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Biosecurity: a new challenge for aquaculture developers!

As aquaculture develops and expands in all regions of the world, there is an increasing focus on environmental conservation and protection and reducing the negative impacts of aquaculture to the environment. Maintaining environmental health is paramount to ensuring sustainable development. In aquaculture, therefore, it is important to control the inputs into the environment, as much as it is important to control the outputs. In aquaculture, globalization and trade liberalization drive increased movement of live aquatics and aquatic products, thus making the sector vulnerable to various threats stemming from exotics, including alien species as well as exotic pathogens. Transboundary aquatic animal diseases (TAADs) are not new to aquaculture. Serious disease outbreaks occurred over the past few decades, causing significant damage to the industry and losing billions of dollars of revenue. Epizootic ulcerative syndrome (EUS) in freshwater and brackishwater finfish in Asia during the 1980s and the 1990s; white spot syndrome virus (WSSV) of penaeid shrimp in Asia and Latin America since the 1990s; koi herpes virus (KHV) affecting common carp, an important food fish species and koi carp, an important ornamental species, since the 1970s - are some examples. These diseases still exist, many are still spreading around (e.g. EUS has now expanded geographical range to the Chobe-Zambezi river system in Southern Africa and confirmed in Botswana, Namibia and Zambia), still causing mortalities in cultured species, thus making many people relying on aquaculture vulnerable.

Over 200 species are produced in aquaculture globally. There are about 25 high value species which are produced commercially and traded globally. As farming these species are lucrative, there is a drive for expansion of their production worldwide. On top of this is the ornamental fish aquarium trade. Species are moved all over the world, in high frequency, rather haphazardly and irresponsibly, with no consideration of the potential negative impacts they may bring to the environment. Such an unfortunate commercially driven movements of live aquatics - including introductions and transfers - are common. If not done in a responsible and prudent manner, the impacts on the environmental health can be significant and the consequences to sectoral development could be serious. Therefore, biosecurity is of prime importance to aquaculture.

Biosecurity safeguards animal health, protects biodiversity, promotes environmental sustainability and enhances food safety. Biosecurity can also stimulate increased market supply and private investments as it enables farmers to produce healthy products which can be highly competitive in the market and makes a country a responsible trading partner. Biosecurity enables developing countries to grow more food efficiently, increase their incomes and thus improve their resilience, reduce vulnerability and effectively respond to the impacts of higher food prices as well as other food production risks. In order to achieve the benefits of maintaining biosecurity, an enabling policy and institutional environment at national levels is essential. Effective legislative framework implemented and enforced within an efficient policy environment is needed to achieve success.

The Fisheries and Aquaculture Department of FAO has a long history of engagement in aquatic animal health management and aquatic biosecurity, globally. Responsible movement of live aquatics and maintaining environmental health are all part and parcel of FAO's Code of Conduct for Responsible Fisheries. There are several "records of firsts" of actions on biosecurity based on the work of the FAO Fisheries and Aquaculture Department. They include the very recent successful investigation of EUS incursion in southern Africa in 2006, emergency responses to KHV in Asia in 2003, building consensus on and the implementation of the Asia regional technical guidelines on responsible movement of live aquatic animals in the late 1990s, establishment of regional surveillance and reporting system for TAADs in Asia in 1998, and creation of two databases on aquatic animal pathogens and diseases (www.aapqis.org) and introduced species in aquaculture (www.fao.org/fi/dias). The Department also pioneered in addressing the application of risk analysis to aquaculture production. This work is expanding to other regions such the Western Balkan region, the Gulf region, the Pacific Islands. FAO's recent actions on improving aquatic biosecurity in southern Africa include an emergency Technical Cooperation Programme (TCP) to combat EUS in the Chobe-Zambesi River, an aquatic biosecurity capacity and performance survey, an active surveillance for EUS involving seven countries bordering the Chobe-Zambezi River, capacity building in the areas of basic EUS diagnosis, surveillance, basic aquatic animal health management and introduction to risk analysis in aquaculture and preparation of extension materials on EUS. More work is planned under TCP and other extra-budgetary funding mechanisms and through FAO's Special Programme for Aquaculture Development in Africa (SPADA).

Let's be responsible in our action, preserve and maintain environmental health, and respect biosecurity!

Melba B. Reantaso
Editor-In-Chief

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INTRODUCTION

The relevance of aquaculture as a production industry in Mexico is now clearly defined in the recently approved General Law for sustainable fisheries and aquaculture in Mexico (24 July, 2004). This new law defines aquaculture as being a sector of public interest and national security. The law allocates the responsibility for the development of fisheries and aquaculture to each state. Chapter 13 of this new law entitles states to prepare their own master plans. In parallel to the national level master plan for aquaculture being prepared by the National Commission for aquaculture and Fisheries (CONAPESCA) and the Center of Biological Investigations of the Northwest (CIBNOR), the regional plans, and the plans and programmes at states levels are gaining importance.

AQUACULTURE AND INLAND FISHERIES IN PUEBLA

Puebla is a Mexican state located in the center east of the country, to the east of Mexico City. Puebla does not have a coastline and covers an area of about 33,919 km^2. The terrain is mostly mountainous and it is the 5th most populated State in Mexico.

The State of Puebla can be divided in three climatic zones; cold, temperate and warm. Cold zones are suitable for trout culture, temperate zones are not adequate for commercial aquaculture and warm zones are the most suitable zones for aquaculture development.

Main aquaculture production in terms of volume are derived from carp (*Ciprinus carpio carpio)*, trout (*Oncorhynchus mykiis)* and tilapia (*Oreochromis Niloticus)*, mostly for the domestic market. Trout culture is well established and has reached its maximum growth; however, current management practices can be improved to increase production. Tilapia culture has been identified as having great potential for commercial aquaculture but marketing strategies and financial assistance are needed for its development. Carp production is mainly derived from capture based aquaculture and is designed to increase food security but current practices also need to be improved. Additional species for culture in Puebla are mainly catfish (*Ictalurus punctatus)*, shrimp (*Litopenaeus vannamei)*, artemia (*Artemia Franciscan)* and baby lobster (*Cherax quadricarinatus)*.

Fish farming in Puebla is mainly carried out in raceways or in earthen ponds with lining, some small scale initiatives for cage culture exists for tilapia and catfish and there is potential for growth. Total aquaculture production for 2006 was about 5,286 tonnes mostly destined for the domestic market. There are a total of 11 hatcheries; however, about half of the fingerlings need to be imported to satisfy the demand.

Fish consumption has doubled since 2000; in fact, it is well above the national annual average growth rate of fish consumption. However, proper fish utilization and marketing mechanisms need to be strengthened and improved.

Fish diseases have been identified by many producers but mass mortalities have not been recorded. Most producers have basic education (primary school). Training and technical experiences are highest for trout, less for tilapia and least for carp. Most producers do not monitor/record production.Technical experience on aquaculture at the Secretariat of Rural Development (SRD) is considered low.

Inland fisheries, is an incipient activity in the state, and is carried out in reservoirs and natural waterbodies. Most carp production is derived from capture-based aquaculture. A

total of 207 vessels and 2 060 fisherfolk were reported in Mexican fishery statistics for 2006. Other fishing activities are carried out in rivers and other reservoirs, for species such as the apple snail (*Pomacea patula*), freshwater prawn *(Macrobrachium sp.)*, and axolotl (*Ambystoma tigrinum*) among others, but no statistics are available and efforts need to be made to conduct research to better determine their use for stocking fish seed in reservoirs.

THE PROJECT

The main goal of this project is to promote the sustainable development of aquaculture and inland fisheries in the State of Puebla.

The immediate objectives of this UTF were to assist the government of Puebla, the SRD, specifically the Aquaculture Department (AD), to prepare and organize:

1. an aquaculture and inland fisheries sectoral review;
2. a master plan for aquaculture and inland fisheries for 2007-2011 that will mainly include policy formulation, strategic development recommendations and action plans;
3. one "consultation workshop" on the current state of aquaculture in Puebla and the results of the master plan; and three "capacity building" workshops on environmental management and the Ecosystem Approach to Aquaculture(EAA), technical lectures on catfish cage culture practices; and simple methods for recirculation systems.

As requested by the SRD and the AD in Puebla, the master plan also provides a fourth component on key recommendations for business plans for aquaculture development that are feasible to implement in Puebla.

J. AGUILAR-MANJARREZ, FAO

La Preciosita farm (intensive Trout culture in concrete tanks and raceways with a restaurant)

The project commenced in December 2007 and was completed in September 2008. Mr Francisco Javier Martínez Cordero served as the National Project Coordinator as well as the consultant on socio-economics and fishery planning while Mr Antonio Garza de Yta acted as the national consultant on Aquaculture. Backstopping was provided by Mr Jorge González de la Rocha (FAORLC) and Mr José Aguilar-Manjarrez (FIMA). Budget of project did not allow for direct participation of FIEP, however, some technical advice was kindly provided by Ms Cecile Brugère.

ASSISTANCE/RESULTS

The master plan identifies political priorities for aquaculture and inland fisheries development in Puebla, provides a strategy with objectives, specific actions for short-term implementation and also sets the stage for medium- and long-term actions.The formulation of this plan was done in a participatory and democratic process using structured questionnaires, interviews, field visits and workshops. The main stakeholders involved in the development of aquaculture were: producers, government agencies, universities, regulation institutes, and environment agencies for land and water use, etc. Therefore, this master plan provides a common vision by the state government and its society for the sustainable development of aquaculture.

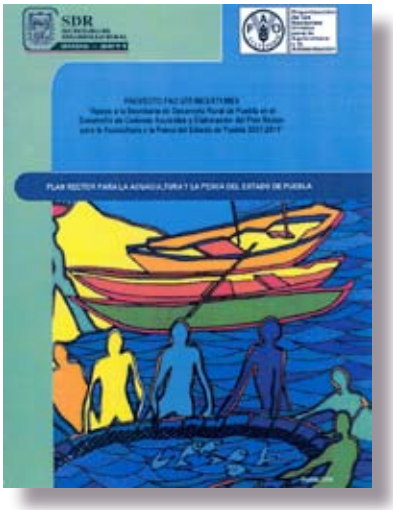
CONCLUSIONS AND RECOMMENDATIONS

Puebla is a state with important levels of population marginalization: 70 percent of the municipalities are classified as very high or highly marginalized. Thus, it is hoped that aquaculture will help reduce poverty, increase household food security, and generate income.

Factors that favour the growth of aquaculture in Puebla include: (1) high fish consumption; (2) value-added practices to aquaculture products creating restaurants adjacent to the fish farms and (3) increased financial support by state and federal governments.

The master plan was presented and submitted to the Governor of Puebla, Mr Mario Marín Torres in a ceremony held in Puebla on 24 September 2008. Thus, the State of Puebla is the first state in Mexico to have a master plan for sustainable aquaculture and fisheries development for the next 30 years. Undoubtedly, the plan will

serve as a model for other states in Mexico. Therefore, FI's role in this project is very relevant and timely when the surge for "sustainable" aquaculture development becomes more evident in Mexico.



