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FAO Aquaculture Newsletter

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Are we prepared for disease emergencies?

The epidemic spread of aquatic animal diseases is an increasing event in many regions of the world. In Asia, we have witnessed the devastating impacts of epizootic ulcerative syndrome (EUS) on freshwater fish during the 1980s and 1990s, viral nervous necrosis (VNN) in marine fish since the 1990s, white spot syndrome virus (WSSV) in penaeid shrimp from the early 1990s, and the emerging taura syndrome virus (TSV) in *Penaeus vannamei*. Since early 2002, Indonesia has been facing a serious epizootic, probably due to koi herpes virus (KHV), that is causing large-scale mortalities with significant economic losses among populations of cultured common and koi carp *(Cyprinus carpio)*.

More recently, during the last quarter of this year, an outbreak of KHV also occurred in common and koi carp in Japan. In Latin America, TSV and WSSV are still haunting the shrimp industry, while several new disease incursions have been recently reported from Europe and North America – Mikrocytosis in the United States of America, MSX disease (Haplosporidium nelsoni) in Canada and spring viraemia of carp (SVC) in Switzerland. There are also still a number of unresolved diseases, such as akoya pearl oyster mortalities in Japan, scallop mortalities in Mainland China, and abalone die-offs in Taiwan Province of China.

These examples demonstrate the vulnerability of aquaculture systems to wide-scale infectious disease emergencies and the significant impacts that new diseases can have on local economies. Unless appropriate health management and biosecurity measures are continuously put in place and effectively implemented, the risks of major disease incursions and newly emerging diseases will continue to threaten the sector. Effective prevention and control measures complemented by extension, educational programmes and capacity building for farmers and producers are essential to reduce the risk of potential transboundary epizootics.

Strong national approaches, along with well thought-out, concerted regional strategies, are required to ensure that operational capability is in place to respond effectively to disease emergencies. Equally important is that governments and the private sector see clearly the benefits from investing and participating in the development of emergency response systems. FAO, in collaboration with its partners, is currently taking action to find avenues for providing guidance and assistance for national and regional improvements.

Rohana Subasinghe
Chief Editor

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Assessing markets and market conditions for aquatic products in Asia

"Aquamarkets 2003: Accessing markets and fulfilling market requirements of aquatic products, seminar, consultation and exhibition", was held in Manila, the Philippines from 2-6 June 2003. It was co-organized by the Network of Aquaculture Centres in Asia-Pacific (NACA), the Philippine Bureau of Fisheries and Aquatic Resources (BFAR) of the Department of Agriculture and the Department of Trade and Industry (DTI). FAO provided assistance to the organization and implementation of this important initiative.

Aquamarkets 2003 was organized following the recommendations made during the NACA/FAO Conference on Aquaculture in the Third Millennium, held in Bangkok in February 2000, the Association of South East Asian Nations – South East Asian Fisheries Development Center (ASEAN-SEAFDEC) "Fish for the People" Conference in Bangkok in November 2001, the first meeting of FAO's Committee on Fisheries' (COFI) Subcommittee on Aquaculture, held in Beijing in April 2002, the ASEAN-European Union (EU) AquaChallenge Workshop, also held in Beijing in April 2002, and the United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP) survey on Asian and Pacific fishery implemented with INFOFISH.

The outputs expected from Aquamarkets 2003 were the following:

- Increased awareness, knowledge and understanding of participants, particularly farmers and potential exporters, on core issues and approaches to accessing and meeting requirements of markets for aquaculture products, as well as on the key stakeholders and players involved;
- Recommendations for action on accessing and meeting requirements of markets for aquaculture products; and
- A technical report on issues and approaches on accessing and meeting requirements of markets for aquaculture products in the Asia-Pacific Region.

Attendance

In total, 156 sectoral stakeholders from Bangladesh, Brunei Darussalam, Hong Kong, India, Indonesia, Malaysia, Nepal, Pakistan, the Philippines, Singapore, Sri Lanka, Thailand, Viet Nam and the United States of America, and from regional and international organizations and institutions such as: ASEAN Fisheries Federation, INFOFISH, FAO, SEAFDEC, the Global Aquaculture Alliance/Aquaculture Certification Council (GAA/ACC), the World Fish Centre (ICLARM), International Marine Alliance and the Nature Conservancy (IMA/TNC), the United Nations Development Programme (UNDP), the World Trade Organization (WTO) and the World Wildlife Fund (WWF) attended the activity.

Issues discussed

First, a two-day Seminar was held, which consisted of presentations and panel discussions on selected issue areas, including product standards, food safety and quality, certification, marketing efficiency, trade and marketing linkages with poverty, food security and environmental sustainability, international trade agreements and national import regulations, and tariff and non-tariff barriers to trade. This was followed by a two-day Regional Consultation, with special sessions on trade, marketing and poverty.

The Proceedings of the Seminar – Consultation on Accessing Markets and Fulfilling Market Requirements of Aquatic Products will be published shortly by NACA, however, most presentations and the draft proceedings can be found on the NACA website at the following address: http://www.enaca.org/AquaMarkets/index.htm.

Strategies for action

Strategies for action on accessing and meeting market requirements of aquatic products were discussed during a special session of the Seminar. Five broad categories of strategy were identified. These focused on:

- Strengthening regional capacities
  - to produce and deliver clean, safe and quality products, according to market requirements, as well as in line with environmental and other standards;
  - to transact with buyers and/or importing countries;
  - to negotiate or participate effectively in various fora, including Codex Alimentarius, the Subcommittee on Fish Trade of FAO's COFI, and the WTO, as well as bilaterally;
  - to influence trade policies through collective regional action.
- Improving domestic market systems (infrastructure, regulations).
- Augmenting access to information and technology.
- Increasing marketing cooperation among aquaculture producers, and
- Improving cooperation among regional governments (particularly to liberalize trade in aquaculture products).

Recommendations

Participants at the Aquamarkets 2003 consultation endorsed the recommendations on markets and trade and on food quality and safety contained in the Bangkok Declaration on Aquaculture in the Third Millennium.

Consultation participants made the following ten recommendations to further support the region in accessing markets and meeting market requirements for products from aquaculture:

- Encourage nations in the Asia-Pacific Region to improve national, regional and international cooperation in order to better share information on markets and trade in aquaculture products, and to ensure that relevant information on fisheries and aquaculture are provided to those engaged in trade negotiations.
- Improve information exchange and communication on marketing and trade in aquaculture products in the Asia-Pacific Region, such as through the development of a regional website, linked with national focal points for information exchange.
- Give special consideration to small holders and economically vulnerable people in the development of national and regional policies in the area of marketing and trade. Enhance understanding of relevant issues (such as the structure and conduct of the domestic market, marketing infrastructure and investment needs, and marketing finance) to inform policy making and support fair trade.
- Enhance cooperation between the private and public sectors on activities to improve access to markets and meeting market requirements.
- Encourage nations in the Asia-Pacific Region to develop a common stance on issues of interest to the aquaculture sector. In particular, efforts are required to harmonize standards and technical regulations, regionally as well as internationally.
- Encourage importing countries and regions, such as the European Community (EC), to harmonize the application of rules and standards and to make these transparent.
- Encourage common regional positions and understanding on issues of interest to the region, for example on Codex Alimentarius, the World Animal Health Organisation (OIE) standard setting, and other relevant work on international aquaculture standards.
- Examine the possibility of establishing a harmonized certification system for aquaculture products from the region.
- Organize further national and regional consultations to promote better national and regional cooperation and information sharing.
- Request regional and international organizations to provide support, technical assistance and capacity building to national and regional efforts with a view to implementing the above recommendations of the consultation, including capacity building on WTO agreements and negotiations issues.

Follow-up

The participants agreed to develop follow-up projects and technical cooperation activities to translate into action the above recommendations made during this highly successful and appreciated event. Meanwhile, in an Asia Pacific Economic Cooperation (APEC) Fisheries Working Group-sponsored workshop along the same lines recently held in Lima, Peru, the workshop participants recommended that APEC consider adopting the AquaMarkets 2003 Recommendations "in view of their relevance to the objectives of the workshop and APEC."

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or the NACA website:
http://www.enaca.org/AquaMarkets/index.htm.

FAO-ASEAN strategic planning workshop on h armonization of standards for shrimp export-import

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In the year 2000, global aquaculture production exceeded 35 million metric tonnes with a value of over 52 thousand million US dollars. Although crustaceans represented only 4.8 percent of total production by weight, they comprised almost 21percent of the value of global aquaculture in 2000. The giant tiger prawn is ranked first by value at over four thousand million US dollars and more recent estimates indicate that white shrimp produced in Asia are making an increasing contribution to the overall production of Asian farmed shrimp.

The USA has been the major market for farmed shrimp over the past few years, and the market condition in the USA is now the predominant factor affecting international market prices. Shrimp is the number one seafood consumed in the USA and imports have now reached 430,000 tonnes per year, worth 3.4 thousand million US dollars, and are still increasing. The Japanese market is also important with 80 percent of its imports coming from Asian countries (particularly Indonesia, Viet Nam and India) in 2002, compared to just 20 percent from Latin America.

The European market is more difficult to penetrate than the United States or Japanese markets, due to consumer pressures that have recently become even more concerned about a range of issues that include sustainability criteria, traceability, contaminants and residues. The issues concerning antibiotics, that led to recent bans on importation and blacklisting of farmed shrimp from many Asian countries, has caused considerable economic losses to many Asian countries.

Part of the problem is due to the disparities in quality control and inspections standards among ASEAN countries. If it were possible to harmonize these, it would result in substantial savings while contributing to the stimulation of intra-regional trade. Common standards could also enhance the reputation of the region as an exporter of safe products of consistent quality and composition.

To address the critical emerging issues on food quality and safety, and in recognition of the need to raise the profile of these issues at a policy level, the ASEAN Sectoral Working Group on Fisheries meeting in Laos PDR in May 2003 established an ASEAN Task Force to work towards recognition of regulatory inspection and control system of antibiotic residues in cultured shrimps. Thailand was assigned as the lead country. As the lead country, Thailand, through the Department of Fisheries, requested FAO for technical and financial assistance in organizing the first strategic planning workshop of the Task Force which was held at the Chaophya Park Hotel, Bangkok, Thailand, from 4 to 6 November 2003. Report of this workshop will be soon available through FAO Regional Office for Asia and the Pacific.

Simon Funge-Smith

AGORA – providing scientific literature to the developing world

AGORA - Access to Global Online Research in Agriculture is a programme of FAO in collaboration with major scientific publishers, Cornell University Mann Library and the World Health Organization (WHO). Further information on AGORA can be obtained at: agora@fao.org

Many fisheries and aquaculture libraries in developing countries have not received any current scientific journals in over ten years. Without access to current scientific information, scientists struggle to keep up with advances in science and technology, to publish their own findings in peer-reviewed journals, to update their teaching curricula, to find funding, and in many other arenas. The demand for access to scientific literature in developing countries has gone unfulfilled for many years, and has led to the isolation of a generation of scientists from their peers.

The long-term goal of the AGORA programme is to increase the quality and effectiveness of agricultural research and training in low-income countries, and in turn, to improve food security. To contribute to achieving this goal, AGORA will provide access over the world-wide-web to a research-level collection of key journals in agriculture and related biological, environmental and social sciences to the poorest countries in the world. It will offer to researchers, policy-makers, educators, students, technical workers and extension specialists, a collection of literature comparable to that available to their counterparts in the developed world.

Fisheries and aquaculture journals

Of the more than 400 journals currently available, over 50 are core fisheries and aquatic sciences titles and include: Aquacultural Engineering (Elsevier), Aquaculture (Elsevier), Aquaculture International (Kluwer Academic Publishers), Aquaculture Nutrition (Blackwell Publishing), Aquaculture Research (Blackwell Publishing), Fish and Shellfish Immunology (Elsevier), Fish Physiology and Biochemistry (Kluwer Academic Publishers), and Journal of Fish Diseases (Blackwell Publishing). The list of Fisheries/Aquaculture journals can be viewed at: http://www.aginternetwork.org/ and the index to all journals can be found at: http://www.aginternetwork.org/en/journals.php. There are other subject areas that include journals relevant to aquaculture, such as Food Policy (Elsevier) in the Food Science and Nutrition category and Environmental Pollution (Elsevier) in the Environment/Ecology/Natural Resources category.

Who can participate in AGORA?

Potential users will be required to register with FAO, and access to AGORA will be password controlled. The AGORA Publisher Partners are opening access free to relevant institutions in eligible countries – a list of countries can be seen at: http://www.aginternetwork.org/en/about.php.

Fisheries branch library of FAO

In addition to the journals provided via AGORA, the Fisheries Library maintains a directory of fisheries-related online journals available full-text free of charge at www.fao.org/fi/library/jou_free.htm.

