Manual – its use within the frameworks of the risk analysis approach and aquatic animal biosecurity;
2. updating of the FAO Diagnostic Guide to Aquatic Animal Diseases;
3. updating of FAO’s web-based Aquatic Animal Pathogen and Quarantine Information System (AAPQIS); and

4. Implementation of regional training/workshops on Information Requirements for Maintaining Aquatic Animal Biosecurity (Asia) and Phase III of the Molluscan Health Management Training/Workshop.

BFAR Region VII Chief Quarantine Officer Jeffrey Cortez welcomed the guests, participants and resource experts from partner organizations. NACA’s Aquatic Animal Health Specialist CV Mohan stressed the importance of biosecurity in Asian aquaculture and the relevance of the workshop to the needs of the region and thanked FAO for conceptualizing and implementing the workshop. FAO consultant JR Arthur highlighted the value of such workshops in creating awareness and building capacity of stakeholders and national policy makers. FAO Representative to the Philippines Kazuyuki Tsurumi, in his inaugural address, emphasized the need for countries in Asia to build capacity and access information to better comply with international WTO-SPS agreement to ensure sustainable aquaculture and problem-free trade in fish and fishery products. Melba Reantaso of the FAO presented the objectives and expected outputs of the workshop and encouraged delegates from participating countries to actively take part in the deliberations.

Purpose of the Workshop: The objectives of the workshop were to increase awareness and build capacity on general principles of biosecurity and to deliberate on key information required for maintaining aquatic animal biosecurity focussing on aspects of risk analysis, diagnostics, health certification and quarantine and epidemiological surveillance and reporting.

Participation at the Workshop: A total of 37 delegates from the Association of Southeast Asian Nations (ASEAN) countries (Brunei Darussalam, Cambodia, Indonesia, Malaysia, Myanmar, Philippines and Thailand), South Asian countries (Bangladesh, India, Nepal),



MB REANTASO, FAO

J Cortez, BFAR Region VII Chief Quarantine Officer welcoming the workshop participants. Others in photo, from left, M Reantaso (FAO), CV Mohan (NACA), JR Arthur (Canada) and K Tsurumi (FAO Representative to the Philippines)

and China and representatives from organizing and partner organizations (FAO, Network of Aquaculture Centres in the Asia-Pacific (NACA), and AusVet) participated in the workshop.

Workshop Process: To set the scene for the Working Group discussions, four technical plenary presentations were delivered by resource experts.

In presenting the General Principles of Biosecurity, MB Reantaso emphasized that governments must implement the biosecurity obligations they have entered into under international agreements. Recent developments in biosecurity in food and agriculture call for integration of and cooperation across sectors among the different international institutions that are responsible for the implementation of these international instruments. In order to implement effective biosecurity at the national level, countries require strong global and regional coordination and interaction to identify and manage emerging risks. Information is a key element in any biosecurity programme and will be required to support national actions such as:

- surveillance programmes and diagnostic services to detect and identify the arrival and spread of pests and diseases;
- timely assessment of the threats from new or expanding species;
- rapid response to eradicate new pests and diseases before they establish and spread;
- standardization of science-based identification of all risk pathways and high-risk organisms and implementation of pre-border, border and post-border measures

to prevent pests and diseases from entering the country;

- national frameworks to regulate, manage and control biosecurity.

In the second plenary presentation on General Principles of Diagnostics, Health Certification and Quarantine, CV Mohan highlighted the potential impacts of aquatic animal health risks on the livelihoods of aquafarmers, national economies, trade, environment and human health. As aquaculture will continue to expand and diversify, trade of aquatic animals will be inevitable and disease will be a major limiting factor. It is thus important to reduce the risk of diseases through appropriate health management strategies. Diagnostics, health certification and quarantine are essential elements of National Strategies on Aquatic Animal Health Management and it is important to understand the principles behind these concepts and tools, their purpose, their limitations and how they can each contribute to reducing the risks of diseases in aquatic production.

JR Arthur in his presentation on General Principles of Risk Analysis concluded that oftentimes the information available for a given commodity, source or country may be insufficient to permit an accurate risk estimate. In these cases, other sources/countries of better known health status should be considered. As applied to pathogen risk analysis, a precautionary approach requires that both importing and exporting nations act cautiously and conservatively to avoid the potential spread of serious pathogens. The

precautionary approach provides an important option that importing countries can use to delay a decision until adequate information has become available; however, the importing country is obligated to move rapidly to obtain such information. In the meantime, where other sources are not available and crucial information is lacking, cautious interim measures can often be applied to permit limited importations to occur until acceptable less stringent measures can be defined. These may include measures such as importing surface-disinfected eggs, requiring health certificates of international standard, quarantine in the country of origin and/or receiving country, repeated health screening of stocks, contingency planning etc., either alone or in combination.

AusVet's J Hutchinson elaborated on the concepts and principles of epidemiology in her presentation on General Principles of Epidemiological Surveillance and Reporting. Epidemiology is about understanding the natural history, transmission and ecology of disease – *in populations*. Epidemiology is also about (i) doing surveillance to detect disease and measure changes, (ii) describing disease patterns, (iii) identifying disease causes, (iv) assessing impacts of disease and (v) designing disease control strategies – *in populations*. The presentation emphasized the need to understand why reporting is important, what is being reported, what system is suitable for which purpose, what type of information is

needed, how such information may be collected, and why farmers should report a disease. The presentation was concluded with an important note that information management is the missing link between surveillance and reporting.

The participants were then divided into 3 groups to deliberate on the information and capacity building requirements of the 3 working group themes, namely: (a) Risk Analysis, (b) Diagnostics, Health Certification and Quarantine; and (c) Epidemiological Surveillance and Reporting. Table 1 presents the outcomes of the working group deliberations.

Increased awareness and better understanding on the principles behind biosecurity, risk analysis, diagnostics, health certification and quarantine and epidemiology and the working group findings on key information and capacity building requirements for the above 3 themes were the most important output of the workshop. In addition, the workshop contributed towards further networking of national delegates on aquatic animal biosecurity.

Further details may be obtained from MB Reantaso at the e-mail address below.