Master plan for aquaculture and inland fisheries in Puebla for the period 2007-2011

The objectives of this project were met. The achievements of this project should provide the state government with the momentum to continue the implementation of the action plan at the short-, medium- and long-term for the responsible and sustainable development of fisheries and aquaculture in Puebla. This process is continuing and the SRD and AD in Puebla should try to make every effort to continue consultation with relevant stakeholders.

FOLLOW-UP ACTIVITIES

Action plans identified include five state programmes and one information system: (1) state programme for development of aquaculture technology; (2) state programme for capacity building on aquaculture practices; (3) state programme for aquaculture zoning; (4) state programme for marketing aquaculture products; (5) state programmes for health management and aquaculture and fisheries information systems.

A total of 76 short-term action plans (1–3 years) were also identified, amongst these, the most important that can be implemented within one year include: (1) establishment of a state council for the sustainable development of aquaculture; (2) creation of a state law for sustainable fisheries and aquaculture; (3) zoning of aquaculture; (4) creation of the state aquaculture and fisheries information system; (5) optimization and prioritization of species and culture systems; (6) research on endemic species for culture; (7) international training courses on aquaculture practices for key personnel at SRD; (8) collaboration with Mexican research centres; (9) initiation of activities on: health management; capacity building and marketing.

Funding permitting, there are vast areas where FI could assist in the near future to guide SRD/DA in the development and implementation of some of the ten development axes[1] identified by the master plan. Specific opportunities for collaborative work between the SRD and FAO identified in this project are: genetic improvement for trout, tilapia and catfish; assistance in developing a state law for aquaculture and fisheries; capacity building on aquaculture practices at all levels; guidance on carrying capacity and zoning; technical assistance on carp culture; and guidance in creating demonstration units for freshwater lobster.

The master plan was based on the CCRF and makes general reference to the importance of the EAA principles[2] for the implementation of the master plan. Therefore, future guidelines on EAA to be completed by FIMA during the first quarter of 2009 will assist Puebla in making the best use of an EAA. In fact, Puebla could serve as a model for the implementation of EAA guidelines.

J. AGUILAR-MANJARREZ, FAO

Technological Institute for Agriculture (demonstration unit for Tilapia culture in earthen ponds)

[1]The ten development axes identified by the master plan are: (1) research and development, human resources and capacity building; (2) natural resources; (3) health management, biosecurity and safety; (4) institutional strengthening; (5) legislative framework; (6) fish utilization and marketing; (7) economic environment; (8) food security (9) organizations; and (10) fish stocking and care for endemic species.

[2]Soto, D.; Aguilar-Manjarrez, J.; Hishamunda, N. (eds). 2008. Building an ecosystem approach to aquaculture. FAO/Universitat de les Illes Balears Expert Workshop. 7–11 May 2007, Palma de Mallorca, Spain. FAO Fisheries and Aquaculture Proceedings. No. 14. Rome, FAO. 221p. (available at ftp://ftp.fao.org/docrep/fao/011/i0339e/i0339e.pdf).

FAO/NACA Regional Technical Cooperation Project "Reducing the dependence on the utilization of trash fish/low-value fish as feed for aquaculture of marine finfish in the Asian region"

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THE PROJECT AND ITS OBJECTIVES

A regional Technical Cooperation Project (TCP) "Reducing the dependence on the utilization of trash fish/low-value fish as feed for aquaculture of marine finfish in the Asian region [TCP/RAS/3203 (D)]" was approved in July 2008. The governments of China, Indonesia, Thailand and Viet Nam are participants to this TCP. The project aims to reduce the perception of small-scale marine fish farmers that trash fish (TF)/ low value fish (LVF) performs better than compounded pellet feeds and is expected to facilitate a transition away from dependence on trash fish to more sustainable alternatives, contributing to the overall sustainability of the sector and the livelihoods of the many thousands of farmers involved.

BACKGROUND

Marine finfish aquaculture in Asia has been developing rapidly at around 10 percent per annum over the last decade and is the fastest growing sub-sector in Asia. Much of this increasing production is attributable to the expanding culture of high-value marine carnivorous species. The countries that lead in marine finfish aquaculture currently are China, Indonesia, Viet Nam and Thailand, as well Korea and Japan, with India planning a major expansion.

Asian finfish mariculture, particularly grouper and cobia farming, is growing rapidly in China, Viet Nam and Indonesia and is largely dependent on trash fish/low-value fish as feed. The total use of 'trash fish' by the aquaculture industry in Viet Nam was estimated to be between 176 420 and 323 440 tonnes in 2001 (Edwards *et al.*, 2004)[1]. A recent estimate placed the Asian use of TF/LVF as fish feed at about 1.6-2.8 million tonnes per year (FAO, 2008)[2]. It is further projected that Viet Nam will use nearly one million tonnes of trash fish and China will require approximately 4 million tonnes by the year 2013 to sustain their marine cage culture activities (De Silva and Hasan, 2007)[3]. The use of TF/LVF as aquaculture feed is unlikely to be sustainable as the supplies of trash fish are declining apart from potential environmental effects and biosecurity risks the use of trash fish may bring about and the increasing consumer's concern about its usage in aquaculture feed when many of these TF/LVF can be used as human food (Tacon, Hasan and Subasinghe, 2006)[4].

The issue was identified as a regional priority by the Asia-Pacific Fishery Commission (APFIC) which endorsed a regional plan of action at its 29th Session[5] for reduction of dependence upon trash fish as aquaculture feeds. Taking into account the importance of this issue, the Governing Council of the Network of Aquaculture Centres in Asia-Pacific (NACA) at its 18th Meeting in Bali, Indonesia, unanimously recommended the need to initiate a regional project to reduce the dependence of small-scale marine fish farmers on trash fish as a feed source. The same issue was also taken up at an FAO Expert Workshop on "Use of wild fish and/or other aquatic species to feed cultured fish and its implications to food security and poverty alleviation", held in Kochi, India in 2007 and the workshop recommended that work on encouraging farmers to use compounded feeds in mariculture be urgently undertaken. This project is a response to these concerns.

IMPLEMENTATION/ COORDINATION

The project is implemented under the overall co-ordination of NACA. The respective governmental national focal agencies implementing the national activities of the project are as follows:

M. R. HASAN, FAO

Experimental cage culture of grouper and marine fish species at Krabi Coastal Fisheries Research and Development Center, Krabi, Thailand

M. R. HASAN, FAO

Preparation of trash fish/low value fish to be fed for cage culture grouper and other marine species, Krabi Coastal Fisheries Research and Development Center, Krabi, Thailand

Indonesia: Ministry of Marine Affairs and Fisheries - Implementing Institution: Main Center for Mariculture Development, Directorate General of Aquaculture, Lampung.

China: Guangzhou Provincial Government, through the Ministry of Agriculture, Central Government, Zhanjiang City, Guangdong.

Thailand: Ministry of Agriculture and Cooperatives - Implementing Institution: Phuket Coastal Fisheries Research and Development Centre (CFRDC), Phuket in collaboration with Krabi CFRDC, Coastal Fisheries Research and Development Bureau, Department of Fisheries.

Viet Nam: Ministry of Agriculture and Rural Development – Implementing Institution: Research Institute for Aquaculture No 3, Nha Trang.

EXPECTED OUTPUTS

The overall outcome of the project will be a reduced dependence on trash fish/low-value fish (and other marine resources) for marine finfish farming in China, Indonesia, Thailand and Viet Nam and more widely throughout Asia via NACA's networking mechanisms. The outcome will be achieved through a combination of:

- Assessment of the livelihoods involved in the supplying of trash fish/low-value fish, its marketing channels, and on farmer perceptions in the use of trash fish/low-value fish as aquaculture feed in all four countries;
- Improved feed practices and a shift in the sector towards better diets, and particularly the use of formulated diets. This outcome will increase the long term viability of marine fish farm operations and improve the livelihood of practitioners and contribute to poverty alleviation;
- Establishment of a scientifically rigorous database on the advantages of using pellet feeds;
- Development of better management practices (BMPs) for improving efficiency of marine finfish feeding and building capacity amongst practitioners on improved feed management; and
- Dissemination of BMPs through farmer organizations such as "aquaclubs" and use of such organizations as mechanisms to develop credit schemes for procuring feeds.

PROGRESS

(1) Inception planning workshop

The first activity of the TCP was an Inception Planning Workshop, convened in Krabi, Thailand, from 8 to 10 September 2008, hosted by the Department of Fisheries, Royal Government of Thailand and held at the Golden Beach Resort, Krabi, Thailand. The workshop was attended by 16 participants (11 from four project participating countries, 3 from NACA and 2 from FAO) and one observer from a feed industry. The workshop was facilitated by 3 NACA personnel (SS De Silva, MJ Phillips and H Kongkeo) and 2 FAO officers (MR Hasan and M Weimin).

The workshop discussed follow-up project activities and finalized the modus operandi with primary focus on the following: a) project concept, rationale, envisaged outputs and broad outline of activities and the feasibilities of carrying out the different activities, b) draft questionnaire outlines that were prepared in respect of the livelihood analysis of trash fish (TF)/low-value fish (LVF) supplier and the environmental impact assessment components, c) methodology to study the farmers' perception on the use of TF/LVF vs. formulated feed, d) in-country logistics of conducting different project components and survey plans for each country, e) overall work plan including the time-frame of implementation and responsibilities of all project holders, and f) other important issues/problems to be addressed before launching the field activities.

The main outputs of the workshop were:

- Better understanding of the marine fish farming sector in the four participating countries directly dependent on TF/LVF as feed for aquaculture and the importance of this TCP for sustainable development of this sub-sector;
- Increased understanding of the project concept, rationale, mechanism of project implementation, envisaged outputs and broad outline of activities and the feasibilities of carrying out the planned activities of different components of the project;
- Outputs related to the implementation of different activities of the project with specific reference to participating countries:
  - nature and extent of the information to be collected for livelihood analysis of TF/LVF supplier and suggestions for revision of draft questionnaires to be used for livelihood analysis survey;
  - design of the livelihood survey including identification of survey location/area, type and size of TF/LVF sample to be surveyed in respective countries,
  - revised methodology of rural rapid appraisal for farmers' perception study on the use of TF/LVF vs. formulated feed;
  - guidelines for carrying out environmental impact assessment study including type of water quality monitoring, sample size and frequency of data collection; and
  - framework of farmer's participatory trial including the selection of site in each country, type of species, number of farms, cage size, duration of growth cycle and monitoring requirement; and
  - finalized TOR of first national stakeholders' workshop/training in four participating countries.