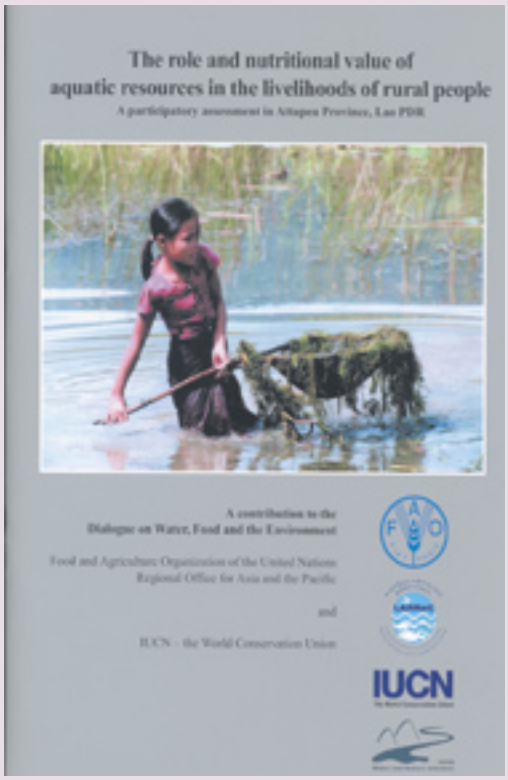
The FAO Library collection includes almost 1000 current fisheries journals, many of which are not available commercially and which contain unique local information and knowledge. FAO Fisheries Department ensures that these publications are indexed for inclusion in international databases such as ASFA (Aquatic Science and Fisheries Abstracts)

(www.fao.org/fi/asfa/asfa.asp) and thus reach a wider audience. The online availability of this "grey literature" i.e. fisheries and aquaculture information published by research institutions and organizations, will give much greater opportunities for its dissemination and for the exchange of information between countries.

For further information about the services of the FAO Fisheries Library, please contact Ms Jean Collins (fi-library@fao.org)

FAO contributes to dialogue on Water, Food and the Environment

As a contribution to the Dialogue on Water, Food and the Environment, the FAO Regional Office for Asia and the Pacific and IUCN – the World Conservation Union have undertaken a joint initiative to investigate the relationships between living aquatic resources, rice agriculture and the livelihoods of the people who manage these systems.



This assessment is intended to address the concern that the ecological and livelihood functions and values of rice fields and adjoining wetlands are not fully appreciated in development planning. A participatory assessment was conducted in Attapeu Province., Lao PDR to determine the role of aquatic resources in the nutritional status of people engaged in rural livelihoods and to determine any opportunities, constraints or threats that may exist concerning the management of aquatic resources and future development in the province.

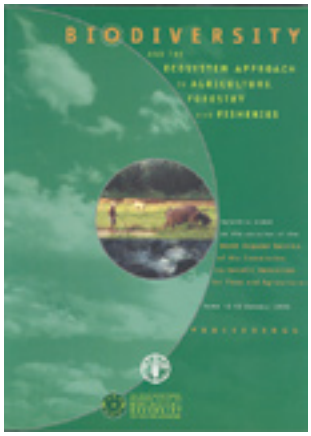
People from the three communities of Tamoyot Village, Sanamsai District, Saisi Village, Saisetha District, and Gayeu Village, Samakisai District participated in activities designed to assess the local availability and use of aquatic resources, their importance in local livelihoods, and the over-all health and nutritional status of the villagers.

The findings indicate that strategies for rural development, food security, and poverty alleviation in these areas need to pay special attention to aquatic resources management to ensure the health and well-being of rural people. Integrated management of freshwater and wetland resources is necessary to meet objectives of increased rice production whilst maintaining the viability and productivity of the aquatic resources upon which rural livelihoods depend.

Meusch, E. Yhoung-Aree, J., Friend, R. & Funge-Smith, S.J. 2003. *The role and nutritional value of aquatic resources in the livelihoods of rural people – a participatory assessment in Attapeu Province, Lao PDR.* FAO Regional Office Asia and the Pacific, Bangkok, Thailand, Publication No. 2003/11, 34 pp.

Biodiversity and the ecosystem approach to agriculture, forestry and fisheries

FAO's Priority Area for Interdisciplinary Action (PAIA) on Biological Diversity for Food and Agriculture and the FAO/ Netherlands Partnership Programme (FNPP) Agro-Biodiversity Theme provided financial support for a Satellite Event on Biodiversity and the Ecosystem Approach in Agriculture, Forestry and Fisheries, which was organized by FAO's Inter-Departmental Working Group on Biological Diversity for Food and Agriculture. "Biodiversity and the Ecosystem Aproach in Agriculture, Forestry and Fisheries" reports the proceedings of the Satellite Event held during the weekend of 12-13 October 2002, which examined the linkages between biodiversity and the ecosystem approach in agriculture, fisheries and forestry.



FAO's Biodiversity Programme turns a common argument on its head. It is often claimed that agriculture is the world's greatest threat to biodiversity. But at the same time, over 40 percent of the world's land surface is covered by agriculture (including pastures, rangelands, inland fisheries and managed forests). Ecological studies of agro-ecosystems reveal the same functional groups of species and essential ecosystem processes found in natural ecosystems. Agriculture depends on ecosystem services delivered through agrobiodiversity and simultaneously delivers ecosystem services (mostly through nonmarket channels) to wider environments. Careless management or bad policy incentives can threaten biodiversity and those services, but agriculture nonetheless represents the world's largest opportunity for ecological learning by the practical managers of ecosystems.

There are well over 500 million farm management units in the world, overwhelmingly found in developing countries. FAO's ongoing field work in over 100 000 rural communities has found that all those farm managers can understand their farms, fields, forests, rangelands and fisheries as ecosystems and thus be able to manage them better. Farmers, even in the poorest and most food-insecure regions of the world, manage genes by their decisions on crop varieties, manage species by their decisions on farm animals, and manage ecosystems by their decisions on soils or pollinators. FAO's Biodiversity Programme includes many applications of the Malawi Principles on the Ecosystem Approach of the Convention on Biodiversity (CBD), some of which are highlighted in the volume "Biodiversity and the Ecosystem Aproach in Agriculture, Forestry and Fisheries".

Farmers, fisherfolk and forest dwellers not only understand and can apply ecosystem approaches in their decision making, but also understand the potential impact of large-scale environmental threats to their livelihoods. Illiterate farmers are still aware of the harmful effects of insecticides on domestic animals, fish and the health of people in their communities and downstream. These rural people are eager to do their part to reduce and mitigate these threats. By valuing and understanding their own experiences using ecological concepts, they can connect and help solve environmental problems at the same time that they solve production problems.

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Trends in national aquaculture legislation (part I)

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This two-part article highlights the most significant trends and initiatives in national aquaculture legislation over the last decade. In general, the developments can be divided into those dealing with planning aspects, the actual operation of the aquaculture farm after its establishment and the aquaculture product. Part I of this article deals with sustainable development, the drafting of comprehensive legal frameworks, integrated coastal management and the tendency to coordinate the various governmental authorizations. Part II, which will appear in the next issue of FAN, will address the growing environmental concerns, food safety and other health issues, the concept of sea ranching, law enforcement and the tendency of the sector toward self-regulation.

Introduction

Aquaculture, or the farming of aquatic organisms, as we know, is one of the fastest growing food production systems in the world. Aquaculture's potential and expected contribution to global foodfish supply over the next few decades has been duly recognized, and the sector is predicted to expand, intensify and develop at a considerable pace over the next few decades. The challenge is to make the future contribution of aquaculture sustainable through better managing the practices and processors, which is also a key to responsible and sustainable development of the sector. Regulation of the sector by state, civil society and/or private-sector mechanisms is vital for its responsible development, thus comprising a major component of a formula for better management. However, regulating the sector is not an easy task, as it is highly diverse and complex.

Is there a single model of an ideal aquaculture law? The answer is no! Characteristically, the sector involves many interests and institutions and is hence regulated under a wide range of legislation. One should pay attention to laws and regulations dealing with various issues, for example, food safety, fish health, environmental issues, access to water and access to (often state-owned) land: the farmer should obtain a secure right to the lands on which the farm is located, through a real property right or a lease or another similar legal instrument. Many of the issues and concerns involved are not unique to aquaculture and may be regulated within a more general legislative regime. The majority of the laws and regulations in place today

were not even developed with aquaculture in mind and are often applied to the sector in an inconsistent manner. Conflicts may arise within the range of legislation applicable to aquaculture or between the agencies and institutions involved.

Legal frameworks

Uncertain and inappropriate legislative arrangements seriously hinder the sustainable development of the aquaculture sector. As a result, a growing attention is given to the role of law. The way, though, in which national legislation controls aquaculture still varies significantly from country to country. For example, many countries lack any specific rule for aquaculture in their legislation, but some of them have now included a statement about aquaculture in their national policy and development plans. Some countries have limited the role of aquaculture to a traditional "enabling clause" in their basic fisheries legislation. Criteria to set up and operate an aquaculture establishment do not exist, and decisions are entirely left to the discretion of the decision-maker. Also notorious are basic fisheries laws that provide for the adoption of a separate aquaculture regulation that, however, in many cases has not yet been developed.

Under the pressure of an expanding industry, there is a noticeable tendency to regulate and control the aquaculture sector more thoroughly. In fact, many of the recently adopted fisheries laws include sections or chapters that deal with certain aspects of aquaculture. In some cases, fisheries and aquaculture are even mentioned side by side, indicating that the legislator attaches a similar importance to both sectors. Apart from the tendency to regulate the sector in separate aquaculture texts, it should also be taken into account that many countries have simply limited themselves to adopting specific legislation dealing only with specific issues related to aquaculture. For example, countries that export aquaculture products have increasingly been forced to adopt food security laws to comply with the quality standards required by importing countries and to adopt better management practices with least environmental impacts.

Although the aquaculture texts and the more specific legislation may provide useful building blocks for modern aquaculture legislation, they do not offer more than a first stage of the legislation that is currently necessary for the sustainable development of the sector. Increasingly, it is being recognized that issues such as registration and access, planning and management and the many environmental impacts of aquaculture should be dealt with in a more consistent manner in order to protect the industry, the environment, other resource users and the consumer. There appears to be a growing interest to invest in developing and setting up comprehensive regulatory frameworks related to aquaculture. The importance of this has been emphasized in the FAO Code of Conduct for Responsible Fisheries 1995.(www.fao.org/fi/agreem/codecond/codecon.asp).

The first essential step in the process of developing a legal framework is the development of an aquaculture policy and preferably, a management plan at the national level. Afterwards, the approach to be adopted will depend on existing laws, traditions and institutional structures. It should be kept in mind that the development of a regulatory framework not only includes the adoption of legislative aquaculture texts, but also the amendment and/or enactment of a number of other related laws, including land, water and environmental legislation. In some cases, it may even be sufficient to limit legislative activities to changes in the existing legislation without formulating a new aquaculture law. One of the difficulties is that legislation may quickly become outdated with the rapid evolution of the industry. New legislation, therefore, should be flexible in the first place.

The more comprehensive approach can be illustrated by the Aquaculture (Regulation) Act 1995 of the Indian State of Tamil Nadu. The Act sets out the conditions to improve the management of aquaculture facilities. It institutes an authorization system and prohibits the location of aquaculture establishments in certain areas, including wetlands, breeding grounds and mangrove areas. Diversion of drainage channels is not allowed and chemicals and drugs are to be used in a limited manner. Remarkable is the establishment of an Eco-restoration Fund, supported by deposits from the aquaculturists themselves, to remedy environmental damage caused by the farms.

Countries that have become significant farmed-shrimp producers have also recognized the need for a clear and comprehensive legal framework. The Philippines Fisheries Code of 1998 provides for the development, management and conservation of fisheries and aquatic resources and integrates all laws pertinent thereto. It addresses a range of interesting issues such as the use of public lands, leasing of fishponds, the establishment of an aquaculture Code of Practice, incentives and disincentives for sustainable aquaculture practices and the establishment of an Aquaculture Investment Fund.

The world's largest aquaculture producer, the People's Republic of China, has revised its basic law related to fisheries and aquaculture in 2000. Besides, the Chinese Government has issued many regulations and directives concerning a variety of aquaculture issues over the years. In particular, further reform and liberalization of the market will be important to further strengthen the development of Chinese aquaculture.

The process of drafting and discussing comprehensive legal frameworks is certainly not limited to less industrialized countries. Noteworthy are developments in the Australian states of Tasmania and New South Wales. In 2000, the Government of New Zealand published a Discussion Document, which recognizes that the law governing aquaculture - the Marine Farming Act 1971 - is actually out of date: a new legal system will have to provide more certainty to everyone involved in the industry. Likewise, in the United States of America, a Bill was introduced in 1995 to amend the National Aquaculture Act of 1980 and in Canada, a Legislative and Regulatory Review of the Aquaculture Sector was published in 2001.