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MB REANTASO, FAO

37 delegates from China, ASEAN, South Asian countries, FAO, NACA and AusVet participated in the workshop hosted by the Philippine Bureau of Fisheries and Aquatic Resources

Table 1. Information and Capacity Building Requirements for Maintaining Aquatic Animal Biosecurity

1. Risk Analysis	Information Requirements	Capacity Building Requirements
Hazard Identification	mode of transmission (biological pathway, vertical/horizontal); incidence outbreak data: OIE aquatic animal disease report, FAO/NACA QAAD, AAPQIS, scientific literature, government report; expert opinion on virulence and infectivity; host factors/susceptible species; criteria for hazard identification; pathogen description (growth/survival, incubation period, other environmental factors requirements); health status of the commodity; evaluation of the competent authority	diagnostic capability; training in microbiology, epidemiology, pathology, parasitology, virology, risk assessment; laboratory facility and equipment; consultancy; access to scientific literature/ references; field investigation/survey; funding
Risk Assessment (Release and Exposure Assessment)	pathways (biological and physical); mode of transmission (biological pathway, vertical/horizontal); host factors/ susceptible species; native susceptible species; destination (in exporting country)	training on risk analysis
Risk Assessment (Consequence assessment)	sector overview (industry); socio-economics loss; affected sectors and species; ecological displacement; cost of containment, control and eradication measures	training on the collection and evaluation of socio-economic data on loss and other impacts to the sector and other relevant sectors
Risk Management	strategies or procedures for containment/control/eradication; analysis of disease surveillance (active & passive) and monitoring data; results of laboratory tests; disease reports; movement data (domestic and international); disease prevention (e.g. vaccination); affected and unaffiliated area (disease-free area); operational procedures for the implementation of a local contingency plan; quarantine management measures (pre, border, post); diagnostics (technical competence of manpower, facilities and techniques); aquaculture insurance assistance; over-all value of the sector; costs of management measures (e.g. prevention strategy, eradication); human resources and capacity within the context of over-all implementation of the risk management measures; funding availability	training on disease reporting, higher detection techniques and latest regulation; training on all aspects of risk analysis
Risk Communication	what? risk, risk management, legislation and enforcement, benefits, contingency plan, preparedness who? Stakeholders: farmers, traders and feed millers, network of fisheries officers, International (OIE), Regional (NACA) and national agencies how? public consultations, meeting, seminars, training, publications, mass media, website when? Frequency a risk communication strategy is required	training on all aspects of risk analysis

2. Diagnostics, Health Certification and Quarantine	Information Requirements	Capacity Building Requirements
Diagnostics	<p>diagnostic supporting information (i.e. qaad, aapqis, oie)</p> <ul style="list-style-type: none"> ▪ case history ▪ clinical signs ▪ method of sampling (i.e. oie standards) ▪ lab examination (level i, ii, and iii) ▪ diagnosis ▪ disease reporting 	<p>qualified personnel; adequate laboratory infrastructure; standard protocols/techniques (harmonization SOPs) ASEAN; bilateral/multilateral; minimum requirements of quarantine and holding facility; better communication between competent authorities (CAs) (i.e. IT networking); information communication for concerned sectors</p>
Health Certification	<p>host commodity information: purpose of certification; requirements of importing countries; species; number of animal per species; life stage of aquatic animal; location of source (farm/wild); transportation/trans-shipment data; port of entry /exit; disease information (exporting and importing countries); laboratory examination, method of diagnosis; competent authority complete address; date of issue; validity of health certificate; signature of ca with official seal or stamp</p>	<p>good communication between CAs, traders (importer/exporter); CA laboratories - training/personnel development and better infrastructure; IT Communication equipments (networking)</p>
Quarantine	<p>checklist of pre-border requirements - stringency of quarantine to be applied (based on risk analysis or information on the aquaculture species to be imported. to consider the following: national list of pathogens, risk assessment, risk management, risk communication, contingency plan, emergency response, good health management practices, list of registered quarantine premises, manual quarantine facilities (i.e. oie standards)</p> <p>checklist of border requirements: documentary examination-validation of travel documents, air way bills, import permit, health certification); species documentation: visual examination, number of aquatic animals, size and species of aquatic animal, sample collection, list of relevant diagnostics tests, decision-making action (e.g. release of aquatic animal to importer, return to the country of origin/quarantine facility), proper disposal procedures</p> <p>post-border requirements: post entry monitoring, health inspection, disposal of products, health records, data management</p>	<p>better communication between regulatory agencies; harmonized guidelines for quarantine; implementation of quarantine rules and regulations; adequate Training; development of infrastructure /holding facility; adequate legal support; adequate logistic support; availability of adequate disposal facility (e.g. incinerators/landfill)</p>

3. Surveillance and Reporting	Information Requirements	Capacity Building Requirements
Farm Level	<p>simple, easy to understand disease information in local languages (e.g. Brochures, disease cards, posters containing pictures, website addresses); model format (recording sheet) for recording disease information for the purpose of surveillance and reporting (e.g. when, where, what, which, etc); list of authorized persons/organizations at Village, district and provincial levels to be contacted, as appropriate; prevention and control measures including early warning</p>	<p>organization of farmers into clubs/associations/societies; strengthening of existing farmers organizations (e.g. minimum laboratory facility); trainings/awareness programs on disease/problem recognition, recording, reporting, early response and existing legislation in support of reporting; training on record keeping and communication; training of voluntary or government field/extension officers in disease recognition, recording and reporting</p>
Provincial Level	<p>important species and diseases at the province and national level; disease information at a higher level (e.g. causation, diagnosis, etc) including diseases of national and international concern; model recording sheet for use at provincial level for the purpose of surveys and surveillance; standard diagnostic procedures (e.g. OIE Aquatic Code); methods for validation and confirmation of disease report; existing or proposed zoning programs in the country; designing surveillance programs and data analysis (e.g. survey tool box, epidemiology, study design); communication strategy to be used (e.g. agreed communication pathways (from farm - province - national and vice versa); data handling, analysis and developing outputs (e.g. epi-info); contingency planning/measures; list of other sources of disease information available at the provincial level (e.g. govt lab, private lab, hatcheries, in- house lab, research lab, traders etc.)</p>	<p>workshop/training at higher level to build technical capacity (e.g. diagnosis, disease control); strengthening of laboratory facilities for diseases of national concern (e.g. trade and national economy); establishing Laboratory networking; training to build capacity in the conduct of targeted surveillance</p>
National Level	<p>diseases of national and international concern (e.g. OIE list, NACA); international regulations and compliance requirements; list of expertise/laboratories available nationally and internationally; communication strategy (information on agreed communication pathway); legislation and regulation requirements (e.g. banned species); validation/confirmation; likely impact of diseases on the national economy and international trade; international reporting and the national dissemination mechanisms; establishing and maintaining national aquatic animal disease database; data handling and analysis (e.g. epi-info); develop national disease tracking system; methods of disease loss estimations/predictions; list of other sources of disease information available at the national level (research labs, universities, etc)</p>	<p>capacity and awareness building at higher level (e.g. Policy workshop, participation in national and international meetings, registering for online courses); strengthening of laboratory facilities for diseases of national concern; networking of laboratories and experts; training in epidemiology, study design, database development, and data analysis; training on developing and managing national surveillance programs; training on developing outputs from national database (e.g. OIE reports, QAAD reports, national disease control strategies, etc); training for online reporting</p>

FAO Fisheries and Aquaculture Department. 2006. *The State of World Fisheries and Aquaculture 2006*. Rome, FAO. 162 pp.