(2) Viet Nam in-country national stakeholder workshop/training

This workshop was organized in Nha Trang from 24 to 27 November 2008 with the participation of national counterparts (National Project Coordinator and other project staff), researchers from Research Institute of Aquaculture (RIA-3) and the University of Nha Trang, other stakeholders (fish farmers and trash fish suppliers), Feed Company (EWOS) representative and NACA. The workshop finalized the selection of farmers for farmers' participatory trial (FPT) including the species to used, time-frame for livelihood analysis for TF/LVF suppliers, record keeping format for FTP, environmental data collection, preliminary design and time table for the FTP.

FORTHCOMING ACTIVITIES

- In-country National Stakeholder Workshop/Training, 2-4 February 2009, Lampung, Indonesia
- In-country National Stakeholder Workshop/Training, 12-14 February 2009, Phuket, Thailand
- In-country National Stakeholder Workshop/Training, Zhanjiang, Guangdong, China, dates to be decided

PUBLICATIONS/REPORTS

- Inception Planning Workshop Report, Krabi, Thailand, 8-10 September 2008
- Report of the National Stakeholder Workshop/Training, Nha Trang, Viet Nam, 24-27 November 2008

S. S. DE SILVA, NACA

Tiger grouper, Epinephelus fuscoguttatus *and humpback grouper,* Cromileptes altivelis

More information on the project can be obtained from Mohammad R. Hasan: FAOHQ Mohammad.Hasan@fao.org, Cécile Brugère: FAO/HQ Cecile.Brugere@fao.org Miao Weimin: FAORAP weimin.miao@fao.org Sena S. De Silva: NACA/Bangkok: sena.desilva@enaca.org

[1]Edwards P., Tuan, L.A. & Allan, G.L. 2004. *A survey of marine trash fish and fish meal as aquaculture feed ingredients in Viet Nam*. ACIAR Working Paper 57, 56 pp.

[2]FAO, 2008. Report of the FAO Expert Workshop on the Use of Wild Fish and/or Other Aquatic Species as Feed in Aquaculture and Its Implications to Food Security and Poverty Alleviation, Kochi, India, 16–18 November 2007. FAO Fisheries Report No. 867. Rome, FAO, 29 pp.

[3]De Silva, S.S. and Hasan, M.R. 2007. Feeds and fertilizers: the key to long term sustainability of Asian aquaculture. *In* M.R. Hasan, T. Hecht, S.S. De Silva and A.G.J. Tacon.(eds). Study and analysis of feeds and fertilizers for sustainable aquaculture development. *FAO Fisheries Technical Paper.* No. 497, Rome, FAO. pp. 19-47.

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

[5]FAO (2006) Asia-Pacific fisheries Commission, report of the 29th Session, RAP Publication 2006/19, FAORAP, Thailand, Bangkok. 39 p.

On-going process towards regional collaboration in fisheries and aquaculture in Central Asian and Caucasus countries

A first step towards regional intergovernmental collaboration in capture fisheries and aquaculture in Central Asia and the Caucasus was recently taken by the Government of Tajikistan. Together with FAO, the Ministry of Agriculture of Tajikistan organized the "Regional Intergovernmental Meeting to Initiate the Establishment of a Central Asian Regional Fisheries Organization". This intergovernmental meeting was held in Dushanbe, Tajikistan on 10-12 November 2008.

The meeting aimed to bring together responsible authorities for capture fisheries and aquaculture from the wider Central Asian region to discuss major regional fisheries and aquaculture problems and issues, and to discuss a proposal for the establishment of a regional fishery and aquaculture arrangement (network or regional commission), taking into consideration existing programmes, networks and available institutional capacity in fisheries and related sectors

The meeting was attended by delegates of the governments of Armenia, Azerbaijan, People's Republic of China, Georgia, Kazakhstan, Kyrgyzstan, Tajikistan, Turkey and Uzbekistan. The FAO Sub regional Office for Central Asia (FAOSEC) and FAO Headquarters provided technical assistance to the meeting.

Mr Kasymov, Minister for Agriculture of Tajikistan, officially opened the meeting and offered the assistance of his ministry to the establishment process for a regional fisheries and aquaculture organization. Overviews of the status of the sector were presented and lessons learned from other regional networks, commissions and organizations were discussed in detail.

The main conclusions from the meeting were the following:

- A regional fisheries and aquaculture arrangement should be financially sustainable, pragmatic, flexible, non-bureaucratic and simple to manage.
- While preferences for certain regional arrangements (specifically Art. 6 and Art. 14 under the FAO constitution and an intergovernmental organization or IGO) were indicated, the meeting agreed that more time was needed to consider all the information. In particular, some delegates requested more time to discuss the various options with competent national authorities.
- The name of the future regional arrangement should reflect its regional scope and objectives; being Central Asia and Caucasus region and both inland capture fisheries and aquaculture development and management.
- Most country delegates preferred a regional arrangement open to all countries concerned, because of the transboundary nature of water bodies and related fish stocks in the region, among other reasons.

R. VANANROOY

The follow-up from this first meeting involves the establishment of a Steering Committee to prepare an outline agreement conceiving a regional collaborative fisheries and aquaculture arrangement. On request of the country delegates,FAO will support the preparation of the agreement and a meeting of the Steering Committee through a TCP-Facility project (TCP/RER/3203) "Support to the establishment of a regional fisheries and aquaculture organization for Central Asia and the Caucasus". The meeting of the Steering Committee will be held at the FAOSEC in Ankara March 2009. It is likely that a second intergovernmental meeting will be called for in mid-2009.

More information can also be obtained from Mr Raymon van Anrooy (FAOSEC) att Raymon.vanAnrooy@fao.org; Mr Ndiaga Gueye (FIEL) at Ndiaga.Gueye@fao.org; Mr Blaise Kuemlangan (LEGN) at Blaise.Kuemlamgan@fao.org or Mr Gerd Marmulla (FIMF) at Gerd.Marmulla@fao.org.

FAO supported the 4th International Symposium on GIS/Spatial Analyses in Fishery and Aquatic Sciences

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FAO actively participated in this symposium with:

two keynote speeches[2]

- Status of GIS, remote sensing and mapping in addressing the principle, objectives and practices of the ecosystem approach to aquaculture (EAA) (J. Kapetsky, J. Aguilar-Manjarrez and D. Soto);
- Status and potential of GIS in implementing the ecosystem approach to fisheries (EAF)(F. Carocci, G. Bianchi, P. Eastwood and G. Meaden);

one oral presentation

- The potential for open ocean aquaculture in Exclusive Economic Zones from global and national perspectives (J. Kapetsky and J. Aguilar-Manjarrez) (Figure 1);

a PC demonstration

- GISFish[3] (J. Aguilar-Manjarrez, J. Kapetsky and F. Carocci) and

a poster presentation

- Identification of reef habitat of the endangered Napoleon Fish using remote sensing and GIS (F. Carocci).

FAO also participated in the sum-up panel discussion session which highlighted the progress being made and discussed ways to move forward.

The main theme of the symposium was the move towards Ecosystem Approach to Aquaculture (EAA) and Ecosystem Approach to Fisheries (EAF), whose application is likely to increase over the next decade. From a GIS perspective, it was noted that the EAA and EAF have many attributes which are common to both aquaculture and fisheries in terms of issues, technological developments as well as data needs. Addressing and taking advantage of these commonalities in implementing EAA and EAF can lead to cost-effective data collection, data processing, spatial analyses and training. While economic or social factors relating to spatial aspects of fisheries or aquaculture were not highlighted during the symposium, in the future, this is likely to change as EAA and EAF become widely applied as important management tools for sustainable aquaculture and responsible fisheries.

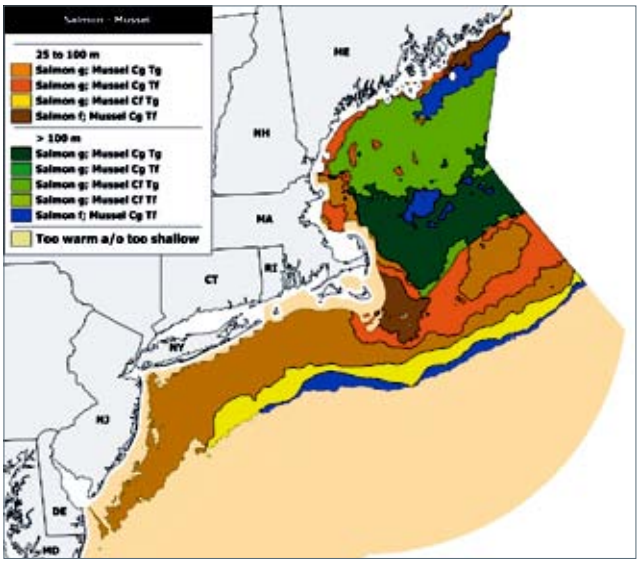

Figure 1. Areas in the United States of America Eastern Exclusive Economic Zones in which Atlantic salmon and blue mussel culture could be integrated which could result in high productivity for both species in terms of depths within the limits of cages and long lines. (Source: symposium presentation by Kapetsky and Aguilar – available at www.fao.org/fishery/gisfish/id/4974)

[1]The symposium, held at Santa Ursula University, Rio de Janeiro, Brazil from 25 to 29 August 2008, is a tri-annual event organized by the Fishery-Aquatic GIS Research Group, a non-profit organization established in 1977 and based at the Environmental Simulation Laboratory in Kawagoe, Saitama, Japan.
[2] www.fao.org/fishery/gisfish/id/5003
[3]www.fao.org/fishery/gisfish

Outcomes of the fourth session of the sub-committee on aquaculture of the committee on fisheries

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The fourth session of the Sub-Committee on Aquaculture of the Committee on Fisheries (COFI) was held in Puerto Varas, Chile, from 6 to 10 October 2008 at the kind invitation of the Government of Chile. It was attended by 38 Members of FAO, by representatives from one specialized agency of the United Nations and by observers from 6 intergovernmental and 3 international non-governmental organizations. Ms Marisol Alvarez (Chile) was elected Chairperson of the Sub-Committee. Ms Supranee Chinabut (Thailand) was elected first Vice-Chairperson. Russia and Australia were elected second and third Vice-Chairs respectively. The Sub-Committee elected Ms Linda Chaves (United States of America) Chairperson of the Drafting Committee with the membership of Belgium, Canada, China, Ecuador, India, Mexico, Norway, Thailand, Uganda and the United States of America.

Important highlights are briefly described below. Technical documents, session report and other relevant information are available at www.fao.org/fi/

Coordinating Working Party on Aquaculture Statistics

The Secretary of the Coordinating Working Party on Fisheries Statistics (CWP) reported the progress towards establishing a CWP Aquaculture Group and highlighted the conclusions and recommendations of the recent meeting held in Puerto Varas. The meeting agreed that harmonization of terminology, concepts, methodologies and standards should be the priorities. In this regard, the Secretary requested assistance from members for participation and funding support.

Implementation of the recommendations from previous sessions

The Sub-Committee commended the Secretariat on the quality, integrity and comprehensiveness of the documents and reaffirmed its support for FAO activities. The Sub-Committee expressed its strong satisfaction on the progress made, especially considering limited financial resources.