Integrated coastal management

Aquaculture, like many other farming activities, is dependent upon the use of limited natural resources such as land and water. Due to a combination of economic development and population growth, these resources are becoming increasingly scarce. Aquaculture currently faces serious competition from other resource users. The need for a balanced resource use can be illustrated by the environmental and health problems in the Asian shrimp industry, where there are tendencies to over-intensify shrimp farms or to concentrate too many farms in close proximity. As a result of this unregulated expansion, many farms have had to cease operation because of pollution and diseases.

Conflicts over the allocation and sharing of natural resources have already taken place and are likely to become more frequent in the future. For example, in India several large corporations entered the aquaculture sector in the late 1980s. In 1991, the Indian Government issued a Notification, which prohibits - among others – the setting up new or the expansion of existing industries within the coastal zones. Local fishers started protesting, but in 1996 the Indian Supreme Court issued a final judgement that confirmed the Notification, thereby banning all nontraditional aquaculture within 500 m of the high water mark or within 1000 m of lakes Chilka and Pulicat. The Indian Government then constituted an Aquaculture Authority in order to take steps and ensure the closure, demolition and removal of the existing nontraditional aquaculture activities by March 31, 1997. In practice, however, demolition has been limited and the situation remains highly uncertain.

In order to balance the wide diversity of interests involved, there is a tendency to base future developments on integrated coastal management plans. Increasingly, it is being recognized that choices need to be made in advance between the different resource uses and their combined impacts on the environment. Long-term planning also provides for predictability that is required for long-term investment and reduces the possibility of conflicts among actual and potential users. However, integrated coastal area management is not a particular aquaculture issue and is often regulated in basic environmental laws. Nevertheless, the idea of integrating the aquaculture sector into coastal area management legislation gradually wins thought. For example, the Philippine Fisheries Code 1998 specifically declares that it will be State policy to manage the fishery and aquatic resources in a manner consistent with the concept of integrated coastal area management. Likewise, the Coastal Zone Management Act 1998 of Belize includes aquaculture proposals to be dealt with in Coastal Zone Management Plans.

One of the main tools to integrate aquaculture into coastal areas is the mechanism of zoning, whereby land and water areas are set aside for (certain types of) aquaculture. Over the years, the concept of zoning has found its way into aquaculture legislation. In Chile, for example, the law provides for appropriate areas to be defined in the coastal area for the exercise of aquaculture. Any activities outside these areas are strictly forbidden. In a similar way, the Tasmanian Marine Farming Planning Act 1995 provides for the designation of areas, in which marine farming may occur, in so-called Marine Farming Development Plans. The Plans are developed following a process of public consultation that takes account of the physical suitability of potential aquaculture sites, the current legal situation and the desire to minimize impacts on other users of the coastal zone.

Coordinated authorization

A major tendency in aquaculture legislation is the requirement of government authorization in order to exercise legal and administrative control over aquaculture establishments. This is particularly the case when access to public land and water is involved. Authorizations can take the form of a license, permit, concession or lease and are commonly subject to certain conditions being met. They constitute a good basis for governments to regulate the limited natural resources available and allow governments to integrate the siting of aquaculture farms within their integrated coastal management plans. Authorization is particularly used to control the environmental impacts of aquaculture operations, often through the requirement of an environmental impact assessment. In order to stimulate the long-term economic development of the aquaculture sector, the licenses should constitute clear rights to establish and operate the aquaculture farm as long as the farmer complies with the conditions of the licenses, as well as other applicable laws.

Authorization procedures may be required during different stages of the aquaculture process. A license is commonly obligatory before setting up an aquaculture establishment, but in many cases additional licensing requirements may be imposed to regulate the actual operation of an aquaculture farm. In Malaysia, for example, the farmer is required to apply for a license to operate the system following its construction. In the ideal situation, activities that have profound environmental impacts, such as water use, wastewater discharge, use of chemicals or disease control, should be continuously monitored and evaluated after the legal commencement of an aquaculture farm. Again, the additional licensing requirements are likely to be found in other, generic environmental, land or water laws.

The authorization process can be a rather complicated affair for the farmer, since the approval and operation of an aquaculture project is affected by a variety of laws, agencies and governmental institutions. Not only the regular fishery and/or aquaculture authorities are involved, but also institutions such as land planning authorities, water institutes, health agencies and environmental protection authorities. Usually a number of documents need to be issued before establishing and/or operating an aquaculture farm, such as land concessions, water licenses, effluent discharge permits and other types of environmental licenses. It is currently the challenge in aquaculture law to remove and/or avoid the existing legal and bureaucratic obstacles and to increase the cost effectiveness of aquaculture operations. Unification of licensing requirements or the streamlining of approval procedures by creating a single or lead government aquaculture agency that controls the application process can do this.

This article will be continued in FAN-31. A comprehensive list of references and reading material will also be made available in Part II of the article. FAO continues to assist countries to develop and adopt appropriate legal frameworks and legislature through its technical assistance programme. For further information and advice on national aquaculture law, regulation and legislature, please contact Ms Annick VanHoutte, Legal Officer at FAO Legal Department - (annick.vanhoutte@fao.org).

Viet Nam applies CCRF for aquaculture development

prepared by
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In early October 2003, a National Workshop on the Code of Conduct for Responsible Fisheries (CCRF) and its practical application to coastal aquaculture development in Viet Nam was held in Hue, central Viet Nam. Coastal aquaculture in Viet Nam, particularly shrimp culture, has developed rapidly in recent years.

The workshop, in which 62 participated, was convened by the Ministry of Fisheries (MOFI) of Viet Nam, in close collaboration with the FAO FishCode Programme, the United Nations Development Programme (UNDP) project VIE/97/030/NEX "Environmental Management of Coastal Aquaculture", the Research Institute for Aquaculture No.1 (RIA1) and the Network of Aquaculture Centres in the Asia-Pacific (NACA). A central issue was the fact that although shrimp farming has brought many benefits to the coastal population in Viet Nam, concerns are being raised about the high risks associated with this development and particularly, its social and environmental impacts.

The specific workshop objectives were to raise awareness on the Code of Conduct for Responsible Fisheries among national and provincial stakeholders, with particular attention to aquaculture development, to review relevant articles and principles of the Code and evaluate the extent to which they are relevant and applicable to shrimp farming in Viet Nam, and to prepare recommendations for follow-up actions to support practical application of relevant articles of the Code to shrimp farming in Viet Nam.

The workshop participants agreed that a National Code of Conduct and an implementation plan should be prepared for coastal aquaculture in Viet Nam. Such a document should provide guidance to support responsible development of the coastal aquaculture sector, based on the FAO Code of Conduct for Responsible Fisheries, cover all coastal farming systems, and be developed by a specially established advisory group involving all relevant stakeholders. A national Code of Conduct should fit the local and sectoral conditions. Moreover, the participants recommended that the MOFI and the departments and research institutes under it should formulate projects/programs in support of the implementation and dissemination of the Code, taking in consideration the needs of stakeholders and local conditions. Other recommendations were that MOFI should continue its recently started work on the development of practical Codes of Practice and/or guidelines for specific species, localities and farming systems, and increase the awareness of stakeholders (e.g. fisheries managers, aquaculturists, service and input suppliers, processing plants and local authorities, including nonfisheries sector stakeholders in agriculture and tourism, where relevant) on the Code-related issues and their responsibilities with respect to its implementation in the coastal areas of Viet Nam.

Detailed information on this workshop can be obtained from Mr Eric Reynolds (eric.reynolds@fao.org), FAO FishCode Programme Coordinator or Mr Raymon van Anrooy (raymon.vananrooy@fao.org), Aquaculture Economist of the Fishery Policy and Planning Division (FIPP). The report of the workshop will soon be available as Fish-Code Review No.11 and can be accessed on the FAO FishCode website: www.fao.org/fi/projects/fishcode/

Koi Herpes Virus (KHV): an Asian problem?

prepared by
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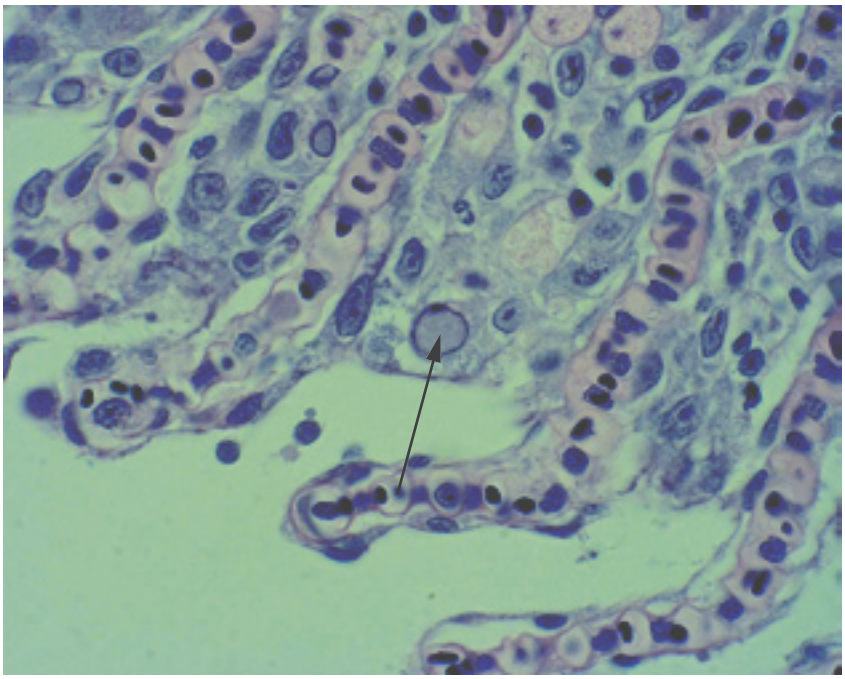
Since the second quarter of 2002, Indonesia has been facing a serious epizootic that is causing large-scale mortalities among cultured common and koi carp *(Cyprinus carpio)* populations. This national epizootic, which first occurred in ponds, raceways, and floating cages in open waters in central Java and is now spreading both northward and southward, has created significant concern about the possibility of an international epizootic that could affect several neighboring countries. The lost revenue of the sector and the socio-economic impact to the rural farming communities have been so far estimated as >US$ 5.5 million (50 billion Indonesian Rupiah; 1 US$ = 9 000 Indonesia Rupiah).

At the request of the Government of Indonesia, an International Emergency Task Force[1], formed by the Network of Aquaculture Centres in Asia-Pacific (NACA), conducted a preliminary assessment of the disease situation in July 2002. The goal of the Task Force was to assess the situation, determine the aetiology and provide advice and recommendations to the Government of Indonesia on how to control the epizootic. As a follow-up to the Task Force activities and in response to a request made by the Government of Indonesia, FAO provided assistance through a Technical Cooperation Programme (TCP) project to find solutions to deal with this serious situation.

Although the Task Force conducted many laboratory examinations, it was unable to confirm the disease agent as Koi Herpes Virus (KHV); however, all other indications, including histology and epidemiology, led the Task Force to believe that this is the case.

KHV is a serious disease causing significant losses and has been reported from several countries around the world. Although the disease is not a "Listed Disease" in the Office International des Épizooties (OIE) Aquatic Animal Health Code (http://www.oie.int/eng/normes/en_acode.htm), an emergency notification regarding this outbreak was provided to OIE by the Indonesian Government in June 2002.



R. Hedrick, UC Davis

Koi herpes Virus (KHV) Hyperplasia and fusion of secondary gill lamellae; intranuclear inclusion (arrow) in the branchial epithelium (gill section stained with hematoxylin and eosin)

The on-going mass mortality of cultured common and koi carp populations in Indonesia brings significant trade implications to the Indonesian aquaculture sector. Both common carp and koi carp are widely traded within Indonesia, between countries in the region, and outside Southeast Asia, and therefore this trade poses a considerable risk of initiating a transboundary epizootic. Common and koi carp are important commodities, as foodfish and as high-value ornamental fish, respectively. Many rural communities depend on these fish to support their livelihoods, both in Indonesia and in several neighboring countries. Effective control measures, quarantine procedures, and responsible movement of live animals are all important to avoid potential outbreaks. Careful diagnosis, confirmation of aetiology, identification of risk factors, development of effective surveillance programmes, establishment of early warning and monitoring systems, emergency preparedness and contingency planning for future outbreaks, development of control measures (including potential vaccines and therapy), effective extension, educational programmes and capacity building for farmers/producers in order to combat the disease are all essential to reduce the risk of this potential transboundary epizootic The Task Force believes that rapid and concerted action by the relevant international research and developmental agencies and the private sector is essential to assist Indonesia in controlling this serious epizootic and to regain both consumer and producer confidence.