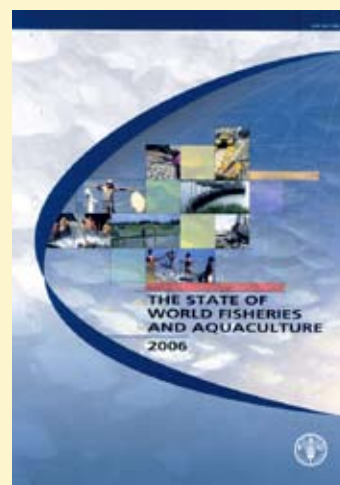
Several decades ago, the efforts of public administrations were concentrated on developing fisheries and aquaculture and ensuring growth in production and consumption. Then, in the 1980's, as many resources became fully or over exploited, attention of policy makers began to focus instead on fisheries management, in addition to development of aquaculture. Subsequent recognition of the many failures in management have now lead FAO Member States and other relevant stakeholders to broaden the approach and governance, that is the sum of the legal, social, economic and political arrangements used to manage fisheries and aquaculture in a sustainable manner, is currently seen as a necessary context for management and is becoming the main concern.

In keeping with these developments, the issue of governance features in several places of SOFIA 2006. Part 1 of the document - the World Review of Fisheries and Aquaculture - ends with a new section called "Governance and Policy". Governance issues and related concerns are addressed also in several places in the remainder of the text.

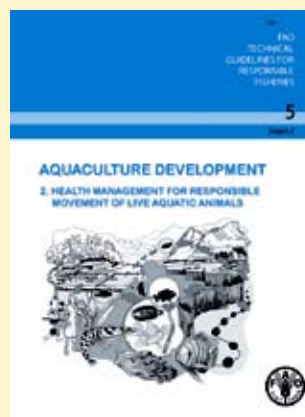
Aquaculture continues to expand, whilst marine capture fisheries - when summed together world-wide - seem to have reached a ceiling. This development was not unexpected. It has constituted a basic assumption in most discussions and studies concerned with the future of the fisheries sector. Past issues of SOFIA have reported on projections for the sector. Although it may be early to evaluate the accuracy of such projections, it can be interesting to compare them with the developments that actually took place. A brief attempt in this respect is made in the last section, entitled "Outlook". Reflecting the growing importance of aquaculture the section ends with a discussion of the challenges which aquaculture is facing as well as of the opportunities that are open to the sector. The discussion is based on a prospective analysis of the aquaculture sector world-wide, which was undertaken by FAO in the past two years.

The format of SOFIA remains unchanged. Like previous issues, this issue contains a CD with

the World Fisheries and Aquaculture Atlas. However, one more CD has been added. It contains FAO documents reviewed in Part 3 and a complete set of past issues of SOFIA.



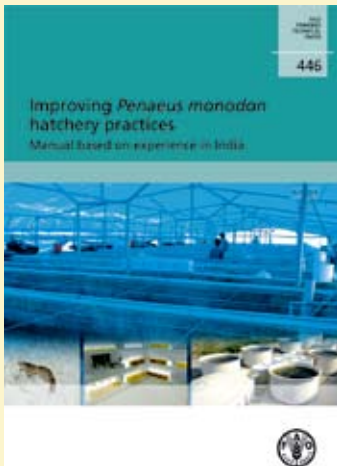
FAO. 2007. Aquaculture development. 2. Health management for responsible movement of live aquatic animals. *FAO Technical Guidelines for Responsible Fisheries*. No. 5, Suppl. 2. Rome, FAO. 31 pp.



These Technical Guidelines on *Health management for responsible movement of live aquatic animals* have been developed to support sections of FAO's Code of Conduct for Responsible Fisheries (CCRF) addressing responsible fisheries management (Article 7), aquaculture development (Article 9),

international trade (Article 11) and fisheries research (Article 12). The objective of these guidelines is to assist countries in reducing the risk of introduction and spread of serious transboundary aquatic animal diseases (TAADs). Although they deal primarily with safe transboundary movement at the international level, they are also applicable to domestic movements between different provinces, geographical areas or zones of differing disease status. These Technical Guidelines also include guidance for health management at the farm and farm-cluster level, to the extent that these local production units are involved in the spread of TAADs.

FAO Fisheries and Aquaculture Department. 2007. *Improving *Penaeus monodon* hatchery practices: manual based on experience in India. FAO Fisheries Technical Paper. No. 446.* Rome, FAO. 2007. 100 pp.



The successful farming of tiger shrimp (*Penaeus monodon*) in India is mainly due to the existence of some 300 hatcheries whose capacity to produce 12 000 million post-larvae (PL) annually has provided an assured supply of seed. However, the sustainability of the sector is still ham-

pered by many problems, foremost among these being a reliance on wild-caught broodstock whose supply is limited both in both quantity and in seasonal availability and that are often infected with pathogens. The current low quality of hatchery produced PL due to infection with white spot syndrome virus (WSSV) and other pathogens entering the hatcheries via infected broodstock, contaminated intake water or other sources due to poor hatchery management practices, including inadequate biosecurity, is a major obstacle to achieving sustainable shrimp aquaculture in India and the Asia-Pacific region. Considering the major contribution of the tiger shrimp to global shrimp production and the economic losses resulting from disease outbreaks, it is essential that the shrimp-farming sector invest in good management practices for the production of healthy and quality seed.

This document reviews the current state of the Indian shrimp hatchery industry and provides detailed guidance and protocols for improving the productivity, health management, biosecurity and sustainability of the sector. Following a brief review of shrimp hatchery development in India, the major requirements for hatchery production are discussed under the headings: infrastructure, facility maintenance, inlet water quality and

treatment, wastewater treatment, biosecurity, standard operating procedures (SOPS), the Hazard Analysis Critical Control Point (HACCP) approach, chemical use during the hatchery production process and health assessment. Pre-spawning procedures covered include the use of wild, domesticated and specific pathogen free/specific pathogen resistant (SPF/SPR) broodstock; broodstock landing centres and holding techniques; broodstock selection, transport, utilization, quarantine, health screening, maturation, nutrition and spawning; egg hatching; nauplius selection; egg/nauplius disinfection and washing and holding, disease testing and transportation of nauplii. Post-spawning procedures covered include: larval-rearing unit preparation, larval rearing/health management, larval nutrition and feed management, important larval diseases, general assessment of larval condition, quality testing/selection of PL for stocking, PL harvest and transportation, nursery rearing, timing of PL stocking, use of multiple species in shrimp hatcheries, and documentation and record keeping. Information on the use of chemicals in shrimp hatcheries and examples of various forms for hatchery record keeping are included as Annexes.