Members acknowledged FAO's efforts in the development of African aquaculture, in particular the establishment of the Special Programme for Aquaculture Development in Africa (SPADA) and the Aquaculture Network for Africa (ANAF). A number of members recognized the relevance of creating aquaculture networks for the development of sustainable aquaculture and also stressed the importance of the establishment of the Aquaculture Network of the Americas (ANA).

Special Programme for Aquaculture Development in Africa (SPADA)

The powerpoint presentation made by the Secretariat on the FAO Fisheries and Aquaculture Department's Special Programme for Aquaculture Development in Africa (SPADA) was well received by the Members. Two other presentations were also made by representatives from two African Members and NEPAD (New Economic Partnership for Africa's Development). The Sub-Committee, in particular all the African members and NEPAD, expressed its appreciation to FAO for the SPADA initiative, urged FAO to further promote and use SPADA as the coherent framework for aquaculture development in Africa, and called for participation of and funding support by development agencies.

Technical guidelines on aquaculture certification

Members commended the work and efforts of the Secretariat to advance the preparation of the technical guidelines on certification in aquaculture and in preparing a draft document which constitutes a good basis for continuing with the processes to finalise the guidelines. Members highlighted the importance of these guidelines for facilitating international trade in aquaculture products and the priority they attach to their finalisation so that guidelines can serve as a basis for the development of transparent and globally acceptable certification schemes in aquaculture. The Sub-Committee requested FAO to invite members to submit their comments on the present draft guidelines by 31 January 2009, and that these comments be consolidated by FAO into a new version of the draft guidelines to be sent to FAO members by 31 March 2009. It was further recommended that the revised version will be discussed at a technical consultation to be held as soon as possible in 2009. During its 28th session in March 2009, COFI will be requested to consider delegating the technical consultation authority to finalise and adopt the guidelines.

Progress reporting on the Code of Conduct for Responsible Fisheries (CCRF)

Many Members expressed their appreciation for the analysis provided and noted that some progress had been made in the last reporting period but at the same time recognized that further improvement was needed. The proposal for a revised reporting mechanism with an interactive questionnaire format was received positively by the Sub-Committee. With regard to the questionnaire for evaluating the progress being made in the implementation of the Code, most Members advised that further work on the proposed reporting template is required. The Sub-Committee recommended that a revised pilot version of the questionnaire format be tested in different regions reflecting different environmental conditions in order to ensure global applicability

Towards better governance in aquaculture

The Secretariat presented the paper on opportunities and challenges for better governance in aquaculture. During the discussion on the agenda item, some Members described their national activities towards strengthening governance in aquaculture. These include risk management frameworks, aquatic animal health management programmes, aquaculture certification and assistance to small-scale aquaculture. Some Members described their collaborative efforts with farmers and farmers' associations particularly using a participatory approach in providing extension and support services. Self-governance was considered to be an additional desirable approach, and the need for capacity building at farmers and farm organization levels was underscored. A few Members indicated that their countries do not have specific aquaculture policies or legislation since it is a relatively recent activity for them.

Building awareness on success stories and highlighting the positive impacts of aquaculture were considered important. Some Members suggested that practical country case studies of successful governance models could be discussed by the Sub-Committee and disseminated in order to improve the sectoral management by other members.

Upon the suggestion of several members, the Secretariat organized a Side Event to share good governance initiatives and experiences. Chile, China, India, Mozambique, Norway as well as NACA and OSPESCA presented their experiences in Aquaculture Governance.

Challenges in meeting the rising the global demand for food fish

The Sub-Committee appreciated the review made by the Secretariat of the current situation, issues and challenges for the sector including the demand for aquaculture products, continued growth of aquaculture, trends in species, consumption and trade, small-scale producers and market access, social responsibility, marine resources and aquafeed, environmental and social aspects, diversification and expansion, communication and networks, and aquaculture insurance.

African participants stressed that the challenges highlighted relate to governance especially supporting structured and responsible growth of the smallholder private sector and the need for supportive and appropriate policies and legislation. This requires access to high quality inputs such as improved fish seed and feed, credit, information and education. Members requested technical assistance for implementing their national aquaculture development plans and for dealing with the challenges at hand.

Many countries, supported by NEPAD, emphasized the need for a regional approach concerning disease outbreaks and the need to establish an aquatic biosecurity framework and requested FAO to provide technical assistance through a regional technical cooperation project under the umbrella of SPADA.

Several countries stressed that well-planned and well-managed aquaculture leads to social benefits, improving food security and helping towards progress in achieving the Millennium Development Goals. The need to educate the public on achievements and positive developments of aquaculture were mentioned. Critical issues identified were i) improving the governance, and organization of farmers, ii) environmental issues including effluents, iii) continued availability of fish feeds, and iv) the integration of aquaculture into water resource management and agricultural sector management plans. Other challenges mentioned included capacity building and farmer training to become more competitive and meet trade requirements, benefits and risks of seafood, sharing of best practices and the need to publicize positive impacts of certain aquaculture practices. Aquaculture in offshore areas was mentioned as promising but still requiring efforts in research as well as improvements in technology and regulatory framework. Climate change and possibilities for mitigation were mentioned by several members as issues of increasing importance that could be dealt with in collaboration with other specialized agencies.

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Some countries mentioned the importance of food safety and the need for cost-effective certification and requested FAO to continue its work towards better market access including through the linkage particularly of small-scale farmers with fair trade organizations. A request was made for FAO technical assistance towards establishing and implementing an ASEAN regional aquaculture development strategy including certification implementation, traceability and cluster farm management. It was suggested that the Sub-Committee examine and report on the use of aquaculture technologies to enhance and rebuild depleted fisheries.

Aquaculture information products

The Secretariat made a presentation on Aquaculture Information Products of the FAO Fisheries and Aquaculture Department.

Fifth Session of the Sub-Committee

The Fifth Session of the Sub-Committee will be held in Thailand in 2010. The Sub-Committee expressed its gratitude to the government of Thailand for its offer to host the session. The exact date and place of the Fifth Session will be decided in consultation with the Royal Thai Government and will be communicated to the Members accordingly.

More information is available on request by writing to Rohana.Subasinghe@fao.org, Technical Secretary of the Sub-Committee on Aquaculture.

Gouvernance de l'aquaculture: expériences et leçons apprises de quelques Etats Membres de la FAO et de certaines Organisations intergouvernementales

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INTRODUCTION

Lors de la quatrième session du Sous-Comité de l'aquaculture du Comité des pêches qui s'est tenue à Puerto Varas (Chili) du 6 au 10 octobre 2008, sur proposition de plusieurs Membres, le Secrétariat a organisé un événement spécial sur la gouvernance de l'aquaculture. Cet événement visait la mise en commun des initiatives et expériences de bonne gouvernance. Le Chili, la Chine, l'Inde, le Mozambique, la Norvège, ainsi que le Réseau de centres d'aquaculture pour la région Asie et Pacifique (NACA) et l'Organisation du secteur des pêches et de l'aquaculture de l'isthme centraméricain (OSPESCA), ont présenté chacun leur expérience en matière de gouvernance de l'aquaculture. Ce papier donne le résumé des ces expériences et des leçons que l'on peut en tirer.

RÉSUMÉ DES INTERVENTIONS: PARTAGE DES EXPÉRIENCES

Illustrant le contexte du développement de l'aquaculture dans son pays, notamment les cadres politiques, juridiques et institutionnels pertinents, le présentateur de l'expérience du Chili a indiqué que ces cadres avaient permis un développement important de l'aquaculture dans son pays au cours des dix dernières années. Il a par ailleurs indiqué que le Chili avait adopté une approche participative pour la définition d'instruments de gouvernance et l'établissement de directives pour l'industrie du saumon. L'adoption de la Loi de base sur l'environnement et de la Politique nationale d'aquaculture il y a une décennie a été un événement important pour la gouvernance de l'aquaculture. Il a souligné que son pays s'attelle maintenant à améliorer le cadre juridique existant dans le but de renforcer la responsabilité sociale et environnementale, et de satisfaire aux exigences internationales sans nuire à la compétitivité du secteur.

En Chine, la gouvernance de l'aquaculture a attiré toute l'attention des responsables politiques il y a plus d'une trentaine d'années. Cependant, assurer la durabilité de l'aquaculture reste un sujet d'actualité et constitue toujours l'essence des lois et des règlements dans le pays. Il existe trois systèmes de gestion de l'aquaculture en Chine, à savoir: la planification de l'aquaculture en eau de surface et sur estran, la certification en aquaculture et la certification dans le domaine de la production de semences. La gouvernance est définie à tous les niveaux administratifs et fait intervenir cinq types d'institutions, notamment: les institutions gouvernementales pour les politiques, la planification et les permis; les institutions d'application de la loi pour la surveillance et l'exécution; les institutions de recherche pour la recherche; les institutions de vulgarisation pour la démonstration et la formation; et les centres de prévention des épidémies pour le suivi, l'alerte et le contrôle.

L'expérience de l'Inde a porté sur la gouvernance en matière de crevetticulture durable. Cette expérience est née de la responsabilisation des petits aquaculteurs grâce à une stratégie de rassemblement des exploitations. En constituant les groupements d'exploitations crevetticoles et en mettant en application les pratiques optimales de gestion de ces exploitations, on a abouti à la création du «Centre national d'aquaculture durable», une institution gouvernementale

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dont l'objet principal est d'étendre et gérer la stratégie de rassemblement des exploitations aquacoles. Cette approche (rassemblement des exploitations aquacoles) a permis de renforcer l'autonomie des petits aquaculteurs dans la mesure où elle leur a fourni un cadre idéal pour, par exemple, répondre aux exigences du marché. Les experts estiment que ce modèle de gestion et d'encadrement des aquaculteurs devrait se reproduire automatiquement et s'étendre à la plus grande partie du secteur aquacole national, notamment, le secteur crevetticole.

Le Gouvernement mozambicain a recouru aux mesures administratives et institutionnelles, et des mesures politiques et législatives comme instruments de bonne gouvernance. Au sujet des mesures administratives et institutionnelles prises, le Gouvernement a créé, en 2000, le Ministère des pêches, et en 2002, une Division de l'aquaculture a été créée au sein de ce ministère. Par ailleurs, en 2008, l'Institut pour le développement de l'aquaculture a été mis en place pour promouvoir ce secteur. Quant aux mesures politiques et législatives, le Mozambique dispose de divers instruments de gouvernance dont une réglementation sur l'aquaculture, une relative à l'inspection et à l'assurance qualité des produits de la pêche et de l'aquaculture, un code d'usages et des procédures opérationnelles normalisées pour la crevetticulture, une stratégie de développement de l'aquaculture destinée à guider le développement du secteur en général et une politique gouvernementale visant à réduire les tarifs douaniers appliqués aux aliments pour poissons importés. Un plan pour la prévention et le contrôle des maladies, avec les règlements connexes, est en préparation. En même temps, la loi sur les pêches, la réglementation relative à l'inspection et à l'assurance qualité des produits de la pêche et de l'aquaculture ainsi que le code des avantages fiscaux et le plan directeur sur les pêches sont en cours de révision.