Melba Reantaso

Melba Reantaso, Oxford laboratory, DNR, Maryland

Koi (top) and common carp (bottom) infected with KHV

More recently, in May-June 2003, an outbreak of KHV also occurred in common and koi carp in Okayama Prefecture, western Japan. This outbreak has since spread to several prefectures, and the Government of Japan is currently trying to control it.

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[1] The International Emergency Task Force was composed of an epidemiologist, an aquatic animal health specialist and a virologist, and was supported by a Local Task Force and a number of participating experts, institutions and laboratories. The work of the Task Force was jointly supported by NACA, the Australian Centre for International Agricultural Research (ACIAR), and Indonesia's Ministry of Marine Affairs and Fisheries.

Responsible shrimp farming in Madagascar

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A relatively young sector, born in 1987 from a United Nations Development Programme (UNDP)/FAO/Government of Malagasy pilot project, the industrial marine shrimp aquaculture in Madagascar has grown at an impressive speed from an initial production of 406 mt in 1994 to an estimated 7 090 mt in 2002. This represents approximately 46% of total shrimp export earnings in 2001. Currently comprising seven industrial farms and one artisanal farm, the sector has made its mark by producing high-quality shrimp using locally harvested juveniles of the giant tiger prawn, *Penaeus mondon.*

With the expectation of continued growth in both the industrial and artisanal sectors and an appreciation of the potential risks of uncontrolled or unmanaged growth, the Aquaculture Department of the Malagasy Ministry of Fisheries (MOF) and the Industrial Shrimp Culture and Fishing Association (GAPCM) organized the "International Conference on Sustainable Shrimp Aquaculture", held from 3-5 December 2003 in Antananarivo, Madagascar.[1] The goals of the conference included a discussion on the development of Malagasy shrimp aquaculture, its place in a global context and the latest available technologies (feeds, genetic research etc.). In addition, the conference organizers hoped to inform the participants and instigate discussion on the risks of diseases associated with shrimp aquaculture and its potential effects on the environment. Approximately 200 individuals from government bodies, the private sector, and academia attended the conference, which was organized into various disciplines.

Summary recommendations

The Conference concluded with a number of recommendations revolving around a central theme of protecting this "pink gold", one of the principal sources of export earnings for the country, benefiting from a currently disease-free and relatively pristine environment.[2] Specifically, the attendees recommended:

- A concerted effort on the part of the administration, researchers and industry for the management and sustainable development of shrimp aquaculture, including participation by regional and international bodies such as GAPCM and the Global Aquaculture Alliance (GAA).
- Implementing, as quickly as possible, an emergency plan of sanitary protection (surveillance, detection and control) against viral and other maladies, including:
  - Producing inputs locally or identifying secure sources for them,
  - Encouraging certification and traceability for all farms,
  - Promoting a regional approach to sanitary protection, and
  - Government capacity building.
- Developing the artisanal/smallscale/family shrimp aquaculture sector, by benefiting from international experiences and in collaboration with the industrial sector.
- Evaluating the economic and technical potential for smallscale aquaculture development.
- Providing technical assistance at all levels of commercialization.
- Considering the idea of satellite farms surrounding the industrial farms.
- Adopting regulations concerning smallscale aquaculture in which sanitary and other standards are maintained at the industrial-sector level.

- Completing the current Aquaculture Management Plan to include the smallscale sector.
- Developing the Malagasy shrimp aquaculture sector in general.
- Defining a National Shrimp Aquaculture Development Plan.
- Adopting the Code of Conduct, the Management Plan and the Law of Responsible Shrimp Aquaculture.
- Creating a Malagasy label to benefit from product and price differentiation (Malagasy farmed shrimp, the majority of which are *P. monodon,* are large (25-33 g) and attractive).
- Studying the world shrimp market, including developments in shrimp aquaculture (e.g. in China).
- Expanding the industrial sector (aquaculture production is estimated to reach approximately 8 000 mt from 2 150 ha of farms by the end of 2003. Additional farm sites have been identified and zoned, with the goal of attaining the potential 15 000 ha of basins).

These recommendations contain multiple and potentially conflicting objectives (e.g. creating a Malagasy label and promoting artisanal aquaculture); therefore, special care must be taken in any efforts by FAO or otherwise, whether relating to the smallscale or industrial sectors, to foresee the possible secondary effects of any management decisions.

[1] Information on this conference and GAPCM is available at http://www.madagascar-contacts.com/gapcm.

[2] A recent book worthy of note is La ruée vers l'or rose: Regards croisés sur la pêche crevettière traditionnelle à Madagascar. Goedefroit, Chaboud, and Breton (eds.); PARIS, IRD EDITIONS, 2002.

NEW ADDITION TO AQUACULTURE GROUP

Cecile Brugere joined the Development Planning Service (FIPP) of the Fisheries Policy and Planning Division (FIP) on 22 September 2003 as Fishery Planning Analyst (Aquaculture Economics). Ms Brugere has obtained her PhD in Agricultural Economics at Newcastle University in late 2002 after having obtained a Masters degree in Ecological Economics at Edinburgh University in 1996 and a Business Management Certificate in Bordeaux, France. She worked as a biological surveyor for a Scottish charity before starting as a Research Assistant (aquaculture socio-economics) at the Institute of Aquaculture in Stirling in 1998. During this post, she spent some time in Bangladesh studying community and gender impacts of small-scale cage aquaculture development. A large component of her PhD dealt with the integration of poverty-focused aquaculture in irrigation systems, for which she undertook micro-economic and livelihood investigations as part of her field work in southern India and Sri Lanka. Previous studies led her to investigate issues surrounding the participation of women in aquaculture in Thailand, Malaysia and Indonesia. She is the co-author of five peer-reviewed papers and has written a number of other reports and articles on aquaculture. Her interests lie mainly in integrated approaches to aquaculture development and in the measurement of its social and economic benefits (improved livelihoods, poverty alleviation, gender relations and resource allocation).

In FIPP, Ms Brugere joins the aquaculture team composed of Nathanael Hishamunda and Raymon van Anrooy. This team works very closely with FIRI. Her role will be to work towards the incorporation of economic analysis in the development and application of policies and strategies aimed at ensuring sustained livelihoods for all beneficiaries of aquaculture. She can be contacted by telephone at +39 06 570 54410 or by email at cecile.brugere@fao.org.

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Matthew Briggs

Is white shrimp *(Penaeus vannamei)* a threat to Asian shrimp culture?

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This article is based on a paper presented at the workshop on "International Mechanisms for the Control and Responsible Use of Alien Species in Aquatic Ecosystems", 26-29 August 2003, Jinghong, Xishuangbanna, People's Republic of China. Further information on this subject will be available soon through a comprehensive review of the introduction of penaeid shrimp species (*Penaeus vannamei* and *P. stylirostris*) to the Asia-Pacific Region that is currently being prepared under the FAO/Network of Aquaculture Centres in Asia-Pacific (NACA)/World Wildlife Fund (WWF)/World Bank (WB) Consortium Programme on Shrimp Farming and the Environment. (http://www.enaca.org/Shrimp/index.htm).

Simon Funge-Smith

Penaeus vannamei

The use of exotic animal species to increase food production and income has a long history and has been an established practice since the middle of the 19th Century. Controversy over the use of exotic species arises from the many highly publicized and spectacular successes and failures. Experimental introductions of white shrimp, *Penaeus vannamei*, to Asia began in 1978/79 to the Philippines and in 1988 to the People's Republic of China (Mainland China). Of these first trials, only Mainland China maintained production and started an industry. However, beginning in 1996, *P. vannamei* was introduced into Asia on a commercial scale. This started in Mainland China and Taiwan Province of China and quickly spread to the Philippines, Indonesia, Viet Nam, Thailand, Malaysia and India.

Simon Funge-Smith

P. vannamei hatchery

Contribution to production

Penaeus vannamei has been introduced and farmed in Asia since the mid-1990s, with production in Mainland China being particularly significant. There have been several reasons for the introduction and subsequent movement of this species: availability of specific pathogen free (SPF) stocks, perceived differences in susceptibility to White Spot Syndrome Virus (WSSV) from *P. monodon*, a shortage of *P. vannamei* in the international market (mainly the United States of America) caused by reduced production in Latin America, and the relative ease with which animals can be cultured and bred in captivity. In some countries, *P. vannamei* has been promoted for culture by some private-sector suppliers as being tolerant or resistant to WSSV, leading to introductions based on a mistaken belief that they are safe.

Mainland China has a large and flourishing industry for *P. vannamei*, producing >270 000 mt in 2002 and an estimated 300 000 mt (71% of total shrimp production) in 2003, which is higher than the current production of the whole of Latin America. Other Asian countries with

developing industries for this species include Thailand (120 000 mt estimated production for 2003), Viet Nam and Indonesia (30 000 mt estimated for 2003 each), with Taiwan, the Philippines and Malaysia also producing thousands of tonnes each.

Total production of *P. vannamei* in Asia was approximately 316 000 mt in 2002, and it is estimated that this will increase to nearly 500 000 mt in 2003, which would be worth some US$4 billion on the export market. However, not all of the product is exported outside of the region, and a large local demand exists in some Asian countries.

Why culture *Penaeus vannamei* in Asia?

There are many reasons for the introduction of *P. vannamei* outside its natural range. Despite the presence of various international, regional and country-specific regulations, the private sector (and/or government) often initiates introductions due to problems with the culture of their indigenous species and the (rightly or wrongly) perceived production benefits of the exotic species. There may be marketing advantages, and a desire to expand, intensify and/or diversify aquaculture systems. Additionally, improved transportation efficiency has removed some old limitations and encouraged international trade in exotic species.

The main reason behind the importation of *P. vannamei* to Asia has been the poor performance, slow growth rate and disease susceptibility of the major indigenous cultured shrimp species, *P. chinensis* in China and *P. monodon* virtually everywhere else. Cultured shrimp production in Asia has been characterized by a series of outbreaks of disease caused by viral pathogens that have caused significant losses to the culture industries of most Asian countries over the past decade. These diseases have not been confined to single countries but have spread throughout shrimp culture regions, apparently as a result of transfers of infected stock. It was not until the late 1990s, spurred by the production of the imported *P. vannamei*, that Asian (and therefore world) production levels began to increase again.

Advantages and disadvantages of *Penaeus vannamei*

Penaeus vannamei offers numerous advantages over *P. monodon* for the Asian shrimp farmer. These are largely associated with the ability to close the life cycle and produce broodstock within the culture ponds. This removes the necessity of returning to the wild for broodstock or postlarvae (PL) and permits domestication and genetic selection for favourable traits such as growth rate, disease resistance and rapid maturation. Through these means, domesticated stocks of SPF and specific pathogen resistant (SPR) shrimp have been developed and are currently commercially available from the USA. Other specific advantages include: rapid growth rate, tolerance of high stocking density, tolerance of low salinity and temperature, lower protein requirements (and therefore production costs), certain disease resistance (related to SPR stocks), high survival during larval rearing, and some marketing advantages.

There are, however, also disadvantages to the importation of *P. vannamei*, including its ability to act as a carrier of various viral pathogens exotic to Asia, a lack of knowledge of culture techniques (particularly for broodstock development) in Asia, a smaller final size and hence lower market price than *P. monodon*, the need for high technology for intensive ponds, competition with Latin America for markets, and a lack of support for farmers due to their often illegal status.

The major disadvantage of using exotic aquatic species such as *P. vannamei* is the potential to transfer serious pathogens. Transboundary pathogen transfers in newly imported species often result in the establishment of infections in naturally susceptible indigenous hosts and may lead to the adaptation of pathogens to a new range of hosts. Due to their inherent genetic variability, rapid rate of replication, and common occurrence as low-level latent infections in apparently healthy animals, the transfer of viral pathogens is of particular concern.

Since it is clear that the culture of *P. vannamei* is already established and growing fast in the Asian Region, it is important that informed decisions regarding these advantages and disadvantages be made and appropriate actions taken. This would ideally develop through a close dialogue between governments, the private sector and other concerned organizations.

Risks and threats

As discussed above, *P. vannamei* is now farmed and established in several countries in East, Southeast and South Asia and is playing a significant role in shrimp aquaculture production. On the other hand, it is also evident that viruses previously confined to Latin America, such as Taura Syndrome Virus (TSV), are taking a toll within *P. vannamei* shrimp aquaculture in many countries in Asia. Also, there have been reports of "runt deformity syndrome" (RDS) in *P. vannamei* caused by Infectious Hypodermal and Haematopoetic Necrosis Virus (IHHNV), which is endemic in *P. monodon* in the region.