FAO Committee on Fisheries. 2007. *Report of the third session of the Sub-Committee on Aquaculture. New Delhi, India, 4–8 September 2006. FAO Fisheries Report No. 816.* Rome. FAO. 85 pp. Trilingual EN/FR/SP.

The third session of the Committee on Fisheries Sub-Committee on Aquaculture was held in New Delhi, India, from 4 to 8 September 2006 at the kind invitation of the Government of India. It was attended by 48 Members of FAO, by representatives from one specialized agency of the United Nations and by observers from four intergovernmental and four international non-governmental organizations. The Sub-Committee appreciated the effort of the FAO Fisheries Department in

responding to the recommendations of the second session of the Sub-Committee. Several working documents, including *State of world aquaculture 2006* and *Prospective analysis of future aquaculture development*, were presented by the Secretariat for information, discussion and decision by the Sub-Committee. They were received with compliments. The Sub-Committee agreed to the International Principles for Responsible Shrimp Farming. The Sub-Committee requested the Secretariat to ensure implementation of priority activities during the intersessional period. Recognizing the constraints in the Regular Programme budget of the FAO Fisheries Department, the Sub-Committee recommended that additional resources should be sought within the Regular Programme or through Extra-Budgetary resources to undertake aquaculture activities. The Sub-Committee expressed its appreciation to the Government and people of India for their hospitality and the excellent facilities that were provided for the session. The Sub-Committee agreed that its next session should be held in 2008 and appreciated the offer by the Government of Chile to host it.

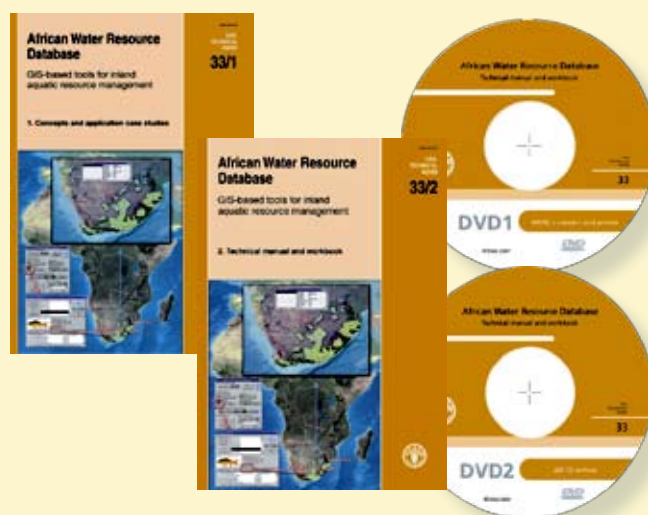


Jenness, J.; Dooley, J.; Aguilar-Manjarrez, J. & Riva, C. 2007. African Water Resource Database. GIS-based tools for inland aquatic resource management. 1. Concepts and application case studies. *CIFA Technical Paper*. No. 33, Part 1. Rome, FAO. 167 pp.

Jenness, J.; Dooley, J.; Aguilar-Manjarrez, J. & Riva, C. 2007. African Water Resource Database. GIS-based tools for inland aquatic resource management. 2. Technical manual and workbook. *CIFA Technical Paper*. No. 33, Part 2. Rome, FAO. 308 pp. (Includes two DVD's.)

The African Water Resource Database (AWRD) is a set of data and custom-designed tools, combined in a geographic information system (GIS) analytical framework aimed at facilitating responsible inland aquatic resource management with a specific focus on inland fisheries and aquaculture. It thus provides a valuable instrument to promote food security.

The AWRD data archive includes an extensive collection of datasets covering the African continent, including: surface waterbodies, watersheds, aquatic species, rivers, political boundaries, population density, soils, satellite



imagery and many other physiographic and climatological data. To display and analyse the archival data, it also contains a large assortment of new custom applications and tools programmed to run under version 3 of the ArcView GIS software environment (ArcView 3.x).

The database allows integration of different types of information into a cohesive program that, because of its visual nature, is easy to understand and interpret. Creative applications of these tools and data could deepen our understanding of inland aquatic resource management and be of immediate value in addressing a wide variety of management and research questions.

The AWRD was designed based on recommendations of the Committee on Inland Fisheries for Africa (CIFA) and is both an expansion and an update of an earlier project led by the Aquatic Resource Management for Local Community Development Programme (ALCOM) entitled the "Southern African Development Community Water Resource Database" (SADC-WRD).

The AWRD publication is organized in two parts to inform readers who may be at varying levels of familiarity with GIS and with the benefits of the AWRD. The first part describes the AWRD and is divided into two main sections. The first presents a general overview and is addressed to administrators and managers while the second is written for professionals in technical fields. The second part is a "how to" supplement and includes a technical manual for spatial analysts and a workbook for university students and teachers.

The primary AWRD interface, toolsets and data integral to the function of the AWRD are distributed in two DVDs accompanying part 2

of this publication, and are also available for download from FAO's GeoNetwork and GIS-Fish GIS portals. A more limited distribution of the above primary database/interface, but divided among ten separate CD-ROMs, is available upon request to the Aquaculture Management and Conservation Service of FAO. Also, high resolution elevation datasets and images amounting to 38 gigabytes are available upon request.

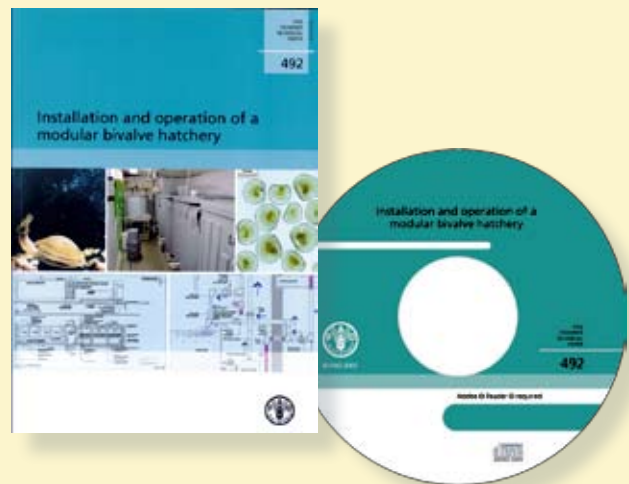


Sarkis, S. & Lovatelli, A. (comp./ed.). 2007. Installation and operation of a modular bivalve hatchery. *FAO Fisheries Technical Paper*. No. 492. Rome, FAO. 2007. 173 pp. (Contains a CD-ROM.)