L'un des objectifs du Gouvernement norvégien en matière de gouvernance de l'aquaculture est d'assurer la durabilité environnementale en freinant les effets négatifs de l'aquaculture sur le milieu naturel, tout en préservant la compétitivité du secteur et en garantissant la transparence demandée par l'opinion publique. D'autres objectifs incluent les ruptures de confinement, la pollution, la santé et le bien-être des poissons, ainsi que les ressources en aliments pour poissons. Dans cet ordre d'idées, l'intervention du délégué de la Norvège a porté sur l'expérience de son pays dans la gouvernance de l'aquaculture d'eau froide en cages. Il a précisé que son pays utilise essentiellement des instruments législatifs dans la gouvernance de l'aquaculture en cages. Il s'agit notamment de la loi sur l'aquaculture qui s'appuie sur quatre piliers dont la rentabilité et compétitivité, la durabilité, la simplification de la législation et de l'administration ainsi que l'accès aux zones côtières. Il s'agit aussi de la loi alimentaire, qui, elle aussi, repose sur quatre piliers incluant la sécurité sanitaire des aliments, l'assurance de la santé, de la qualité et de l'intérêt des consommateurs, une industrie de production alimentaire viable et un accès durable au marché, et une bonne santé végétale et animale.

Le représentant de NACA a partagé l'expérience de son Organisation en se servant d'un paquet d'exemples de réussite en aquaculture. Il a mis en exergue certaines expériences de développement aquacole ayant eu des impacts socio-économiques positifs avec un minimum d'effets négatifs sur l'environnement, ce qui a permis de mieux comprendre les facteurs et les approches favorisant une croissance durable de l'aquaculture accompagnée de changements sociaux positifs.

Dans son intervention, le représentant d'OSPESCA,

qui a parlé de la gouvernance de l'aquaculture en Amérique centrale, a indiqué que l'un des objectifs de son Organisation était de promouvoir un développement durable et coordonné des pêches et de l'aquaculture en Amérique centrale, et que ses pays membres ont oeuvré de concert pour cet objectif. L'harmonisation et la mise à jour des législations dans presque tous les pays, la modernisation des politiques nationales, une participation coordonnée aux tribunes internationales, le partage des expériences et la mise en œuvre de projets régionaux représentent quelques unes des réalisations communes signalées. Les Membres d'OSPESCA utilisent le Code de conduite de la FAO pour une pêche responsable comme guide.

LEÇONS APPRISES

Quelques leçons qui peuvent être tirées des expériences qui ont été partagées par quelques Etats Membres ainsi que par les représentants de certaines Organisations intergouvernementales ayant pris part à cette session du Sous-Comité de l'aquaculture du Comité des pêches peuvent se résumer comme suit : (1) Pourvu qu'il y ait une bonne gouvernance du secteur, le développement d'une aquaculture responsable et durable est possible et réelle à tous les échelons ; (2) Pour aboutir à une aquaculture durable et responsable, différents instruments de bonne gouvernance peuvent être utilisés dans différentes situations.

La bonne gouvernance s'appuie sur l'existence de textes législatifs clairs, transparents, équitables et aisément applicables, des réglementations simples couvrant tous les aspects de l'aquaculture et de sa chaîne de valeur, des mesures d'incitation économiques favorisant l'adoption de pratiques éprouvées, l'aide et l'encouragement aux exploitants pour les inciter à formuler, soutenir et appliquer des codes de gestion auto réglementés et à promouvoir des systèmes de production durable. Une bonne gouvernance de l'aquaculture nécessite également des institutions et des appareils administratifs solides et efficaces.

English Summary

At the fourth session of the Sub-Committee on Aquaculture of the Committee on Fisheries (COFI), which was held in Puerto Varas, Chile, from 6 to 10 October 2008, and at the request of several delegates, the Secretariat organised a special event on Aquaculture Governance. The aim was for countries to share their initiatives and experiences in this area. Chile, China, India, Mozambique, Norway as well as NACA (Network of Aquaculture Centres in Asia-Pacific) and OSPESCA (la Organización del Sector Pesquero y Acuícola del Istmo Centroamericano) were the presenters. This paper summarises their interventions and presents some lessons learned from their experiences. Provided that there is good governance of the sector, a sustainable and responsible aquaculture development is possible, and at all scales. Different governance instruments are available for use in different situations. Good governance in aquaculture requires predictable, transparent, equitable and easily enforceable legislative frameworks and simple regulations covering all aspects of aquaculture and its value chain, economic incentives that encourage best practices, prompting and assisting farmers to elaborate, support and enforce self-regulating management codes and the promotion of sustainability-conducive production systems. It is equally important to have robust and efficient institutional and administrative setups in place.

RECOFI-WGA Regional Technical Workshop on Aquatic Animal Health

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The Regional Commission for Fisheries (RECOFI) Regional Technical Workshop on Aquatic Animal Health, held in Jeddah, Kingdom of Saudi Arabia, from 6 to 10 April 2008, was implemented by the RECOFI Working Group on Aquaculture (WGA) in response to one of the recommendations of the fourth session of RECOFI (Jeddah, Kingdom of Saudi Arabia, 7–9 May 2007) and technical meeting of the RECOFI Regional Aquaculture Information System (Kuwait City, Kuwait, 6–8 November 2007). Hosted by the Ministry of Agriculture of the Kingdom of Saudi Arabia, 19 delegates participated representing official participants and observers from five RECOFI member countries (Bahrain, Saudi Arabia, Oman, Qatar and the United Arab Emirates) and representatives from FAO (Cairo, Jeddah and Rome).

The major activities undertaken during the workshop included: (1) a number of presentations[1] were delivered to set the scene for the regional strategy planning; (2) working group discussions tasked to examine the overall Aquatic Animal Health Programme component and essential elements that are covered, from both regional and national perspectives and from the overall goal and for each of the elements, to identify specific activities, timeframe, responsibility, indicators and potential problems; and finally approve the framework for the regional programme; (3) field trip to the National Prawn Company (NPC)[2] located at Al-Lith, south of Jeddah; and (4) a technical seminar[3]. As part of the programme planning exercise, the working groups were guided to perform a simple SWOT (strengthens, weaknesses, opportunities and threats) exercise, in which they brainstormed on these various categories as they relate to the development and success of a regional programme for aquatic animal health.

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Participants attending the RECOFI-WGA aquatic animal health workshop

The three main documentation outputs of the workshop were:

FAO/Regional Commission for Fisheries. 2008. Report of the Regional Technical Workshop on Aquatic Animal Health. Jeddah, Kingdom of Saudi Arabia, 6–10 April 2008. *FAO Fisheries and Aquaculture Report.* No. 876. Rome, FAO. 2008. 119p.

Arthur, **J.R., Reantaso, M.B. and Lovatelli, A. 2008.** RECOFI regional aquatic animal health capacity and performance survey: Summary of survey results and analysis. In FAO/Regional Commission for Fisheries. Report of the Regional Technical Workshop on Aquatic Animal Health. Jeddah, Kingdom of Saudi Arabia, 6–10 April 2008. *FAO Fisheries and Aquaculture Report.* No. 876. Rome, FAO. pp. 21–99

RECOFI. 2008. Proposal for a regional programme for improving aquatic animal health in RECOFI member countries. In FAO/Regional Commission for Fisheries. Report of the Regional Technical Workshop on Aquatic Animal Health. Jeddah, Kingdom of Saudi Arabia, 6–10 April 2008. *FAO Fisheries and Aquaculture Report.* No. 876. Rome, FAO. pp. 101–118.

The workshop report (FAO/RECOFI, 2008) highlighted the major achievements of the workshop which included the following:

- RECOFI member countries fully cooperated in the completion of the questionnaires which were presented and further discussed and finalized during the workshop and served as basis for the development of a regional programme.
- Proposal for a Regional Programme for Improving Aquatic Animal Health in RECOFI member countries – developed during the regional workshop based on the

outcomes of the questionnaire survey and the working group discussion; outlines a long-term agreed-upon plan of activities to improve aquatic animal health capacity in the RECOFI member countries and identifies activities of regional interest and importance.

- Awareness and capacity building on aquatic animal health – a significant activity where workshop participants acquired knowledge on aquatic animal health concepts such as basic fish health management, development of aquatic animal health strategy, general principles of the risk analysis process and field experiences in dealing with important aquatic diseases such as Koi herpes virus and epizootic ulcerative syndrome.
- Interim activities identified with agency responsibilities prior to the next RECOFI session scheduled for May 2009.

The survey and performance report (Arthur, Reantaso and Lovatelli, 2008) outlines the processes undertaken in the development of the survey questionnaires, its objectives, its implementation and the outcomes and analysis of the survey returns. The purpose of this survey was to obtain information on national capacity and the agencies mandated to implement aquatic animal health programmes for the eight RECOFI member countries (Bahrain, Islamic Republic of Iran, Iraq, Kuwait, Oman, Qatar, Saudi Arabia and the United Arab Emirates). The survey also collected relevant information essential to support the development of the aquaculture sector through healthy aquatic production and seeks opinions on the components and activities that might be included in a regional aquatic animal health programme. The results of this survey will help guide regional and national strategic planning for improving aquatic animal health and assuring adequate and rational support services to achieve sustainable aquaculture development. The survey questionnaire contained 18 sections pertaining to: (1) international trade in live aquatic animals and national border controls; (2) control of domestic movement of live aquatic animals and other domestic activities that may spread pathogens; (3) policy and planning; (4) legislation; (5) disease surveillance/monitoring; (6) disease diagnostics; (7) emergency preparedness and contingency planning; (8) extension services; (9) compliance/enforcement; (10) research; (11) training; (12) expertise; (13) infrastructure; (14) linkages and cooperation; (15) funding support; (16) current challenges; (17) constraints; and (18) additional information.

The proposal for a regional programme for improving aquatic animal health in RECOFI member countries (RECOFI, 2008) outlines a long-term, agreed-upon plan of activities to improve aquatic animal health capacity in the RECOFI member countries. The Programme identifies the activities of regional interest and importance that can be addressed jointly by RECOFI members and the national aquatic animal health activities that must be accomplished by individual RECOFI countries in order to accomplish the Regional Programme itself. The finalized Regional Programme will be submitted to the RECOFI Commission for endorsement and possible funding support. It may also be used to approach international organizations such as the World Organization for Animal Health (OIE) and other regional and bilateral mechanisms, as well as the RECOFI governments for possible funding and/or organizational support. The Regional Programme includes a Vision and set of Guiding Principles for aquatic animal health in the RECOFI region and consists of five Programme Components, within which are 18 Programme Elements containing a total of 44 Programme Activities. The five Programme Components address the broad themes of: Governance, Disease diagnostics, Aquatic biosecurity, Access to information, and Regional cooperation and networking. Throughout the various components of the Regional Programme, where appropriate, emphasis will be placed on developing capacity to deal with health problems in key species that are widely cultured in the RECOFI region. These include: marine finfishes (e.g. seabreams, groupers, snappers); penaeid shrimp; and freshwater finfish (e.g. tilapia, common carp). The Regional Programme recognized the importance of human capacity building, and this is addressed primarily in the form of training programmes and workshops for the various areas of aquatic animal health. Development of research capacity is also highly important; however, this generally involves post-graduate training and thus is to be addressed by the national governments.