The overall performance of *P. vannamei* as a candidate species within the shrimp aquaculture sector in Asia is still unclear. An understanding of the social, economic, and environmental impacts resulting from the introduction of this species into Asia is still lacking. As a newly introduced species, it is uncertain how *P. vannamei* will behave and perform in the region, and what impacts it will have on the regional economy, environmental sustainability, rural livelihoods and biodiversity.

Taura Syndrome Virus (TSV), which was initially identified in *P. vannamei* shrimp farms near the Taura River in Ecuador in early 1992, caused severe production and economic losses to the shrimp sector in the Americas and remains a major constraint to sectoral development. Similarly, White Spot Syndrome Virus (WSSV), which was initially identified in *P. monodon* in Mainland China and Taiwan, severely affected the Asian shrimp industry and subsequently spread to the Americas where it affected *P. vannamei* production systems. Although there is no evidence that TSV has spread to the major indigenous farmed shrimp species (*P. monodon* and *P. chinensis*), there has been a report of infection in wild metapenaeid shrimp in Taiwan and an accompanying genetic adaptation of the virus.

In Asia, first Yellowhead Virus (YHV) from 1992 and later WSSV from 1994 caused continuing direct losses of approximately US$1 billion per year to the native cultured shrimp industry. In Latin America, first TSV from 1993 and later, particularly WSSV from 1999, caused direct losses of approximately $0.5 billion per year. Ancillary losses involving supporting sectors of the industry, jobs, and market and bank confidence put the final loss much higher.

It is widely believed that these three most economically significant viral pathogens (and a host of other pathogens) have been introduced to the Asian and Latin American countries suffering these losses through the careless introduction of live shrimp stocks. Except for China, most Asian countries have legislated against the introduction of P. vannamei due to fears over the possibility of importing new pathogenic viruses and other diseases from Latin America to Asia.

Many governments have allowed the importation of supposedly disease-free stocks of *P. vannamei* that are available from the USA. The encouraging trial results; the industry-perceived benefits, including superior disease resistance, growth rate and other advantages, allied with problems controlling the imports from other countries, has lead to the widespread introduction of this species to Asia, primarily by commercial farmers. Unfortunately, importation of cheaper, non-disease free stock has resulted in the introduction of serious viral pathogens (particularly TSV) into a number of Asian countries, including Mainland China, Taiwan, Thailand, Indonesia, and possibly elsewhere. There are now many hatcheries established in Asia that are producing PL for stocking, although the original sources of the stocks and their current health status are quite uncertain. What can be assumed is that many of the hatcheries are not able to maintain their stocks as SPF and invariably they become infected with local viral diseases and quite possibly, with diseases that are typical to the species when in Latin America (e.g. TSV). This is partly due to private-sector hatcheries being unaware of the requirements for maintaining clean stocks and partly due to corner cutting due to the rising demand for postlarval *P. vannamei.*

Biodiversity and impacts on wild stocks

Although TSV does not yet seem to have affected the indigenous cultured and wild shrimp populations, time and research effort have been insufficient to prove this. TSV is also a highly mutable virus, capable of mutating into more virulent strains that are able to infect other species. In addition, other viruses probably imported with *P. vannamei*, for example, a new Lymphoid Organ Vacuolization (LOVV)-like virus, have been implicated as causing the slow growth

problems currently being encountered with the culture of the indigenous *P. monodon*. There remain many unanswered questions regarding the possible effects of introduced species on other cultured and wild shrimp populations in Asia. For example, at present there is still no information available regarding whether or not *P. vannamei* has established in the wild and if so, the impacts of its interactions with native crustacean species.

What is next?

Since it is clear that the many of Asian countries have already introduced *P. vannamei* (either legally or illegally) to some extent, there is now some determination to try to ensure that any negative impacts are minimized. Some countries are considering enforcing their official bans and destroying all stocks found within their borders (i.e. the Philippines and Malaysia). Short of this difficult (and perhaps legally unenforceable) procedure, the species, and in most cases, its attendant viruses will remain in most countries.

A more pragmatic approach would be the investigation of all stocks and the elimination of those found to be infected with serious pathogens, followed by an opening of the borders only to certified disease-free stocks. This assumes that the capability to test stocks for pathogens and the necessary border controls would be strengthened, since it is the inability to effectively control imports that has allowed the introductions that have so far occurred. This approach at least offers a working solution to the reality that *P. vannamei* is already present in many countries and being cultured at significantly economic levels in several of them. This also allows countries to take advantage of the potential benefits offered by this exotic species and would encourage a more responsible approach to the issue of shrimp movements and disease in the region. What is certain is that blanket bans on the importation of species such as *P. vannamei* that are desired by the commercial sector are ineffective at preventing introductions under the current conditions in Asia

Increased awareness regarding the potential for SPF stocks and reduced disease risks is encouraging some farmers to think again about the production and culture of SPF *Penaeus monodon*. Also, since *P. vannamei* tends to be harvested at a relatively small size, this is creating new marketing challenges and also negatively affecting prices in the region. The larger-sized *P. monodon* compete in a different part of the market and often have a better market price.

The next few years in Asia will inevitably see much more emphasis on good broodstock and hatchery control for the production of healthier shrimp PL. In turn we can hope that this will lead to increased reliability of growout production and a more stable industry.

To learn more about penaeid introductions to the Asia-Pacific, please contact Mr Simon Funge-Smith, at FAO Regional Office for Asia-Pacific – simon.fungesmith@fao.org

Matthew Briggs

Using International Mechanisms for the Control, Movement and Responsible Use of Alien Species in Aquatic Ecosystems

reported by
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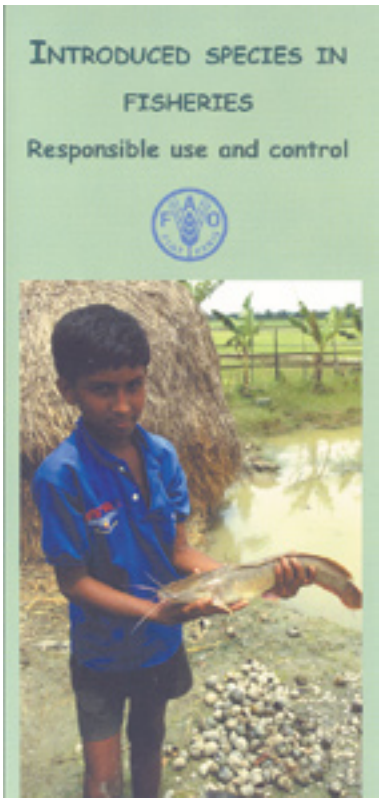

Figure 1. Awareness brochure on alien species

Previous articles in FAN have addressed the responsible use of alien species in fisheries and aquaculture.[1] Furthermore, the Fisheries Department, with the assistance of Member countries and other partners, has developed a framework of FAO mechanisms for the responsible use and control of alien species in fisheries figure 1 (ftp://ext-ftp.fao.org/FI/Brochure%20aliens/brochure1.pdf). However, alien species are a cross-cutting issue whose use will be under the mandates of several international agencies and conventions. Policy makers will need to be aware of all of these mechanisms, how they interact and what obligations they impose on national fishery management.

In order to enable policy makers and senior resource officers in the Greater Mekong/Lancang Subregion to use international mechanisms for the control, movement and responsible use of alien species in aquatic ecosystems, an international workshop, International Mecha-nisms for the Control and Responsible Use of Alien Species in Aquatic Ecosystems, was convened from 27-30 August 2003, in Xishuangbanna, People's Republic of China. The workshop was sponsored by the Asian Institute of Technology (AIT); the Food and Agriculture Organization of the United Nations (FAO); the Mekong River Commission (MRC); the Network of Aquaculture Centres in Asia-Pacific (NACA); the University of California Sea Grant College Program (UCSG); the World Conservation Union (IUCN); the Ministry of Fisheries, Peoples Republic of China; and the FAO/Netherlands Partnership Programme (FNPP). The workshop was hosted by the Yunnan Provincial Bureau of Agriculture and the Xishuangbanna Fisheries Administration and Regulation Station.

The objectives of the workshop were to review the relevant international mechanisms, to identify major constraints to their implementation in the subregion, to review the status of alien species in the area, and to identify future actions needed to promote the control,

FAO/D. Bartley

Opening session of workshop, from left to right are: Mr Sam Nuov, Mr Simon Funge-Smith, Ms Liu Qing, Mr Yang Zhimin, Mr Han Huaxing

movement and responsible use of alien species in the greater Mekong/Lancang Subregion. A full report and proceedings of the meeting will be published in 2004. A brief summary of the main findings is presented here.

Summary of workshop conclusions

The workshop affirmed the fact that alien species provide valuable food and economic opportunity to rural sectors of the Mekong/ Lancang River Basin. However, there are also environmental and social risks associated with their uncontrolled use. Aquaculture and fisheries in this subregion are composed of a mixture of native and alien species – management must acknowledge this mixture and strive to balance benefits and risks.

In order to provide useful information on this issue, the workshop determined the following broad elements to be important:

- Evaluation of existing mechanisms dealing with alien species and their application in the Mekong/Lancang River Basin,
- Identification of the main drivers of the practice of moving species into new areas,
- Identification of constraints to effective control of alien species, and
- Identification of practical control measures.

- Several significant conclu-sions emerged from the meeting:
- There is still little awareness among senior policy makers and line officers in the subregion of the contents of the Code of Conduct for Responsible Fisheries (CCRF) in general, and much less awareness of codes of practice and guidelines such as the International Council for the Exploration of the Sea/European Inland Fisheries Commission (ICES/EIFAC) codes of practice on introductions. Once these codes and guidelines were explained, there was general agreement that they provided a useful means to manage introductions of alien species.
- While many countries in the subregion advocate some form of environmental risk assessment, less formal queries on potential impacts are often directed to resource managers and aid agencies. Assessments or answers to informal queries cannot often be given because of a lack of readily available information on the potential impacts of alien species on the environment in general and on the specific habitats of the Mekong/ Lancang. Thus, many countries expressed the need for additional assistance to increase capacity in order to undertake preliminary environmental impact assess-ment and import risk assessment. Additionally, countries noted the difficulty in accessing relevant information for impact/risk assessment, and there was a

clear call to organize the various types of information on impacts of alien species into a central repository or clearing house for the subregion.

- Alien species, such as tilapia *(Oreochromis spp.)*, play an important role in providing cheap and readily available protein to rural and poor sectors of the basin. Alien species are easy to breed, are tolerant to pond conditions and are therefore suitable for mass production (this is important for those areas that do not enjoy massive inland capture fishery resources).

- The development and use of indigenous species are options to the use of alien species. However, indigenous species have not received the same amount of attention, research, development and use as many alien species. Therefore, in order for indigenous species to compete, the Workshop recommended much more research and development be devoted to domestication and husbandry of native species. The Mekong River Commission's (MRC) programme on Aquaculture of Indigenous Mekong Species was highlighted as a good example of this type of development.

- There is an urgent need for and interest in the creation of regional guidelines on the responsible use of alien species in fisheries. Associated with this is the desire to establish an international body or group of experts to advise on introductions of alien aquatic species. Participants felt that this group could be informal and non-mandatory, and that there were several organizations operating in the subregion that could offer assistance; FAO and NACA were identified as lead partners in this endeavour.

- There is still the need to standardize terminology and concepts related to alien species and invasiveness. The definitions of the Convention on Biological Diversity (CBD) and FAO's Code of Conduct on Responsible Fisheries (CCRF) help in this regard, but more is needed. The Workshop noted that the "invasiveness" of a species depends on the specific environment, potential disturbances to the environment and on society's perception of what "harm" is. Similarly, many genetically differentiated stocks within a species constitute alien "genotypes", yet these organisms are often not thought of as "alien".

FAO/D. Bartley

Alien species, such as tilapia, can provide food and economic opportunity to rural and poor sectors of society

- Much of the regulation and control of alien species is based on political boundaries and not on ecological conditions or watersheds. Thus, within a country species may be moved across natural boundaries or into ecologically sensitive areas, and subsequently cause adverse impacts. Countries and regions should look at the distribution of species within their borders and prevent the unrestricted movement of species within a country. Zonation and Global Information Systems (GIS) could assist in this regard.

- In light of the difficulty of enforcing regulations on the movement of alien species and patrolling long coastlines, borders and airports, participants thought that awareness of the dangers of irresponsible movement of alien species should be improved among the general public and fishery line officers. This should be done through training courses with the assistance of international and regional organizations, the popular media and local governments.

- Several steps are necessary for effective use and control of alien species in the subregion. Subregional coordination of policies and practices on alien species is needed for effective national management. National policies need to be in place, and the population needs to be aware of issues before countries can implement international mechanisms such as the CBD or CCRF. Thus, regional coordination and national policy development are necessary actions that should go hand in hand in order to facilitate implementation of broader international agreements.