The above publication was first announced by the FAO Fisheries and Aquaculture Department in the December 2006 issue of the FAO Aquaculture Newsletter (Issue No. 36; page 51). This technical publication was written for those interested in establishing a bivalve hatchery, with minimal experience in this activity and limited technical support and restricted access to information. The manual stands as an entity, providing not only the technicalities of setting up and operating a bivalve hatchery, but also makes some of the scientific background readily accessible. The manual is divided into chapters for each rearing stage: broodstock conditioning, algal culture, hatchery, nursery, growout and economic considerations. The first five chapters include both the physical requirements and culture considerations and procedures for the relevant rearing stage. The final chapter on economic considerations provides an insight into the labour involved for each stage of production, along with a list of equipment and supplies.

To further facilitate the use of this manual and interpretation of the technical drawings of the various hatchery sections the scaled drawings are available as PDF files in an enclosed CD-ROM at the back of the manual allowing the reader to print any of these for ease of use and consultation. The CD-ROM also contains PDF files of all chapters.

This new publication is part of three FAO technical publications dedicated to bivalve aquaculture. The first volume of this series entitled "Hatchery culture of bivalves: A practical manual" (*FAO Fisheries Technical Paper*. No. 471) was published in 2004 and is now available in Chinese, English, French and Spanish and shortly in Arabic. The third



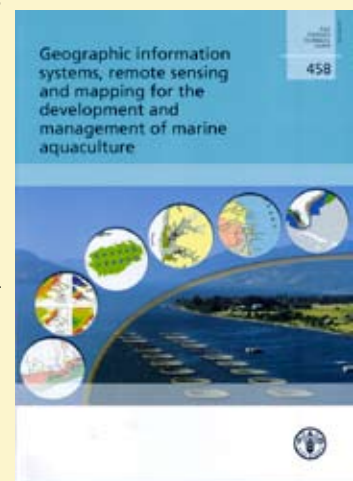
publication of this series deals with bivalve depuration. This volume will be available towards the end of 2007.

Further details can be obtained by writing to Mr Alessandro Lovatelli at FAO/HQ, E-mail: Alessandro.Lovatelli@fao.org.



Kapetsky, J.M. & Aguilar-Manjarrez, J. 2007. Geographic information systems, remote sensing and mapping for the development and management of marine aquaculture. *FAO Fisheries Technical Paper* No. 458. Rome, FAO. 125 pp.

The objective of this document is to illustrate the ways in which Geographic Information Systems (GIS), remote sensing and mapping can play a role in the development and management of marine aquaculture. The perspective is global. The approach is to employ example applications that have been aimed at resolving many of the important issues in marine aquaculture.



The underlying purpose is to stimulate the interest of individuals in the government, industry and educational sectors of marine aquaculture to make more effective use of these tools. A

brief introduction to spatial tools and their use in the marine fisheries sector precedes the example applications. The most recent applications have been selected to be indicative of the state of the art, allowing readers to make their own assessments of the benefits and limitations of use of these tools in their own disciplines.

The applications are organized issue-wise along the main streams of marine aquaculture: culture of fishes in cages, culture of shellfishes and culture of marine plants. A case study, is included that illustrates how freely downloadable data can be used to estimate marine aquaculture potential. Because the ultimate purpose of GIS is to aid decision-making, a section on decision support tools is included.



The document was prepared under the supervision of Dr Melba B Reantaso, Fishery Resources Officer of the Aquaculture Management and Conservation Service (FIMA) of the FAO's Department of Fisheries and Aquaculture based in Rome, Italy.

This publication contains valuable information on these pathogens of aquatic animals (mainly salmonids and cyprinids) in Latvia. The information presented consist of the following: causative agent, host range, epizootiology, clinical aspects, diagnostic methods, modes of transmission and control measures. Colored photographs and life cycle illustrations are also provided.



Arthur, J.R. & Te, B.Q. 2006. Checklist of the parasites of fishes of Viet Nam. *FAO Fisheries Technical Paper*. No. 369/2. Rome, FAO. 133 pp.

The Extension Manual on Some Important Viruses, Parasites and Bacteria of Aquatic Animals in Latvia is one of the final outcomes of the FAO Technical Cooperation Project (TCP) TCP/LAT/3001 – Improving Aquatic Animal Health and Quality and Safety of Aquatic Products – implemented from 2004 to 2007. The aim of this manual is to provide useful guide for use by farmers, extension officers, researchers and students to identify some important viruses, parasites and bacteria of fishes in Latvia. This is part of FAO's continuing efforts to address the need for information on diseases and pathogens of aquatic animals.



This publication is a checklist summarizing information on the parasites of Vietnamese fishes contained in world literature dating from the earliest known record (Billet 1898) to the end of 2003. Information is presented in the form of parasite-host and host-parasite lists and contains

453 named species of parasites (not including 4 *nomina nuda*), distributed among the higher taxa as follows: Protozoa - 48, Myxozoa - 33, Digenea - 151, Monogenoidea - 112, Cestoda - 16, Nematoda - 53, Acanthocephala - 21, Hirudinea - 2, Branchiura - 3, Copepoda - 12 and Isopoda - 2. Many records of parasites not identified to species level are also included. The Parasite-Host List is organized on a taxonomic basis and provides information for each parasite species on the environment (freshwater, brackish water, marine), the location (site of infection) in or on its host(s), the species of host(s) infected, the known geographic distribution (by administrative division) in Viet Nam, and the published sources for each host and locality record. The Host-Parasite List is organized according

to the taxonomy of the hosts, and includes, for each host, the English language and local (Vietnamese) common names, environment (freshwater, brackish water, marine), status in Viet Nam (native or exotic), and information on the known distribution in Viet Nam of the parasites. Both lists are accompanied by remarks and footnotes, as warranted, giving specific information on points of systematics, nomenclature, possible misidentifications, introductions, etc. Citations are included for all references, as well as parasite and host indices. The following new taxonomic combinations are made: *Elongoparorchis siamensis* (Oshmarin, 1965) n. comb.; *Capillaria ariusi* (Parukhin, 1989) n. comb., *Falcaustra babei* (Ky, 1971) n. comb. and *Neocamallanus trichogasterae* (Pearse, 1933) n. comb.

The parasite fauna of fishes of Viet Nam has received considerable attention, particularly by scientists of the former Soviet Union, in the marine environment, and by Vietnamese and Czech freshwater scientists. Nevertheless, parasites have been recorded from only about ten percent of the more than 1 300 species of marine and freshwater fish occurring in the waters of Viet Nam. Knowledge of freshwater fauna is hampered by a lack of descriptive work and by many probable misidentifications of parasites, due to the tendency of Vietnamese workers to report European species from the local fish fauna.