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IQF shrimp produced by the National Prawn Company (NPC)

[1]Included presentations on (a) Harmonization of international and regional planning and policy for aquatic animal health – experiences from Asia and elsewhere; (b) RECOFI regional aquatic animal health capacity and performance survey – survey results and analysis; (c) Regional strategy for improving aquatic animal health capacity in RECOFI member countries; and (d) Outline of possible contents of a regional strategy.

[2]The NPC is one of the world's largest fully integrated desert coastal shrimp (*Penaeus indicus*) farm, resulting from research and development initiated in late 1990s.

[3]Included presentations on (1) Health management in aquaculture; (2) Lessons learned in managing Koi herpes virus outbreak in Indonesia and epizootic ulcerative syndrome in southern Africa; (3) Role of risk analysis in aquatic animal health planning and management; and (4) Some practical experience in risk analysis for aquatic animals.

FAO technical assistance to the Democratic People's Republic of Korea on mariculture

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The Department of Fisheries and Aquaculture of FAO is in the process of finalizing a 2-year project document that aims at providing technical support to the finfish mariculture industry in the Democratic People's Republic of Korea through a Technical Cooperation Programme (TCP). The proposal under preparation will follow the structure of an earlier project[1] that successfully transferred sea cucumber and scallop hatchery and polyculture technologies through close technical cooperation with experts from neighbouring China consisting in a series of practical hands-on training sessions abroad as well as in-country technical support through the recruitment of competent regional aquaculture experts.

The Aquaculture Management and Conservation Service (FIMA) acknowledged the need to provide such technical support to the country and recommended that project outputs should be complementary to on-going national and international efforts in support of the national mariculture sector as a whole. The project formulation mission will be fielded next February with the participation of two Chinese experts. Prof Chen Jiaxin, former director of the Yellow Sea Fisheries Research Institute (YSFRI) in Qingdao and former FAO expert will lead the mission. Over the years he has worked in the country for FAO and has been involved with the implementation of different aquaculture projects. Prof. Jiaxin will be accompanied by Dr Gao Chun-ren, a cold water fish aquaculture expert working at the YSFRI (Chinese Academy of Fish Sciences) since 1984. He has been engaged in breeding research of commercially important marine finfish (including the seabass, *Lateolabrax japonicus*, the European turbot, *Scophthalmus maximus*, the red Seabream, *Pagrus major*, and the Humphead wrasse, *Cheilinus undulates*), fish disease and nutrition and has published over 50 scientific papers.

The expected output of the mission supported through TCP Facility funds is a revised and technically sound TCP project document on the transfer of cold water finfish aquaculture hatchery and farming technologies. The project document will clearly: i) identify the finfish species of relevance; ii) the type of technologies to be transferred; iii) identify the institute and country where training and study tours will be organized, respectively (most likely in the People's Republic of China considering that the two countries share the same marine species and climate conditions); iv) identify the TCDC (Technical Cooperation among Developing Countries) and national consultants needed and finalize their Terms of Reference; iv) work out a realistic activity workplan and implementation timetable based on the training needs and the biological culture cycle of the identified finfish species; v) identify and specify equipment to requirements; and vi) indicate actions the beneficiary Government will be in a position to undertake in scaling-up the activities following the FAO's assistance.

The new technical project proposal will be prepared in collaboration with FIMA (Responsible technical officer: Mr Alessandro Lovatelli) following the field mission to effectively verify and quantify the actual national needs (in terms of technologies, expertise required, equipment needs, etc.). Existing

A. LOVATELLI, FAO

Commercial harvest of the endemic species of sea cucumber (Apostichopus japonicus) *mainly for export markets*

A. LOVATELLI, FAO

A specimen of young Japanese kelp (Laminaria japonica) *farmed on submerged long-lines*

A. LOVATELLI, FAO

View of a typical coastal bay along the eastern coast of the Democratic People's Republic of Korea where sea cucumber, scallop and kelp polyculture is widely practiced by fishing and aquaculture cooperatives

aquaculture facilities will be visited by FAO's consultants to identify the most suitable project beneficiary facility.

The two consultants will be visiting and meeting up with representatives from Hongwon Fisheries' Cooperative, Hongwon County, South Hamkyong Province, and from Yanghwa Fishery Cooperative, based in Sinpo City, South Hamkyong Province which will likely become the new project site. Furthermore meetings will be arranged with representatives of the Ministry of Fisheries (External Cooperation Department, Inland and Mariculture Department, and Fisheries Information and Research Bureau) and technical staff of the East Sea Fishery Research Institute and Wonsan University of Fisheries.

The expected outcome of the mariculture project include a core of technicians from the fishing cooperative and researchers at the institutional levels (East Sea Fisheries Research Institute and the Research Institute of the Wonsan Fisheries University) trained on the artificial propagation, rearing fingerlings and cage culture techniques for commercially important marine species. The acquired skills and technical knowledge will certainly enable the adaptation of the introduced techniques to the local environmental and economic conditions of the country. Furthermore it is expected that the trained research personnel will provide technical support to the beneficiary fishing and mariculture cooperatives at the start of its hatchery operations particularly in areas such as diseases, chemical and microbiology analysis that require support from adequately equipped and staffed centres. The training course in China will give a unique opportunity to the participating cooperative members and technicians to experience and learn artificial propagation, cage culture management and farming techniques through practical hands-on activities and field visits of commercial operations. Useful contacts will be established with aquaculture specialists in China and formal contacts between research and training institutions will be strengthened. Linkages with aquaculture institutes, researchers and technicians in China should promote further exchanges of experiences and information among the two neighbouring countries. These human resources will certainly constitute the basis for future follow-up actions and expansion of mariculture activities on a larger scale in the Democratic People's Republic of Korea.

[1]The title of this project was "*Strengthening Marine Aquaculture Development*" (TCP/DRK/3001). The objective of the project was to introduce and transfer the technology of sea cucumber aquaculture, scallop spat production and pilot level demonstration of kelp-scallop-sea cucumber polyculture in the north-east coast of DPR Korea. The project was operationally closed at the end of January 2006 and the main project beneficiary was the Hongwon Fishing and Mariculture Cooperative. Among the outputs of the project was a technical manual on bivalve hatchery design and construction. This technical document has since been publish by FAO and is available (Sarkis, S.; Lovatelli, A (comp./ed.). Installation and operation of a modular bivalve hatchery. *FAO Fisheries Technical Paper.* No. 492. Rome, FAO. 2007. 173p. Contains a CD-ROM).

FAO's Code of Conduct for Responsible Fisheries and Technical Guidelines on Aquaculture

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The Code of Conduct for Responsible Fisheries (CCRF)[1] of FAO was adopted in October 1995 by over 170 Member Governments during the Twenty-eight Session of the FAO Conference. The process took four years from its initiation during the Nineteenth Session of the FAO Committee on Fisheries (COFI) in March 1991 which recommended that FAO develop the concept of responsible fisheries and to elaborate a Code of Conduct to achieve this. During the interim period since 1991, many activities, consultations and presentations in various international fora were undertaken.

Although a voluntary instrument, the CCRF represents a globally recognized international framework covering the world's marine, coastal and inland fisheries and including aquaculture. The Code which is based on major international agreements such as the United Nations Convention on the Law of the Sea (UNCLOS), United Nations Conference on Environment and Development (UNCED) and the Convention on Biological Diversity (CBD) sets the principles and international standards of behaviour for responsible practices with a view to ensuring the effective conservation, management and development of living aquatic resources, with due respect for the ecosystem and biodiversity. It contains 12 articles covering all major issues and practices in fisheries and aquaculture including those related to its implementation, monitoring and updating and special requirements of developing countries (see Box 1).

Since its adoption in 1995, there have been a series of 9 FAO Technical Guidelines for Responsible Fisheries (see Box 2)

The FAO CCRF and the supporting technical guidelines are available in all FAO languages. The Code has also been translated in other languages. The Code is also supported by a number of booklets containing different thematic information about the Code and described in a non-technical manner.

CCRF Technical Guidelines for Responsible Fisheries No. 5 – Aquaculture Development – and its supplements

The aquaculture section of the Code is contained in Article 9 on Aquaculture Development and which contains 4 principles on the following areas:

- Responsible development of aquaculture, including culture-based fisheries, in areas under national jurisdiction (9.1)
- Responsible development of aquaculture including culture-based fisheries within transboundary aquatic ecosystems (9.2)
- Use of aquatic genetic resources for the purposes of aquaculture including culture-based fisheries (9.3) and

Box 1

Art. 1 Nature and Scope of the Code
Art. 2 Objectives of the Code
Art. 3 Relationship with other International Instruments
Art. 4 Implementation, Monitoring and Updating
Art. 5 Special Requirements of Developing Countries
Art. 6 General Principles
Art. 7 Fisheries Management
Art. 8 Fishing Operations
Art. 9 Aquaculture Development
Art. 10 Integration of Fisheries intro Coastal Area Management
Art. 11 Post-harvest Practices and Trade
Art. 12 Fisheries Research

► Responsible aquaculture at the production level (9.4)

The **FAO Technical Guidelines for Responsible Fisheries No. 5 – Aquaculture Development**[2] – provides annotations to the above-mentioned principles. Such annotations are aimed to provide general guidance and should be taken as suggestions or observations which may assist interested parties in identifying their own criteria and options for actions, as well as partners for collaboration in support of sustainable aquaculture development.

Currently, 3 technical guidelines serving as supplements to FAO's Technical Guidelines for Responsible Fisheries No. 5 have been published. These are: 5.1 – Good Aquaculture Feed Manufacturing Practice; 5.2 – Health Management for Responsible Movement of Live Aquatic Animals; and 5.3 – Genetic Resource Management. Three guidelines are presently in preparation, namely: Use of Wild Fish/Fishery Resources for Capture-based Aquaculture, Ecosystem Approach to Aquaculture and Use of Wild Fish and Other Aquatic Species as Feed in Aquaculture.