Next steps

The meeting was extremely useful as a means to raise awareness of important issues and how international instruments can address them. We plan to produce similar workshops in other regions with slightly different emphasis, e.g. how to involve donors and private industry in the responsible use and control of alien species. Following this series of workshops, we will produce Technical Guidelines on the Responsible Use and Control of Alien Species in Fisheries and Aquaculture.

For further information on alien species in aquaculture and aquatic environments please contact Mr Devin Bartley at FAO/FIRI (devin.bartley@fao.org).

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[1] Bartley, D.M. and C.V. Casal. 1999. Impact of introductions on the conservation and sustainable use of aquatic biodiversity. FAO Aquaculture Newsletter 20; Garibaldi, L. and D. Bartley. 1998. Database on Introductions of Aquatic Species (DIAS): the web site. FAO Aquaculture Newsletter 20:20-24. Bartley, D.M. 1994. Conservation of Biodiversity and coho salmon broodstock development in Chile. FAO Aquaculture Newsletter No 8: 19-20. Bartley, D.M. 1993. Introduced Aquatic Organisms. Editorial. FAO Aquaculture Newsletter 5: 1–2.

FAO/D. Bartley

Participants from four international development agencies, two advanced centers of learning, and nine countries met in Jinghong, Yunnan Province of China to promote responsible use and control of alien species in aquaculture and fisheries

International workshop on advances in sea cucumber aquaculture and management

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Last 14-18 October, the FAO Fisheries Department organized an international workshop on the "Advances in Sea Cucumber Aquaculture and Management" (ASCAM) in collaboration with the Chinese Ministry of Fisheries in the northern Chinese coastal city of Dalian, Liaoning Province. The intense fishing efforts on an increasing number of sea cucumber species, the constantly growing markets and the recent advances in farming technologies were the three main reasons behind the organization of this workshop. The Workshop was organized in three main sessions focusing on the status of resources and utilisation, on resource management, and on aquaculture advances. During the Workshop, 35 presentations were delivered by international experts from 20 countries including Australia, the People's Republic of China, Cuba, Egypt, Malaysia, New Caledonia, Papua New Guinea, Seychelles, Tanzania and Viet Nam.

The opening paper was delivered by Prof Chantal Conand, a respected scientist in the field of holothurian research and editor of the "Beche-de-Mer Information Bulletin" from the University of La Réunion (see http://www.spc.org.nc/coastfish/News/BDM/bdm.htm under the Secretariat of the Pacific Community). Prof Conand's paper provided an overview on the present status of world sea cucumber resources and utilization focusing on traditional and commercial tropical and temperate fisheries in the western Pacific and Indian oceans. Subsequent presentations provided updated information on resources, fisheries, aquaculture and trade in some of those countries where sea cucumber play an important role in the rural economy of fishing communities. A comprehensive report on China was delivered by Prof Chen Jiaxin, former director of the Yellow Sea Fisheries Research Institute in Qingdao (Shandong Province). His report was well received from the foreign experts, particularly as limited information on the past and current activities in China has been available in the international literature. Among the other countries, Cuba and Egypt reported the exploitation status of their sea cucumber resources for the first time.

In the resources management session, chaired by Dr Steve Purcell (WorldFish Center) and Dr Sven Uthicke (Great Barrier Reef Marine Park Authority, Australia), 12 reports presented existing management and conservation plans, restocking and enhancement strategies and on-going research activities. The last session of the Workshop focused on recent advances in aquaculture farming technologies, with many of the speakers coming from Chinese research institutions and the private sector. This session was chaired by Drs Jean-François Hamel and Annie Mercier from Canada. Presentations dealt with hatchery and farming techniques covering diseases, nutrition and other important topics related to sea cucumber reproduction and farming.

The Workshop was an excellent opportunity to visit some of the commercial facilities in the area and a day-long field tour was organized to visit the hatcheries and on-growing sites of two important Chinese companies farming the Japanese sea cucumber (*Apostichopus japonicus*).

At the end of each session, the participants engaged themselves in group discussions in order to deliberate on major issues raised during the various presentations. All the comments made were carefully noted and provided the material for discussion during the last day of the Workshop, which was only attended by the session chairpersons and the FAO Fisheries Department officer (Mr A. Lovatelli). A list of recommendations was produced at the end of the activity that will hopefully serve international and regional development organizations and national governments in prioritizing their activities concerning sea cucumber conservation and exploitation.

The full papers, recommendations and the list of participants of the ASCAM Workshop will be published by the FAO Fisheries Department as a technical document and will be available in March 2004. For further information and follow-up activities, please contact Mr A. Lovatelli (alessandro.lovatelli@fao.org).

Second Session of the COFI Sub-Committee on aquaculture concludes successfully

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George Kourous
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This past August, the Sub-Committee on Aquaculture of FAO's Committee on Fisheries (COFI) concluded a very successfully meeting in Norway. The second-ever meeting of the Sub-Committee was held from 7 to 11 August 2003 in the northern port city of Trondheim at the kind invitation of the Government of Norway, and was attended by over 150 people representing 64 FAO member countries, nongovernmental organizations (NGOs) and intergovernmental organizations (IGOs).

During opening remarks made on behalf of FAO, Mr Serge Garcia, Director, Fisheries Resources Division, Fisheries Department, expressed the Organization's gratitude to Norway for hosting the meeting, for its generous hospitality, and for having helped support attendance by a number of member countries. In his comments, Mr Garcia stressed the importance of aquaculture to both developed and developing countries as a source of food, employment and revenue, and also highlighted the diversity of the sector in different regions. He noted that aquaculture presents a number of opportunities in terms of its capacity to help meet goals for eliminating hunger established at recent international fora, such as the World Food Summit and the World Food Summit: Five Years Later. Additionally, he emphasized that while the sector provides significant social, economic and nutritional benefits worldwide, continuing public debate concerning health, safety and environmental issues related to aquaculture means that the Sub-Committee has an important role to play as a unique global intergovernmental forum for discussing policy issues related to the sustainable development and responsible management of the sector.

The welcoming address on behalf of the Government of Norway was delivered by His Excellency Svein Ludvigsen, Minister of Fisheries. Minister Ludvigsen noted that the rapid development of aquaculture in Norway over the past 30 years has been a direct result of close collaboration and communication between the aquaculture industry, researchers, and public administrative agencies. He also drew attention to the opportunities and challenges that are presented by the global trade in aquaculture products, emphasizing the importance of appropriate frameworks for aquaculture development to ensure that products are safe for consumers and environmentally acceptable.

During the five-day working meeting, representatives from FAO member countries wrestled with a wide range of issues, including the environmental impacts of shrimp farming, the use of antibiotics by aquaculture, the introduction of non-native fish species into new regions, harmonization of trade standards, and the need for better monitoring of product safety. In its final report, the Sub-Committee made a series of recommendations for action by FAO as well as by the individual countries that make up the Organization's membership.

To help promote national policies conducive to responsible fish farming, FAO will develop detailed guidelines for the responsible management of fish farms aimed at both improving the quality of the fish farmed and at reducing any environmental impacts. A reference compendium of aquaculture-related legislation already on the books in different countries will also be produced. Assistance to member countries in implementing the relevant provisions of the Code of Conduct for Responsible Fisheries (CCRF) will also be provided.

Raschad Al Khafaji

Mr Serge Garcia, Director of the Fisheries Resources Division, addressing the Meeting on behalf of the Director General

Responding to developing countries' comments that they are often unable to keep up with changing safety standards governing fish imports, FAO will work to improve information sharing between importing and exporting nations and, via the international Codex Alimentarius Commission, to develop international standards for the safety of fish products. The Organization will also evaluate various labelling systems being used to certify aquaculture products as safe and environmentally friendly, with a view to encouraging worldwide adoption of a single set of science-based standards.

Countries attending the event also agreed to work with FAO to improve and enhance the collection of world data about aquaculture. In early 2004, FAO's Fisheries Department will convene an Expert Consultation to address the issue of better trends reporting in aquaculture and improving data and statistics on aquaculture (www.fao.org/fi/NEMS/events/detail_event.asp?event_id=14402 for more information).

Boosting the role of aquaculture in meeting food and nutritional needs, especially in the developing world, was another area of priority that the Sub-Committee recommended for action by FAO. To increase the contribution that fish farming makes to world food security, FAO's Fisheries Department will organize technical consultations on small-scale rural aquaculture, and possibly will convene a major conference in Africa aimed at outlining a strategy for the development of aquaculture there.

Discussing inland fisheries and their contribution to aquatic production, the Sub-Committee emphasized that appropriate management schemes for stocking activities and other culture-based fisheries – based on ecological evaluation of water bodies and fishery resources and appropriate community-based management schemes – are vital. At the request of the Sub-Committee, FAO's Fisheries Department will formulate technical guidelines and best practices for responsible stocking programmes, conduct feasibility assessments of shrimp ranching, engage in specific-risk evaluations for transfers of selected species, and provide support to regional cooperation related to coordination of stocking programmes in transboundary watersheds.

The Sub-Committee also discussed several different shrimp culture certification schemes being implemented or developed under various auspices, in some instances without adequate stakeholder input. Several Members expressed concern that these schemes could constitute a barrier to international trade and might require developing countries to adapt constantly to new and changing trade rules. In order to address this issue, FAO will embark on a programme to review and analyse certification systems already in place, with a view to helping harmonize approaches and procedures. This work is expected to be conducted through the FAO/NACA/WB/WWF Consortium Programme on Shrimp Farming and the Environment (see http://www.enaca.org/shrimp for more information)

The final report of the second COFI/AQ/II session will be available on the FAO Fisheries Department Website in all official Organization languages in January 2004.

The next session of the Sub-Committee will be held in India in 2006. Exact dates and location details are pending.

Raschad Al Khafaji

India

In June 2003, the FAO project "Health Management of Shrimp Aquaculture in Andhra Pradesh" (TCP/IND/2902) took off in India. This project addresses one of the main problems that the shrimp sector in Andhra Pradesh has had to deal with in recent years. Indian shrimp culture production increased from about 30 000 metric tonnes (mt) in 1990 to around 100 000 mt during 1999-2000. This fast development was not homogenous; it showed a rapid growth between 1990 and 1995, when it reached 97 500 mt. However, in 1997, production decreased to 54 500 mt owing to a viral disease epidemic caused by the White Spot Syndrome Virus (WSSV). Of all the coastal states, Andhra Pradesh (AP) witnessed the largest growth, expanding from 6 000 ha of ponds in 1990 to 84 300 ha in 1999. Simultaneously, the state has also been most drastically affected by the WSSV epidemic.

Michael Philipps, NACA

Mr Subasinghe examining shrimp larvae at a hatchery in Kakinada, India

The fast expansion of the sector in the east coast states in the early 1990s generated a large demand for shrimp postlarvae that could not be met by the hatcheries built at the time in India. The uncontrolled importation of postlarvae from other Asian countries that had already been affected by the WSSV in the early 1990s led to the introduction of the virus in 1994 in Tamil Nadu. The virus spread rapidly throughout the country, leading also to infection of crustacean resources in the wild. The economic losses that have been attributed to the mortalities caused by the virus have been enormous and are estimated at over US$200 million during 1999-2000.

The WSSV has been affecting both traditional and extensive farms, and the lack of plans of action to combat the disease has led to cross infection of farms in the same watershed. Many of the farmers in Andhra Pradesh are small farmers with holdings between 1.0 and 1.5 ha, and measures to identify and to manage the disease are not commonly applied in the affected areas. The lack of alternative forms of aquaculture to utilize the unused shrimp ponds further contributed to the social and economic difficulties that the rural poor communities are now facing.

At the request of the Department of Fisheries (DOF), FAO is providing assistance under this project in support of the sustainable growth of the shrimp aquaculture sector in the state. The immediate objectives are:

- To improve the capacity for health management and reduction in risks of shrimp disease outbreaks in Andhra Pradesh;
- To improve the sustainability of the sector through Integrated Coastal Area Management (ICAM), the use of Geographical Information Systems (GIS) technology, and appropriate institutional arrangements; and
- To support better management of the sector through organizing farmers, improving farmer-farmer and state-farmer contacts, and diversification.

It is felt that a multidisciplinary approach is required to obtain positive and permanent results.

Apart from FAO, there are other national, regional and international organizations providing assistance for sustainable development and management of the shrimp aquaculture sector in AP. They include the Australian Centre for International Agriculture Research (ACIAR), the Network of Aquaculture Centres in Asia-Pacific (NACA) and the Marine Product Export Development Authority of India (MPEDA). The activities of the FAO project are designed to take advantage of the complementary assistance and inputs by ACIAR, NACA and MPEDA. In future issues of the FAO Aquaculture News-

letter we will certainly come back to you with the experiences of this project.