Kirjušina, M. & Vismanis, K. 2007. Checklist of the parasites of fishes of Latvia. *FAO Fisheries Technical Paper*. No. 369/3. Rome, FAO. 113 pp.

This checklist summarizes information on the parasites of Latvia fishes contained in the world literature dating to the end of 2005. Information is presented in the form of parasite-host and host-parasite lists and includes 305 named species of parasites, distributed among the higher taxa as follows: Protista – 42, Myxozoa – 49, Digenea – 38, Monogenoidea – 81, Cestoda – 33, Nematoda – 31, Acanthocephala – 11, Hirudinida – 2, Mollusca – 6, Branchiura – 2 and Copepoda – 10. Also included are many records of parasites not identified to species level. The Parasite-Host List is organized on a taxonomic basis and provides information for each parasite species on the environment (freshwater, brackish, marine), the location (site of infection) in or on its host(s), the species of host(s) infected, the known geographic

distribution (by major waterbody) in Latvia, and the published sources for each host and locality record. The Host-Parasite List is organized according to the taxonomy of the hosts, and includes for each host, the English language, Latvian and Russian common names, environment (freshwater, brackish, marine), status in Latvia (native or exotic) and the list of parasites reported. Both lists are accompanied by remarks, as warranted, giving specific information on points of systematics, nomenclature, possible misidentifications, introductions, life cycles, etc. Citations are included for all references and parasite and host indices are included. The parasite fauna of fishes of Latvia has received considerable attention. Nevertheless, parasites have been recorded from only about 45 percent of the more than 114 species of marine and fish occurring in the country's waters. The common freshwater fish species (particularly those having economic importance, such as the cyprinids, percids, esocids and salmonids) have been particularly well studied, providing a good general picture of their parasite faunas and data having value for use in faunistic analyses.



Copies of the CD ROM "FAO publications and reports on inland fisheries and aquaculture, version 1 (English/French/Spanish)" now available from fi-library@fao.org



Morales, Q.V.V. & Morales, R.R. 2006. Síntesis regional del desarrollo de la acuicultura. 1. América Latina y el Caribe – 2005/Regional review on aquaculture development. 1. Latin America and the Caribbean – 2005. *FAO Circular de Pesca/FAO Fisheries Circular*. No. 1017/1. Roma/Rome, FAO. 177 pp.

The FAO Fisheries Department conducts reviews of aquaculture development status and trends on a regular basis. This document is a result of such an exercise conducted during 2005 and 2006. The regional review is a synthesis of the National Aquaculture Sector Overview (NASO) of 22 countries from Latin America and the Caribbean. The production volume and value data have been derived from the latest FAO FISHSTAT Plus database for 2003. As part of the review process, a regional expert workshop was conducted in Panama, Republic of Panama, in 2005, to discuss the regional aquaculture development status and trends. The report of this expert workshop is also included in this review.

The regional review provides a description of how the aquaculture sector developed in Latin America and the Caribbean over the past decade. The review and analysis of data and information clearly show that the sector is growing exponentially with salmon, shrimp and tilapia as the leading species. However, according to data recorded by FAO it may be observed that during the last 10 years there are important increments in the production of other groups of species such as macroalgae, bivalves, caracids and catfish. Chile, Brazil, Mexico and Ecuador are the leading countries in terms of production for 2003. Most countries are showing a rapid growth of the sector thus having important social and economic effects on regional and local economies mostly through medium to larger scale commercial aquaculture. Rural aquaculture in Latin America is still largely dependent on State or international technical and financial support schemes. Overall, aquaculture in this region continues to grow steadily but will need greater organization and coordination between the private sector and government particularly to achieve larger social effects.

Network of Aquaculture Centres in Asia-Pacific. 2006. Regional review on aquaculture development. 3. Asia and the Pacific – 2005. *FAO Fisheries Circular*. No. 1017/3. Rome, FAO. 97 pp.

The FAO Fisheries Department conducts reviews of aquaculture development status and trends on a regular basis. This document is a result of such an exercise conducted during 2005 and 2006. The regional review is a synthesis of the National Aquaculture Sector Overview (NASO) of 16 countries from five sub-regions of Asia and the Pacific and information from two additional countries, Japan and the Democratic People's Republic of Korea. The review also contains a brief description of the aquaculture development trends and issues in the Pacific island nations. The production volume and value data have been derived from the latest FAO FISHSTAT Plus database. As part of the review process, a regional expert workshop was conducted in Ramzar, Islamic Republic of Iran, in 2006, to discuss the regional aquaculture development status and trends. The report of this expert workshop is also included in this review. The regional review provides a description of how the aquaculture sector developed in Asia and the Pacific over the past three decades. The review and analysis of data and information clearly show that the sector is growing and expanding and is predicted to meet the increasing demand for aquatic food products in the years to come, with a few clear trends. These are: (a) increasing demand for aquaculture products; (b) increasing intensification of production systems; (c) continuing diversification of production systems and species farmed; (d) increasing influence of markets, trade, consumers and consumption; (e) enhanced regulation and better governance; and (f) drive towards better management. The review also attempts to analyse the trends and look at the sector's sustainability and how the sector is behaving as a responsible food production sector in Asia and the Pacific.



Poynton, S.L. 2006. Regional review on aquaculture development. 2. Near East and North Africa – 2005. *FAO Fisheries Circular*. No. 1017/2. Rome, FAO. 79 pp.

The Fisheries Department of the Food and Agriculture Organization of the United Nations (FAO) regularly conducts reviews of aquaculture status and trends, most recently in 2005. This regional review for the 17 countries in the Near East and North Africa is a synthesis of the available National Aquaculture Sector Overviews (NASOs) and Prospective Analyses for Future Aquaculture Development (PAFADs), with a focus on the period 1994-2003. The review process also included regional expert workshops held in Cairo (Egypt) and Muscat (Oman) in 2005, for discussion of the regional aquaculture development, in particular the status, trends and challenges. The information from these workshops is also included in this regional review. In the last decade, the sector has demonstrated remarkable growth from 96 700 tonnes in 1994 to 566 250 tonnes in 2003, and the contribution of aquaculture to total fisheries increased from 4.5 percent to 18.7 percent. Nearly all countries are expected to increase their aquaculture production, manifest in increased production tonnage and diversity of culture species. Production is dominated by Egypt and the Islamic Republic of Iran, with Bahrain, Kuwait, Oman, the United Arab Emirates and Yemen being emerging producers. In many instances, increases in production are driven by a need to increase reliability of the domestic supply. Production of protein for human consumption is dominant, particularly of finfish such as tilapia, carps and marine finfish species; the Indian white prawn is the only crustacean of significant economic importance. Within food fish production the main trends are increased culture of marine species, intensification, and more integrated agriculture-aquaculture. Within non-food species, the main trend is towards production of ornamentals. Successfully addressing four key priority issues is essential for the continued growth of aquaculture in the region: (i) farming systems, technologies and species; (ii) marketing and processing; (iii) health and diseases and (iv) policies, legal frameworks, institutions and investment.