Box 2

1 Fishing Operations (1996)
  1.1 Vessel Monitoring System (1998)
2 Precautionary Approach to Capture Fisheries and Species Introductions (1996)
3 Integration of Fisheries into Coastal Area Management (1996)
4 Fisheries Management (1997)
  4.1 Conservation and Management of Sharks (2001)
  4.2 The Ecosystem Approach to Fisheries (2003)
5 Aquaculture Development (1997)
  5.1 Good Aquaculture Feed Manufacturing Practices (2001)
  5.2 Health Management for Responsible Movement of Live Aquatic Animals (2007)
  5.3 Genetic Resource Management (2008)
6 Inland Fisheries (1997)
  6.1 Rehabilitation of Inland Waters for Fisheries (2008)
7 Responsible Fish Utilization (1998)
8 Indicators for Sustainable Development of Marine Capture Fisheries (1999)
9 Implementation of the Plan of Action to Prevent, Deter and Eliminate Illegal, unreported and Unregulated Fishing (2002)

CCRF Technical Guidelines No. 5 Suppl. 1 on Good Aquaculture Feed Manufacturing Practice[3] cover issues such as site location and design of manufacturing facilities; selection and purchasing of raw ingredients, including ingredient quality control; receiving ingredients; storage and handling of ingredients and finished goods; feed ingredient processing; feed formulation and manufacturing; packaging and labelling; warehousing and shipping; sampling methods and analysis; recalling defective or mislabelled product; plant cleanliness and worker safety; housekeeping; plant maintenance and repair; personnel; and documentation. The development of the guidelines took into consideration the outputs of the FAO Expert Consultation on Animal Feeding and Food Safety held in Rome, Italy from 10 to 14 March 1997 and an international collaborative effort with information drawn from Asia, Europe, North America, South America and Africa.

CCRF Technical Guidelines No. 5 Suppl. 2 on Health Management for Responsible Movement of Live Aquatic Animals[4] supports responsible fisheries management (Article 7), aquaculture development (Article 9), international trade (Article 11) and fisheries research (Article 12). The objective of these guidelines is to assist countries in reducing the risk of introduction and spread of serious transboundary aquatic animal diseases (TAADs) (both international and domestic

movements) through aquatic animal health programmes, national strategies on aquatic animal health and biosecurity and the application of precautionary approach. The national strategies consist of the following elements: policy, legislation and enforcement; risk analysis; pathogen lists; information systems; health certification; quarantine; disease surveillance, monitoring and reporting; zoning; emergency preparedness; research; institutional structure; human resources development; and regional and international cooperation. The guidelines also include guidance for farm-level health management and biosecurity programmes covering cluster management, better management practices, compliance with national legislation, certification, on-farm disease prevention, surveillance and reporting of disease outbreaks, emergency preparedness and information sharing and farmer education. The development of the guidelines took into consideration the outputs of the FAO Expert Workshop for the Preparation of the Code of Conduct for Responsible Fisheries Technical Guidelines on Health Management for Responsible Movement of Live Aquatic Organisms to Reduce the Risk of Spread of Infectious Aquatic Animal Diseases, held from 1 to 4 November 2005 in Dambulla, Sri Lanka. More detailed technical guidance in support of CCRF Technical Guidelines No. 5, Suppl. 2 have also been published[5].

CCRF Technical Guidelines No. 5 Suppl. 3 on Genetic Resource Management[6] provide guidance on broodstock management and domestication, genetic improvement programmes, dissemination programmes for genetically improved fish, economic considerations in genetic improvement programmes, risk assessment and monitoring, culture-based fisheries, conservation of fish genetic resources, gene banks, a precautionary approach and public relations. Twelve experts in the field of genetic resource management contributed to the individual chapters of the guidelines. The guidelines recognized that effective management of genetic resources, risk assessment and monitoring can help promote responsible aquaculture by increasing production output and efficiency and help minimise adverse impacts on the encvironment. The guidelines also emphasized the need to communicate the benefits of the responsible application of genetic principles to aquaculture to consumers, policy-makers, scientists and others interested in responsible fisheries and aquaculture.

[1] FAO. 1995. Code of Conduct for Responsible Fisheries. Rome, FAO. 41p
[2] FAO. 1997. Aquaculture development. FAO Technical Guidelines for Responsible Fisheries. No. 5. Rome, FAO. 40p..
[3] FAO. 2001. Aquaculture development. 1. Good aquaculture feed manufacturing practice. FAO Technical Guidelines for Responsible Fisheries. No. 5, Suppl. 1. Rome, FAO. 47p.
[4] FAO. 20007. Aquaculture development. 2. Health management for responsible movement of live aquatic animals. FAO Technical Guidelines for Responsible Fisheries. No. 5, Suppl. 2. Rome, FAO. 31p.
[5] Arthur, J.R., Bondad-Reantaso, M.G. & Subasinghe, R.P. 2008. Procedures for the quarantine of live aquatic animals: a manual. FAO Fisheries Technical Paper. No. 502. Rome, FAO. 74p.
[6] FAO. 2008. Aquaculture development. 5. Genetic resource management. FAO Technical Guidelines for Responsible Fisheries. No. 5, Suppl. 3. Rome, FAO. 125p.

A. LOVATELLI, FAO

Fish Farming Centre – Fish hatchery building and view from the inside

Updates on the Aquaculture Project in the Kingdom of Saudi Arabia

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The fisheries and aquaculture component of the latest 5-year Trust Fund Project between the Government of the Kingdom of Saudi Arabia (KSA) and the Food and Agriculture Organization of the United Nations (FAO) which is titled "Support to the Fish Farming Center in Jeddah" (Project Symbol UTFN/SAU/017/SAU) had its inception workshop in January last year. This short article describes what has been done in 2008 and the activities planned for 2009.

The main thrust of the project is capacity building for the national research staff, to better equipped them to perform their main function of conducting scientific aquaculture research. The Fish Farming Centre (FFC) is the only aquaculture research centre in the Kingdom which is tasked to generate science-based sustainable aquaculture technologies appropriate for the country. The capacity building focus of the project is assisting resident researchers to fully appreciate the process of scientific research from conceptualizing a problem, writing the proposal, conducting the research itself, gathering and interpreting data, and writing up the results and findings.

Specific training courses designed to answer specific needs in the Centre were also programmed and implemented. In May-June 2008, one researcher of the FFC attended the International Training Course on Marine Fish Hatchery Operations and Management organized by the Southeast Asian Fisheries Development Center (SEAFDEC), Aquaculture Department in Iloilo (Philippines) to learn new techniques on breeding and larval rearing of marine fish species such as groupers, Asian seabass and siganids, the same group of marine fish that the Centre is working on. In October 2008, two additional researchers attended a 1-month training courses on Fish Health Management and Culture of Natural Food Organisms, respectively, organized by the same organization in the Philippines. More training courses for the staff are planned for 2009. Furthermore, a fish health expert will be visiting the Centre this January to initiate the establishment of a PCR-based disease diagnosis lab. This will definitely improve the diagnostic capability of the Centre. During the first semester of this year, two aquaculture experts on cage aquaculture and environmental monitoring will also be visiting the Centre in Jeddah for capacity building on marine cage culture technology and environmental monitoring. It will be a very busy year ahead for the Centre and its staff.

F. G. AYSON, FAO

Fish health training – Preparing samples for virus detection using PCR

Misión para la implementación del proyecto "GDCP/RLA/001/SPA Desarrollo de la Acuicultura rural y de pequeña escala en América Latina y el Caribe"

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América Latina y el Caribe (ALC) hasta ahora no ha logrado un crecimiento importante en acuicultura que influya masivamente en toda la región. Sólo cuatro países concentran el 84% de la producción (Brasil, Chile, Ecuador y México). En cifras, la producción de América Latina y el Caribe en 2005 fue de un millón 400 mil toneladas, es decir sólo un 2,9% de la producción global. Sin embargo es una de las regiones con mayor potencial de crecimiento para el sector principalmente debido a la abundancia en recursos acuáticos tanto interiores como marinos. Por ello en el marco del Programa de Cooperación Descentralizada FAO - Xunta de Galicia (España), durante los meses de agosto y septiembre de 2008 se realizó una misión conjunta con el fin de ejecutar un diagnóstico en terreno de las condiciones y requerimientos físicos, económicos y financieros para la instalación y puesta en marcha de un proyecto de Desarrollo de la Acuicultura Rural y de Pequeña Escala en América Latina y el Caribe (Proyecto Galaqua).

En este contexto, entre el 23 de agosto y 11 de Septiembre de 2008 una misión compuesta por cinco expertos en acuicultura de Galicia y dos especialistas de la FAO, del Servicio de Gestión y Conservación de la Acuicultura (FIMA) y de la Oficina Regional de la FAO para América Latina y el Caribe (RLC) respectivamente, más una experta en comunicaciones y difusión en acuicultura; realizaron una "Misión Conjunta FAO/Galicia de Identificación y Formulación" en cinco países (El Salvador, Nicaragua, Costa Rica, Panamá y Perú). La misión tenía como objetivo conocer en terreno el estado de la acuicultura en dicha zona y contribuir a la elaboración de un documento de proyecto cuya puesta en marcha se estima en el primer trimestre de 2009, y con una duración de 36 meses.

El proyecto será parcialmente financiado por la Consellería de Pesca y Asuntos Marítimos de la Xunta de Galicia. La ejecución estará principalmente bajo la tutela de la Oficina Regional de FAO RLC con el apoyo técnico de FAO FIMA y del Centro Tecnológico del Mar (Fundación Cetmar) perteneciente a la Conselleria de Pesca.

PAÍSES VISITADOS

Para decidir los países a visitar durante la misión se realizó un análisis del estado de la acuicultura en 19 países de ALC, así como la identificación de las principales instituciones ligadas con el sector para buscar potenciales socios del proyecto. A través de las respectivas oficinas de FAO se coordinó la agenda de reuniones y visitas a terrenos en cinco países. En total se realizaron 45 encuentros informativos con autoridades nacionales y locales, representantes de organismos de investigación y educación y con acuicultores de estos países.

La visita a El Salvador se realizó entre el 23 y 25 de agosto de 2008 con el apoyo permanente de la Dirección General de Desarrollo de la Pesca y la Acuicultura (CENDEPESCA). La delegación visitó a los productores de tilapia de la Asociación de Regantes de Distrito Atiocoyo Sur. Este grupo se encuentra organizado a través de la Asociación de Acuicultores de Atiocoyo (ASACATOC). La actividad además cuenta con una Asociación de Acuicultores de El Salvador que reúne a los productores de todas las especies. Además del cultivo de peces, con apoyo de la Agencia Internacional de Cooperación Japonesa (JICA), en el Salvador se han desarrollado proyectos de cultivo de semillas de ostra del Pacifico (*Crassostrea gigas*), curil (*Anadara tuberculosa*) y casco de burro (*Anadara grandis*). Además están trabajando con un proyecto de construcción de arrecifes artificiales para la Ostra de Piedra (*Crassotrea iridescens*), con el fin de mejorar la calidad de vida de los pescadores a través del cultivo de moluscos.