For more information on the above project, please contact Dr Rohana Subasinghe at (rohana.subasinghe@fao.org).

Uruguay

An FAO Technical Cooperation Project titled "Development of Aquaculture in Uruguay" (TCP/URU/2904) started in November 2003. The Ministry of Livestock, Agriculture and Fisheries of Uruguay asked for FAO assistance to develop the aquaculture sector in the country, which is almost insignificant at present. In 2001, the total aquaculture production of Uruguay was only 17 mt, while marine capture fisheries accounted for 104 583 mt and inland fisheries for 468 mt. The production from capture fisheries is declining rapidly due to over-exploitation by a relatively modern fleet. This has caused a decrease in fish exports and the availability of fishery products for the domestic market.

Therefore, the Government considers the development of aquaculture as one of the main opportunities to maintain and/or increase fish consumption (now 7 kg/caput/year). It worked together with FAO on the improvement of a legal framework for the fisheries sector in 2002, increased fisheries research efforts and carried out an analysis of the national fisheries sector with INFOPESCA in 2001.

The current FAO project aims to assist the Government in the formulation of a development vision (short-medium and long term) based on the existing potential for aquaculture in the country and taking in consideration economic, financial, social, technological, institutional and human capacity issues. The findings of this project and the insights and visions obtained should feed into a national plan for the development of the aquaculture sector in Uruguay, which will be developed under a future FAO Technical Cooperation Project.

For more information on this project, please contact Mr Jose Aguilar-Manjarrez at FAO/FIRI (jose.aguilarmanjarrez@fao.org) or Mr Angel Gumy at FAO/FIPP (angel.gumy@fao.org).

Uganda

The FAO aquaculture project in Uganda titled "Assistance to Fish Farmers in Eastern Uganda" (TCP/UGA/0167) is almost coming to its end. This project, which started in early 2002, helped the Fisheries Resources Department of the Ministry of Agriculture, Animal Industry and Fisheries in establishing sustainable, private-sector-driven fish farming in eastern Uganda by ensuring reliable private supplies of quality fish seed and introducing farmer-friendly aquaculture technologies to both farmers and extensionists.

This year, the project brought in TCDC aquaculture management and hatchery operations experts from Asia (Thailand and Vietnam) to assist private-sector fingerling (tilapia and catfish) producers in their activities. Some private-sector fingerling producers and relevant government staff went on a study tour to Thailand (organized in cooperation with the Network of Aquaculture Centres in Asia-Pacific (NACA)) to learn from the Asian experiences with these species. Moreover, the project delivered pond-side training to a large number of fish farmers in Iganga, Kamuli and Tororo districts in Eastern Uganda. The training sessions included record keeping, marketing, pond management, feed management, fish reproduction etc.

A socio-economic survey of the fish farmers' activities in various districts in Eastern Uganda was carried out in late 2002 and early 2003 and revealed among others, the following issues:

- The number of places where fingerlings can be purchased is low, which results in low levels of competition. Farmers are currently price-takers as far as fingerling prices are concerned.
- Mixed culture of species (tilapia, carp and catfish) is practiced by over 30% of the farmers, although the practicing farmers have no idea as to the best combination of species to culture. Stocking densities are generally too low to justify the current labour inputs. Moreover, the best sex ratios of broodstock are not known and feeding schedules based on the weight of the fingerlings/fish are generally not used.
- Most farmers seem to have started aquaculture out of interest in the activity, on a hobby basis, using rudimentary general farming knowledge, through trial and error, taking into account their farm resources

R. van Anrooy

Hatchery in Mbale district Eastern Uganda

(especially water supply and own-farm feed availability for aquaculture), trying to diversify their farm activities to increase farm income earning opportunities, guarantee a stable income, and decrease farming-related risks.

- Although the farmers, when asked for their overall objective of doing aquaculture, generally mention "making profits", this should be seen in the light of their technical, labour and economic capabilities. The profits sought are generally not achievable, due to a combination of limited technical knowledge in aquaculture, low labour productivity and limited farm management and marketing skills. It is clear that the farmers interviewed would benefit from (additional) elementary technical training in aquaculture.
- The aquaculture practices of the average farmer in Eastern Uganda are characterized by low stocking densities (average of 1 fish m^2) and low feed inputs, which result in low outputs. The system used can be therefore called a low input-low output system.
- As the opportunity costs of most farmer's 'labour are higher than the costs of hired labour, it would be cost-effective for the farmers to hire more labour than is now done, and to use less of their own labour.
- In view of the current high costs involved in security/guarding of the ponds (sometimes more is spent on security than the value of the fish in the pond), it is advisable that farmers have their ponds closer to home, so that control/monitoring of the pond is easier and can be done at no additional costs to the farmer.
- A comparison of three systems, "catfish-tilapia", "tilapia only" and "carp-tilapia", showed that only the carp-tilapia farmers are currently making profits. This can be explained by the fact that this system is characterized by smaller ponds (around 500 m^2 instead of 1000 m^2), lower mortalities of fish during the growout period and no security costs.

The project is currently (November 2003) finalizing its training programme and conducting a study on the economic aspects of hatchery production. The last activity of the project will be a national workshop (mid-December 2003) to disseminate the results of the project and discuss follow-up activities.

For more information on this project please contact Mr John Moehl at FAO/RAFI (john.moehl@fao.org) or Mr Raymon van Anrooy at FAO/FIPP (raymon.vananrooy@fao.org).

Beardmore, J.A. & Porte, J.S. 2003. Genetically modified organisms and aquaculture. FAO Fisheries Circular. No. 989. Rome, FAO. 35 pp.

This document was written by John A. Beardmore and Joanne S. Porte, under the supervision of Devin Bartley (FIRI), as part of an overall presentation on the role of genetically modified organisms (GMOs) in aquaculture given at a special session organized by FAO and the World Aquaculture Society on 27 April 2002. The production of appropriate GMOs offers considerable opportunities for more efficient and more effective aquaculture across a wide range of species. Although this potential is being realized in crop production, with over 60 million ha under cultivation, there has been no commercial use of GMOs in aquaculture. The authors review the nature of GMOs, the range of aquatic species in which GMOs have been produced, the methods and target genes employed, the benefits to aquaculture, the problems attached to the use of GMOs, and the regulatory and other social frameworks surrounding them. They conclude with a set of recommendations aimed at best practice.

Lovatelli, A., Walters, R. & Anrooy, R. van. (eds.). 2003. *Report of the Subregional Workshop to Promote Sustainable Aquaculture Development in the Small Island Developing States of the Lesser Antilles.* Vieux Fort, Saint Lucia, 47 November 2002. FAO Fisheries Report. No. 704. Rome, FAO. 122 pp.

The workshop was organized by the FAO Subregional Office for the Caribbean in collaboration with the Development Planning and Inland Water Resources and Aquaculture Services of the FAO Fisheries Department, Rome. It was hosted by the Government of Saint Lucia and attended by 15 participants from seven countries, four regional institutions and the FAO Fisheries Department. The syntheses of the national experiences and status of aquaculture development in the Lesser Antilles reflected a significant level of diversity in the scale of activities among the island nations; they also revealed many similarities in the results and present status of aquaculture development in the subregion. The case studies elicited very positive comments and enquiries from the country representatives.

In the plenary deliberations, to identify the constraints to and opportunities for developing aquaculture sustainably in the subregion, participants recognized the need to rank the aquaculture development activities based on individual country-priorities and stage of development. The workshop agreed that participants would consult with the decision-makers in their respective countries and communicate a priority-list of needs for possible technical assistance to the technical secretary of the workshop. It was also agreed that such a list would be used to identify common themes that could form the basis for a possible subregional Technical Cooperation Programme (TCP) project proposal.

FAO Inland Water Resources and Aquaculture Service, Fishery Resources Division. 2003. Review of the state of world fishery resources: inland fisheries. FAO Fisheries Circular. No. 942, Rev.1. Rome, FAO. 60 pp.

The objective of this review is to present a broad view of the state of inland capture fisheries as of 2001. Status and trends are reported, along with coverage of selected sections on the impacts of dams on fisheries, fisheries in rice-based ecosystems, database on African water resources, indices of human development and environmental sustainability, and new approaches to improving inland fishery information.

Inland capture fisheries production was reported to FAO by 150 countries, with a total production of 8.7 million metric tonnes (mmt) in 2001. Inland capture fisheries accounted for 6.1 percent of the global total capture fisheries and aquaculture production. The 15-year (1986–2001) trend in production is mainly positive, with 109 of the 150 countries maintaining stable or increasing outputs; 81 percent of the production was from these countries where capture fisheries is stable or slowly increasing.

By continent, inland capture fisheries production was 5.8 mmt from Asia; 2.1 mmt from Africa; 0.3 mmt from Europe and South America each; 0.2 mmt from North America; and 22 thousand metric tonnes (tmt) from Oceania. Twenty countries accounted for 84 percent of the total global inland capture fisheries production, with the top producers being China (2.1 mmt), India (1.0 mmt) and Bangladesh (0.7 mmt). Based on production per se, most of the important inland fisheries countries are in Asia and Africa.

Inland capture fisheries are an important source of animal protein. In seven countries, inland fisheries provided the only source of fish; in 20 additional countries they accounted for 81 to 99 percent of total fish production from all sources; in four countries they accounted for 61 to 80 percent of total production from the aquatic sector. Seventy-one Low-Income Food-Deficit Countries (LIFDCs) produce 80 percent, nearly 7 mmt, of the world total inland capture fisheries output. In 27 of the LIFDCs, inland capture fisheries are the sole source of fish, and in an additional 22 countries they account for at least 81 percent of the total inland fish production. In an additional three countries, inland capture fisheries make up at least 61 percent of inland production.

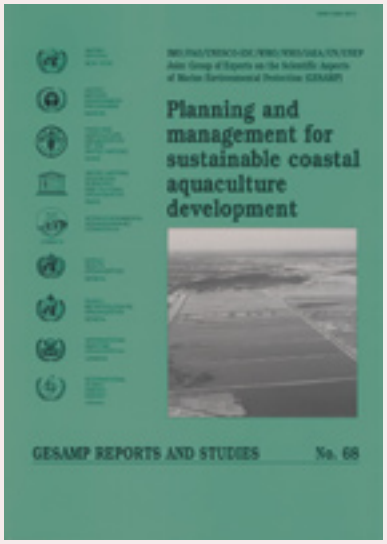
The Human Development Index (HDI) measures a country's achievements in three aspects of human development: longevity, knowledge and a decent standard of living. In 33 countries with low HDIs, inland capture fisheries are the sole source of inland fish in 16 and account for at least 81 percent of inland fish production in an additional 14 countries. Inland capture fisheries production is very important in the fish supply of nearly all of the countries with low HDIs. A threat to the sustainability of inland fisheries is degradation of the environment.

The Environmental Sustainability Index (ESI) is a measure of overall progress towards environmental sustainability that has been developed for 142 countries, of which 133 reported inland capture fisheries production. Globally, 94 of the inland capture fisheries countries have ESIs that range from moderate to high, while there are only 39 that range from moderately low to low. Thirty-four (59 percent) of the countries that are highly dependent (i.e. inland fisheries provide at least 81 percent of the total fish supply) on inland fish production for their fish supply have at least a moderate ESI. Of potential concern are the inland fisheries countries for which the ESI ranges from moderately low to low and for which the 15-year trend in production is slowly or moderately decreasing; ten countries fall into this category.

GESAMP (IMO/FAO/UNESCO-IOC/WMO/WHO/IAEA/UN/UNEP Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection) 2001. Planning and management for sustainable coastal aquaculture development. Rep. Stud. GESAMP, (68): 90 pp.

The coastal zone is characterized by ambiguities of resource ownership and complex interactions between resources, ecosystems and resource users. It has been widely recognized that to address these complexities and to promote sustainable development in the coastal zone, a more integrated approach is needed, ideally within the framework of Integrated Coastal Management (ICM).

The rationale for more integrated approaches to aquaculture development is powerful: coastal aquaculture has brought significant economic and employment benefits to both national economies and coastal people throughout the world; aquaculture is highly vulnerable to pollution caused by other resource users; if poorly designed or managed, it may cause pollution or the spread of disease; its impacts are often limited but incremental and cumulative; and it often takes place in areas where resource ownership or use rights are ill



defined and ambiguous. Efforts to integrate aquaculture into coastal management can contribute to improvements in selection, protection and allocation of sites and other resources for existing and future aquaculture developments.

This report is based on a review of literature and experience relating to the planning and management of aquaculture development and its integration into coastal area management. It explores in detail how more planned and integrated approaches can be applied to aquaculture development. These approaches range from "enhanced sectoral" initiatives, to incorporation within comprehensive ICM programmes.