Hecht, T. 2006. Regional review on aquaculture development. 4. Sub-Saharan Africa – 2005. *FAO Fisheries Circular*. No. 1017/4. Rome, FAO. 96 pp.

The FAO Fisheries Department conducts reviews of aquaculture development status and trends on a regular basis. This document is a result of such an activity conducted during 2005 and 2006. This review was made by synthesizing National Aquaculture Sector Overview (NASO) from 16 countries in sub-Saharan Africa. The 16 countries included, Côte d'Ivoire, Ghana, Liberia, Nigeria, Sierra Leone in West Africa; Cameroon, the Republic of Congo and the Democratic People's Republic of Congo in Central Africa; Uganda, the United Republic of Tanzania and Kenya in East Africa; and Angola, Mozambique, Madagascar, Zambia, Malawi in southern Africa. South Africa was also included. The production volume and value data have been derived from the latest FAO FISHSTAT Plus database. As part of the review process, a regional expert workshop was conducted in Mombasa, Kenya, in 2005, to discuss the regional aquaculture development status and trends. The report of this expert workshop is also included in this document. The synopsis provided here summarizes the current status and recent advances that have been made by the aquaculture sector in the sub-Saharan Africa region during the last decade and the last five years in particular.



Olin, P.G. 2006. Regional review on aquaculture development. 7. North America – 2005. *FAO Fisheries Circular*. No. 1017/7. Rome, FAO. 25 pp.

The aquaculture industry in North America is a relative newcomer in the agricultural sector and has become well established in the last 25 years. Channel catfish (*Ictalurus punctatus*) and Atlantic salmon (*Salmo salar*) are the two major species cultured. The governments of Canada and the United States of America (USA) support the continued expansion of the aquaculture sector and are engaged with the industry to facilitate this development. At the same time there is a strong sentiment within the industry that regulatory agencies should take a much more proactive role to eliminate overlapping jurisdictions, resolve conflicting mandates and establish clear guidelines for industry expansion. A significant constraint

to future aquaculture development is public concern about environmental risks associated with aquaculture, the safety of aquacultured products, and the potential impact of fish farms on marine ecosystems. The industry is responding to these concerns with the development of best management practices and environmental codes of practice to insure the long-term sustainability of land based, coastal and offshore aquaculture systems. Current production technology and the extensive environmental regulatory processes in place in Canada and the USA are effective in preventing these concerns from becoming problems. The document analyses the state and the trends in aquaculture development over the past few years in the North American region.



2005 Statistics on Aquaculture Production Volume and Value Available Through FishSTAT

The FAO Fisheries database of statistics on aquaculture production and values has been updated to include data for 2005. Total aquaculture production of aquatic animals (i.e., excluding aquatic plants) for 2005 was reported to be 48.1 million tonnes¹ with a farm-gate value of US\$ 70.9 billion. With the inclusion of aquatic plants, the production increases to 63.0 million tonnes with a value of US\$ 78.4 billion. Growth in global aquaculture continues to be strong as these figures represent an increase in production of 5.2% from the total aquaculture production reported for 2004, and a 4.8% increase when only aquatic animals are considered. The entire database, containing data from 1950-2005, can be downloaded from the FAO Fisheries website at www.fao.org/fi/statist/fisoft/fishplus.asp. FISHSTAT Plus is a powerful and easy-to-use software package that allows the user to query the databases for aquaculture production and values, as well as the other FAO Fisheries Statistics databases, including global capture fishery data, fishery commodities data, and regional databases.

¹All FAO aquaculture and capture fishery production statistics are expressed in live weight-equivalent units

Moehl, J.; Brummett, R.; Kalende Boniface, M. & Coche, A. 2006. Guiding principles for promoting aquaculture in Africa: benchmarks for sustainable development. *CIFA Occasional Paper No. 28*. 122 pp.

In August, 2003, The Economist wrote about "The promise of a blue revolution: how aquaculture might meet most of the world's demand for fish without ruining the environment"¹. Two years later, the New Partnership for Africa's Development (NEPAD) recognised "growing opportunities and emerging successes of aquaculture development in the region". Aquaculture in Africa seems perched on the verge of a new era when high expectations can be matched with appropriate technologies and best practices to be able to put food on the table and money in the pocket. Aquaculture seems to have real potential and be able to realistically contribute to Africa's urgent need for significantly enhanced economic growth and food security.

This current situation is a long way from the prognosis given by FAO's Aquaculture Planning In Africa – Report Of The First Regional Workshop On Aquaculture, 2-17 July 1975, when it was stated: "failures of some of the ill-conceived programmes during the early part of the century have continued to remain a major constraint in convincing the farmers and investors of the economic viability of aquaculture". The Workshop noted that aquaculture: "should be organised either as a government subsidised food production industry to feed the poor, like agriculture or even fishing in many countries of the world, or in the alternative as an economically viable industry that can make substantial contributions to the overall food production, economy and employment situation in the country"².

Today, the option of supporting a "government subsidised industry" is a non-starter. Aquaculture is a business and must be promoted and managed as such.

It is imperative for us to take new and innovative approaches to aquaculture development if the current Blue Revolution is to succeed. We must shake off the remnants of the "state-does-it-all" approach and establish mechanisms and procedures which facilitate private-sector-led, technically sound, economically profitable, socially acceptable and environmentally sustainable national and regional aquaculture programmes. The present document looks back at those plush days of the 70s when donor-led aquaculture programmes abounded in Africa.

It extracts from these a clear suite of lessons which should guide our future aquaculture development efforts. We must heed these lessons, we must reform and adjust. The State has a key role as a facilitator and monitor. But the business of production, be it fish for the table or fingerlings for the pond, is the business of business and should be soundly put in the hands of the private sector with firm and appropriate public support. The future is promising and holds the best rewards for those with the foresight to change for the better.

¹ The Economist. London: August 9, 2003. Vol. 368, Iss. 8336; pg. 20.

² Aquaculture Planning in Africa, Report of the First Regional Workshop on Aquaculture Planning in Africa, Accra, Ghana, 2-17 July 1975, Aquaculture Development and Coordination Programme, FAO/UNDP, Rome, September 1975. pg. 1-3.