No simple, effective and widely applicable models have been identified. The most appropriate approach will depend upon a wide range of local factors, including available skills and resources, the urgency of the problems or opportunities, and the nature of existing planning and development frameworks. The less comprehensive approaches may be the only realistic option in some situations, but should be seen as a starting point for, and stimulus to, more comprehensive ICM. These approaches should contribute to more systematic planning and improved management of individual aquaculture operations, as well as to the coastal aquaculture sector as a whole.

This report is available in English at:
ftp://ftp.fao.org/fi/document/gesamp/y1818e00.pdf
and Chinese at:
ftp://ftp.fao.org/docrep/fao/006/y1818c/1818c00.pdf

The FAO Fisheries no. 886 revision 2 (FIRI/C886(rev.2) "Review of the state of world aquaculture" is now also available in the four languages, Arabic, Chinese, French and Spanish.

Larinier M. , Travade F. & Porcher J.P. 2002. Fishways: biological basis, design criteria and monitoring. Bull. Fr. Pêche Piscic., 364 Suppl., 208 pp. Published by FAO, Cemagref Editions & CSP.

The authors outline in this paper the basic principles that can be used as a guide for planning fish passage facilities at dams or obstructions. The first part addresses the negative effects of barriers across rivers on natural fish populations, contributing to the reduction of abundance and even the extinction of species. French statutory legislation on fish passage at obstructions is given. Functional features and design parameters are described for different types of fish facilities, focusing on the advantages, the limits and the cost of each type: pool-type fish passes, baffle fish passes, fish locks, fish elevators, natural bypass channels and pre-barrages. Stress is laid on the importance of the location of the fishway, hydraulic conditions and the low discharge at the entrance. Special mention is made of fish facilities for shad, young eels and elvers. Various monitoring techniques to evaluate fish passage efficiency are presented (trapping, automatic counters, video recording, telemetry). Fish passage through culverts, rock weirs and at estuarine obstructions is addressed. Finally, downstream migration problems at hydroelectric power plants are discussed: evaluation of fish mortality in spillways and hydraulic turbines, design of fish screening and alternative behavioural diversionary techniques used to prevent entry of downstream migrants into intakes. Special mention is made of the most popular technology in France, i.e. surface downstream bypasses associated with conventional trashracks, focusing on their design criteria, advantages and limits.

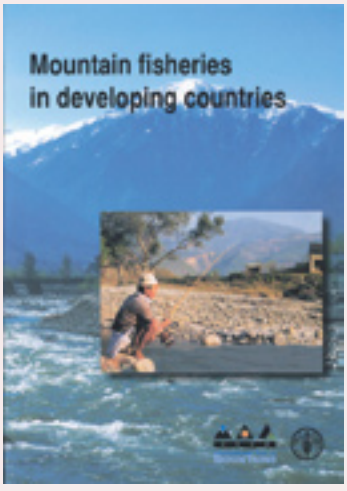
Dams, fish and fisheries. Opportunities, challenges and conflict resolution. (Marmulla, G., ed.). 2001. FAO Fisheries Technical Paper. No. 419. Rome, FAO. 166 pp.

The four papers presented in this publication address major fishery issues in relation to dams as identified by the World Commission on Dams (WCD) and FAO for the purpose of WCD's global reviews on "Dams and Development". Characteristics of river and reservoir fisheries in various regions of the world are reviewed. Production figures for reservoirs in Africa, Asia, Latin America and the Caribbean, as well as for the Commonwealth of Independent States, are given. Fish production figures for large

rivers are also provided, emphasizing the importance of floodplains for fish production. A non-exhaustive review of the current status of the use of fish facilities at dams throughout the world is presented, with the main target species considered from North America, Europe, Latin America, Africa, Australia, New Zealand, Japan and Asia. Fisheries management capacity and information base requirements are reviewed for the six phases of the dam project cycle, i.e. identification, design, project appraisal, construction, operation and decommissioning. Effective environmental assessment and management coupled with improvements in design of civil engineering structures have made some recent dam projects more fish friendly and environmentally acceptable. The need for drafting legal instruments that will facilitate modification of dam structures to incorporate mitigation measures and help alter dam operation rules to be more beneficial to fish biodiversity and fisheries is emphasized.

Petr, T. 2003. Mountain fisheries in developing countries. Rome, FAO. 55 pp.

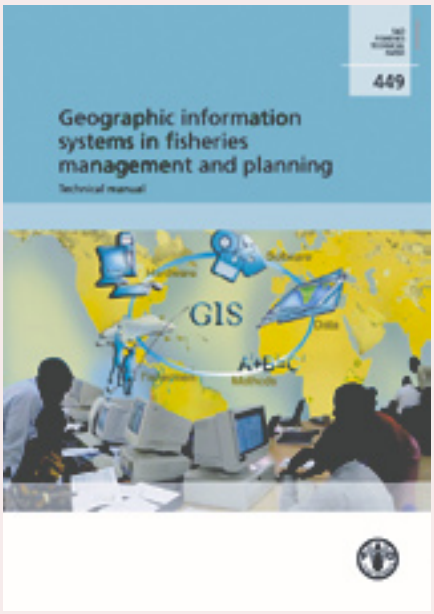
With the present document, which reviews the current status of capture fisheries and aquaculture in the mountains of developing countries of Asia, Latin America, Africa and the Pacific, the FAO Fisheries Department contributes to the efforts of the United Nations to promote sustainable mountain development. Mountains of the world cover about one fifth of the land surface, are home to one tenth of the world's population, and provide livelihood to some of the poorest communities in the world. Mountain lakes and streams are a source of freshwater for countless riparian human communities, support industries, and provide water for irrigation and hydropower electricity production and for fish. Some countries situated in mountain areas are landlocked, with no access to marine fishery resources; hence, the fish of lakes, streams, rivers and reservoirs are an important source of animal protein, always in short supply in mountain countries. As fisheries play an important role in providing food and income to people in mountain areas, they must be integrated into rural development and water resource development initiatives. Several problem areas are common to neighbouring countries in mountain regions and fishery resources, such as migratory fish stocks, may have to be shared. Specific action programmes for mountain countries, with collaborative actions on a regional scale, may become the most cost-effective way to address those common problems and share experiences.



De Graaf, G., Marttin, F.J.B., Aguilar-Manjarrez J. & J. Jenness. FAO. 2003. Geographic Information Systems in fisheries management and planning. Technical manual, FAO Fisheries Technical Paper. No. 449. Rome. 173 pp.

Many fishery biologists and policy makers involved in inland fisheries management and planning are unaware of GIS technology and its potential for fisheries planning and management. The FAO Inland Water Resources and Aquaculture Service (FIRI) has been active for the last 19 years in promoting the use of GIS and remote sensing in fisheries and aquaculture. Promotional activities have been carried out through training, projects, field missions, and oral presentations and publications. However, a manual to use along with GIS software for the fisheries biologist in the field explaining GIS in a way that is understandable to non-GIS users had not been produced until now. This manual was written to overcome this knowledge-gap; it is a "do-it-yourself" manual giving a short introduction to GIS software and its applications in fishery science.

The overall objective of this manual is to encourage fishery managers to use this tool (GIS) to foster the sustainable use of natural resources. The manual is aimed at fisheries biologists, aquatic resource managers and decision makers in developing countries who have no knowledge about GIS. The manual was written for use with ESRI's ArcView 3.x and Spatial Analyst software.



There are five main sections in the manual:
• GIS concepts and functions and key tools provided by ArcView 3.x,
• Geographic coordinate system and map projections,
• Raster data and analysis,
• Regression analysis, and
• Application case studies.

All sections are accompanied by exercises that have been designed to illustrate key applications of GIS in inland and marine fisheries management. Also, a custom-designed ArcView grid regression extension is included to show the integration of GIS with surplus production models.

At the end of the training with this manual, readers should be able to: apply learned principles and GIS to their own professional situations, perform analyses on their own data, be aware of the vast possibilities that GIS can provide and be able to communicate with GIS expert counterparts.

The manual is useful for a broad range of fishery applications. However, it by no means covers all possibilities of GIS, it merely touches upon some of the most important features for fisheries management and planning.

Arthur, J.R., Phillips, M.J., Subasinghe, R.P., Reantaso, M.B. & MacRae, I.H. (eds.) 2002. Primary aquatic animal health care in rural, small-scale, aquaculture development. Technical proceedings of the Asia Regional Scoping Workshop. Dhaka, Bangladesh, 27-30 September 1999. FAO Fisheries Technical Paper. No. 406. Rome, FAO. 382 pp.

This document is the Technical Proceedings of the Asia Regional Scoping Workshop on "Primary Aquatic Animal Health Care in Rural, Small-scale, Aquaculture Development," held in Dhaka, Bangladesh from 27 to 30 September 1999. The workshop was organized by the Department for International Development of the United Kingdom (DFID), the Food and Agriculture Organization of the United Nations (FAO) and the Network of Aquaculture Centres in Asia-Pacific (NACA), and hosted by the Ministry of Fisheries and Livestock of the Government of Bangladesh (GoB). The objectives of the workshop were two fold: (1) to review information on socio-economic impacts, risks of disease incursions and health management strategies in rural, small-scale aquaculture and enhanced fisheries programmes; and (2) to identify potential interventions for their better health management and appropriate follow-up actions. The workshop was attended by 48 participants from 12 countries and is complementary to the efforts of FAO, NACA and others to assist countries within the Asian Region to develop effective policies and improve capacities to minimize the impacts of aquatic animal disease outbreaks. The workshop was preceded by several case studies in countries of the Asian Region that explored the social and economic impacts of aquatic animal disease on the livelihoods of people involved in small-scale aquaculture and enhanced fisheries. The

workshop largely focused on understanding the impacts of aquatic animal health risks in small-scale rural, low-input aquaculture and enhanced fisheries and evaluating their impacts on rural livelihoods. The workshop also attempted to derive appropriate management interventions to deal with health risks within rural livelihood programmes involving aquaculture and enhanced fisheries.

The workshop was a unique event bringing together experienced aquatic animal health specialists, aquaculturists, sociologists, economists, extension specialists and rural development practitioners in the Asian Region. Although quantitatively estimating the overall impacts of disease on rural livelihoods was difficult due to lack of adequate socio-economic information, the consensus among the workshop participants was that aquatic animal health problems are a risk to the livelihoods of people involved in small-scale aquaculture and enhanced fisheries in Asia. From the information derived from specific case studies, it was clear though that health problems impact on the livelihoods of rural, resource-poor aqua-farmers, fishers and their dependants, through loss of production, income and assets. A necessity to better quantify the livelihood impacts was clearly identified. The workshop agreed that the risks to sustainable livelihoods from the introduction of aquatic animal pathogens and health problems originate from several fundamental inadequacies, with lack of knowledge in understanding and managing risks being a major basis for concern. The workshop considered that health management interventions should be a component within programmes aimed at harnessing aquaculture's potential for rural development. It was also recognized that aquatic animal health problems in inland enhanced fisheries systems are often beyond the control of rural communities, making the livelihoods of rural poor most at risk when serious disease outbreaks occur. While the risks and impacts of disease in small-scale aquaculture and enhanced fisheries vary between countries and localities, and the management interventions for mitigation may differ, the workshop identified a number of strategies with the potential to reduce risks to livelihoods from such problems. This Technical Proceedings, including the case study papers, presentations, discussions and findings from the workshop, represents a valuable and unique collection of information on aquatic animal health in small-scale aquaculture and enhanced fisheries within the Asian Region.

Travaglia, C., Profeti, G., Aguilar-Manjarrez, J. & Lopez, N.A. 2004. Mapping coastal aquaculture and fisheries structures by satellite imaging radar: *Case study of the Lingayen Gulf, the Philippines.* FAO Fisheries Technical Paper. No. 459, FAO, Rome. 44 pp.

Inventory and monitoring of coastal aquaculture and fisheries structures provide important baseline data for decision-making in planning and development, including regulatory laws, environmental protection and revenue collection. Mapping these structures can be performed with good accuracy and at regular intervals by satellite remote sensing, which allows observation of vast areas, often of difficult accessibility, at a fraction of the cost of traditional surveys.

Satellite imaging radar (SAR) data are unique for this task not only for their inherent all-weather capabilities, very important as aquaculture activities mainly occur in tropical and subtropical areas, but essentially because the backscatter from the structure components allows for their identification and separation from other features.

The area selected and object of the study has been Lingayen Gulf, sited in Northwestern Luzon Island, the Philippines, where all these structures of interest occur.

Field verification of the methodology resulted in the following accuracy: fishponds 95 percent, fish pens 100 percent. Mapping accuracy for fish cages was estimated at 90 percent and for fish traps at 70 percent.

The study is based on interpretation of SAR satellite data and a detailed image analysis procedure is described. The report aims at the necessary technology transfer for an operational use of the approach indicated in other similar environments.