Nguyen T, N.; Hurwood, D.; Mather P; Na-nakorn U.; Kamonrat, W. & Bartley, D. 2006. Manual on Application of Molecular Tools in Aquaculture and Inland Fisheries Management, part I: Conceptual basis of population genetic approaches 80 pp. and part II: laboratory protocols and data analysis. 134 pp.

The aim of this manual is to provide a comprehensive practical tool for the generation and analysis of genetic data for subsequent application in aquatic resources management in relation to genetic stock identification in inland fisheries and aquaculture.

Part I of the manual contains general principles of genetic resource management.



Section 1. The fundamental nature of DNA.

1.1 Basic DNA structure

1.2 Where does variation in DNA sequences come from?

Section 2. Genetic variation in nature

Section 3. Basic concepts in population genetics

Section 4. Natural selection

Section 5. Genetic drift

Section 6. Non-random mating and population structure

Section 7. Environmental influences on population processes

Section 8. Ecological influences on population processes

Part II of the manual is to provide step-by-step laboratory protocols and methodologies for data analysis, and a guideline to design a population genetic study.

Part II covers most commonly used techniques for screening genetic variation, general background on the methodologies for estimation of important parameters in population genetic studies for different forms of molecular genetic markers.

Section I - Molecular markers - an overview: provides an overview of common molecular markers used in population genetic studies.

Section I - Laboratory protocols: provides step-by-step protocols of commonly used molecular genetic techniques.

Section III - Data analysis and project design: deals with aspects of data management such as data analysis, interpretation and presentation, and a guideline to design a population genetic studies.

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Some often conducted by States that carry a "flag of convenience" - vessels that are officially registered in one nation, but are owned and operated by persons of another nation. It is considered an irregular and illegal practice of non-national trade. FAO has initiated the development of an international Plan of Action to help nations deal with this - that nations place a high priority on IUU is evidenced by the fact that 98 countries have developed or are in the process of developing a national plan to address it.

Ramsar Convention on Wetlands

Ramsar Convention on Wetlands, an intergovernmental treaty with more than 150 member countries, produced with FAO and other partners, a brochure to highlight the importance of fisheries and aquaculture in wetlands, and the importance of healthy wetlands to productive fisheries and aquaculture. In light of the following - one billion people rely on fish including both finfish and shellfish (molluscs and crustaceans) as their main or sole source of protein; - 35 million people are directly engaged, either full- or part-time, in fishing and aquaculture; over 95 percent of them live in developing countries, and the majority are smallscale fishers; - 75 percent of commercially important marine and many inland fish stocks are currently being overfished or are being fished at their biological limit; - demand for seafood products (including "sea food" from inland waters) has nearly doubled over the past 40 years and is likely to continue alongside a growing global population, the brochure discusses relations among wetlands, aquaculture, fishing, people and the environment. The brochure can be found at: http://www.ramsar.org/wwd/7/wwd2007_leaflet_e.pdf

The Code of Conduct for Responsible Fisheries

An ecosystem approach to sustainable management of fisheries, rather than management of individual fisheries or species, is now the focused way forward - but many governments still work with the latter in their management practices.

Through the UN Convention on the Law of the Sea (UNCLOS), by 1994 coastal nations had exclusive rights for exploitation for 200 nautical miles out to sea - exclusive economic zones or EEZs - an area where about 90% of the marine catch is realised. This agreement significantly reduced the 'open access' area of the marine environment where there is no agreed control over exploitation (now only about 1% of the global catch comes from this 'open access' area), so it was generally seen as a 'good thing'. But it leads to management challenges:

International challenge: Unfortunately, fish don't take much notice of EEZs so for certain exploited species that readily cross these areas (or worse, for those species such as tuna and swordfish that are known to range thousands of kilometers) there is often a need for formal collaboration between neighbouring nations, and this is usually very challenging - a recent assessment reckons that effective bilateral or multilateral agreements are the exception rather than the rule.

To assist countries to take a more responsible, ecosystem-based approach to fisheries management, FAO introduced a Code of Conduct for Responsible Fisheries in 1995.

National challenge: Even at a national level, having, implementing and enforcing effective fisheries management plans, and putting the necessary laws in place to control exploitation in their exclusive fishing zones, is not easy and only a few countries are managing this particularly well.

A significant problem area that is being addressed at both international and national levels is 'IUU' - Illegal, Unreported and Unregulated - fishing. IUU fishing takes place in many capture fisheries but it is particularly prevalent in high value species, such as

Code of Conduct for Responsible Fisheries

The Code of Conduct for Responsible Fisheries is an important set of recommendations and guidelines for governments in developing their fisheries and aquaculture sustainably. A broad set of national policy makes and fisheries managers. It covers a wide range of topics, from how nations should manage and monitor their fleets, to how they should conduct fisheries research and develop aquaculture systems. Nations are encouraged to follow the Code as a guide to better fisheries and aquaculture in their waters and other wetlands.

Principles of the Code include:

- Manage stocks using the best available science
- Use ecosystem-based approaches when the effects of fishing practices are understood (precautionary approach)
- Reveal everything known or otherwise known fishing capacity
- Minimize discards of fish and bycatch
- Prohibit destructive fishing methods
- Review depleted fish stocks
- Implement appropriate national laws, management plans, and means of enforcement
- Monitor the effects of fishing on all species in the ecosystem, not just the target fish stock
- Work cooperatively with other nations to coordinate management plans and enforcement actions
- Recognize the importance of artisanal and small-scale fisheries, and the value of traditional management practices
- Develop aquaculture as an environmentally and socially responsible resource

To support the Code, FAO has issued a number of technical guidelines for responsible fisheries that look in much greater detail at certain subject areas. For example, there are FAO guidelines on integrating fisheries management into coastal zone management, inland fisheries, developing ecosystem integrity, and creating an 'integrated approach' to fisheries.

The Sustainable Aquaculture Development Centre has carefully produced Regional Guidelines in several areas of fisheries management covered by the Code.

Read more about the Code of Conduct and associated guidelines at http://www.fao.org/fishery/2007/06/01/20070601_CCFR_ppt.pdf



FAN

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The FAO Aquaculture Newsletter (FAN) is issued two times a year by the Aquaculture Management and Conservation Service (FIMA) of the FAO Fisheries and Aquaculture Department, Rome, Italy. It presents articles and views from the FAO aquaculture programme and discusses various aspects of aquaculture as seen from the perspective of both headquarters and the field programme. Articles are contributed by FAO staff from within and outside the fisheries Department, from FAO regional offices and field projects, by FAO consultants and, occasionally, by invitation from other sources. FAN is distributed free of charge to various institutions, scientists, planners and managers in member countries and has a current circulation of about 1 500 copies.

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