Se visitó Nicaragua entre el 26 y 29 de agosto de 2008. En este país el Instituto Nicaragüense de Pesca y Acuicultura (INPESCA) está desarrollando un plan nacional para lograr que la acuicultura se consolide como la actividad más productiva y rentable dentro del sector pesquero nacional. Durante la misión se visitaron las instalaciones de productores de tilapia y centros de investigación que cuentan con instalaciones demostrativas para el cultivo de tilapia de la Universidad Nacional (UNA) e INPESCA. Sin embargo aún no se concibe este cultivo como una actividad comercial por sí sola, es más bien secundaria/ complementaria de la agricultura. Se visitó también el centro de producción de larvas de tilapia de Nicafish, empresa de capitales noruegos, que está desarrollando un ambicioso programa de mejora genética de reproductores de tilapia para producir larvas de buena calidad destinadas a su propia producción. Del mismo modo, se realizó una reunión con representantes del Centro de Investigación de Ecosistemas Acuáticos (UCA-CIDEA), que está ejecutando programas de cultivo de moluscos de especies autóctonas como *Anadara sp*. como alternativa para comunidades costeras, junto con manejo integrado de la acuicultura.

La visita a Costa Rica se realizó entre el 29 y 31 de agosto de 2008 con una reunión inicial en la Estación Los Diamantes en Guápiles, del Departamento de Acuicultura de Instituto Costarricense de Pesca y Acuicultura INCOPESCA. En la zona de Puntarenas, en el Golfo de Nicoya, océano Pacífico, se realizó un recorrido por el Parque Marino del Pacífico, institución que cuenta con instalaciones de capacitación e instalaciones de cultivo de peces y moluscos. Se conoció una experiencia de cultivo de pargo de mancha (*Lutjanus guttatus*) en jaulas que desarrolla una asociación de pescadores artesanales, integrado a un servicio de restaurante flotante en proximidad con las jaulas de engorda. Posteriormente se visitó la Estación de Biología Marina para conocer el desarrollo de semillas de moluscos y peces. También se visitaron experiencias de cultivo de tilapia y otras especies para pequeños desarrollos turísticos de "pesque y pague".

La visita a Panamá se realizó entre el 1 al 3 de septiembre coordinando las actividades con la Oficina Subregional de la FAO para Centroamérica con base en Panamá (SLM). Se efectuaron encuentros con las principales asociaciones de productores de acuicultura, con productores de ricipiscicultura (cultivo de arroz y tilapia) y con representantes de la Autoridad de Recursos Acuáticos (ARAP) para hacer un análisis del sector, particularmente de los productores rurales. Posteriormente la misión se trasladó a la localidad de Chitré donde se visitó a pequeños productores que cultivan tilapia y *Colossoma* sp en campos de arroz como acuicultura principalmente de subsistencia y que reciben permanente asistencia de ARAP. Adicionalmente se visitó una de las principales estaciones de acuicultura, "Divisa" donde se desarrollarían programas de formación y cultivo de semillas para entrega a los productores.

La visita a Perú ocurre entre el 4 al 11 de septiembre de 2008. Se incluyeron reuniones con autoridades en Lima como la Dirección General de Acuicultura, del Ministerio de Producción (PRODUCE), la Agencia Peruana de Cooperación Internacional (APCI), el Fondo de Desarrollo Pesquero (FONDEPES), y el programa Sierra Exportadora. Además la delegación se reunió

M. TANG

Venta local de tilapia, El Salvador

M. TANG

El equipo de misión en estación acuicola de Panama

con los representantes de la Agencia Española de Cooperación Internacional para el Desarrollo (AECID) Perú, quienes explicaron los alcances del programa PROPESCA en la región de Puno y la red de Centros de Formación para potenciar la acuicultura andina. En tanto, en Iquitos se realizaron visitas a terreno en las instalaciones de Nuevo Horizonte de FONDEPES y el Instituto de Investigación de la Amazonía Peruana (IIAP), junto con reuniones con representantes del Gobierno Regional de Loreto. Allí se pudo observar los avances en el cultivo de especies amazónicas, principalmente Gamitana (*Colossoma* sp).

Por su parte en Puno, Altiplano peruano, la delegación se reunió con las autoridades relacionadas con el cultivo de truchas, principalmente arcoiris

(*Oncorhynchus mykis*), entre ellas representantes del Gobierno Regional de Puno, de la Dirección Regional de la Producción de Puno, del Instituto del Mar del Perú (IMARPE), del Instituto Tecnológico Pesquero (ITP), del Programa Sierra Exportadora, de la Autoridad Binacional del Lago Titicaca (AALT), del Proyecto Especial Binacional Lago Titicaca (PELT). En la localidad de Chicuito, Puno, se realizó una reunión con las asociaciones de productores de trucha quienes presentaron y discutieron sus principales problemas.

PRINCIPALES CONCLUSIONES DE LA MISIÓN Y ORIENTACIÓN DEL PROYECTO

La misión pudo confirmar las necesidades más relevantes en la región y reflejarlas en las acciones propuestas y orientación del proyecto. Se reafirmó que la especie más cultivada en Centroamérica, con una inversión relativamente pequeña (y por tanto asequible para los pequeños productores) es la tilapia (principalmente *Oreochromis niloticus*).

M. TANG

Bagre Amazonico de cultivo, Iquitos, Peru

M. TANG

Gamitana de cultivo, Iquitos, Peru

La acuicultura de subsistencia (ej. arroz y tilapia) si bien ocurre en algunos lugares (ej. Panamá), requiere en forma permanente del apoyo del Estado o de otros entes externos y no ha logrado transformarse en una actividad sustentable. Las comunidades no tienen tradición de consumir pescado y en general sin la asistencia externa los proyectos son abandonados cuando no existen los incentivos comerciales. En la mayoría de los lugares visitados aun no hay programas adecuados de producción y manejo de las semillas/larvas para los pequeños productores, por lo que esta innovación podría producir una mejora sustantiva en la calidad de los peces cosechados.

El cultivo de especies amazónicas es muy promisorio, especialmente de gamitana que ya ofrece un buen conocimiento de las tecnologías. Es una especie omnívora de alto crecimiento y de una excelente calidad. Los requerimientos de inversión y de cuidados son similares a aquellos para tilapia, es una especie resistente y de fácil manejo. Además se trata de una especie nativa de la cuenca del Amazonas, lo cual es un elemento muy importante. Sin embargo es necesario mejorar su comercialización y también producir mejores alimento y mas asequibles.

El cultivo de trucha en la zonas andinas también ha aumentado y hay muchos pequeños productores, especialmente en el Lago Titicaca, pero falta profesionalización y mayor capacitación para lograr un mejor producto con producción más sostenida y de calidad. Muchos de los productores están en el borde de la rentabilidad aun cuando existe interés de los mercados pero la calidad y cantidad del producto no permitiría acceder a éstos excepto, por un grupo selecto de productores. Un problema común para toda la región es la adquisición/ producción de alimentos adecuados para peces a precios razonables y este factor es un obstáculo que debe ser enfrentado en forma organizada para que los pequeños productores puedan tener éxito.

La misión concluye que deben hacerse esfuerzos coordinados para la capacitación a los productores rurales, aprovechando las capacidades que ya existen en la región. Se identificaron cuatro actividades de cultivo que se consideran de mayor potencial para estos productores y que se propone desarrollar en módulos de capacitación; i) cultivo de tilapia, ii) cultivo de especies Amazónicas, iii) cultivo de bivalvos y otros organismos marinos costeros y iv) cultivo de trucha en las regiones altas andinas y sierras. En estos módulos se capacitará sobre: la producción y manejo de semillas y larvas, el proceso de alimentación y engorda, aspectos de manejo ambiental y sanitario, cosecha, procesamiento y mercadeo con énfasis en desarrollar mercados locales. Si bien los módulos se instalarán en países focales, el entrenamiento estará abierto a todos los países de la región, realizándose especiales esfuerzos por incluir a mujeres en la capacitación.

El objetivo general de este proyecto es que la acuicultura rural y de pequeña escala se transforme en un motor de desarrollo social y económico para las comunidades rurales en todos los países de América Latina y el Caribe donde existan las condiciones ambientales para el desarrollo del sector, mejorando así la calidad de vida de las comunidades más necesitadas.

En un plazo de 36 meses se espera contar con los siguientes resultados:

- Como objetivos de corto plazo se plantea capacitar a productores de acuicultura rural de ALC y a representan-tes de las instituciones relevantes en el apoyo y promover la organización de la acuicultura rural de los países en al menos los cuatro tipos de cultivo mencionados.
- Como objetivo a mediano plazo se plantea el establecimiento de una red de capacitación para la acuicultura rural en la región aprovechando las capacidades y fortalezas de la región y la cooperación Iberoamericana
- Como objetivo de largo plazo se pretende incrementar en forma significativa la producción de acuicultura rural y el desarrollo de mercados locales y regionales fuertes con un consiguiente aumento de disponibilidad y de consumo de pescado y organismos acuáticos

La formulación del proyecto y la misión han contado con el apoyo del Servicio de Elaboración del Programa de Campo del Departamento de Cooperación Técnica (TCAP) de FAO.

M. TANG

Cosecha de peces Amazonicos de cultivo en la Estación Nuovo Horizonte, Iquitos, Perú

English Summary

Mission for the Implementation of the project GDCP/RLA/001/SPA - Developing rural and small scale aquaculture in Latin America and the Caribbean

Within the framework of the Decentralized Cooperation Program between FAO and the Galicia Government of Spain, FAO and the Conselleria de Pesca y Asuntos Marítimos de la Xunta de Galicia have agreed to collaborate in a project to improve rural and small scale aquaculture farming in Latin America and the Caribbean.

In order to better define the project approach, a joint mission - FAO/Galicia (Centro Tecnológico del Mar, CETMAR) - coordinated by FIMA and with the participation of FAO's Regional Aquaculture Officer plus five aquaculture experts from Galicia and one aquaculture communications expert took place between 23 August 2008 and 11 September 2008. The team visited five countries (El Salvador, Nicaragua, Panamá, Costa Rica and Perú) with a total of 45 technical visits/meetings in these countries over a period of 20 days.

In Central America countries, the group visited tilapia hatcheries, grow-out ponds and research and training centres for aquaculture, fisheries and aquaculture authorities, as well as NGOs, IGOs and other cooperation organizations. The mission also met with small farmers associations, and visited family farms in rural areas. In Lima, Peru, the group met with the main aquaculture authorities while in Iquitos, in the Amazonian region, they learned about the aquaculture of amazonic species and activities and programs of training and research centers. In Puno in the Peruvian high Andes, the mission gathered information about the situation of trout farming in Lake Titicaca and held several meetings with small farmers associations and other authorities.

The mission concluded that there are four aquaculture systems with high potential for success for small scale farmers and they are proposed as training modules. These are the farming of (1) tilapia, (2) amazonic species, (3) trout in the Andean areas and (4) mariculture, especially bivalve culture. Each module will include the following training subjects: (i) seed production and handling, (ii) grow-out and feeding process, (iii) environmental and health management, (iv) harvesting and processing, and (v) marketing. The project will make special efforts to involve women in the training activities, and will be open to all countries of the region although the modules will be located in few countries.

Preliminary note on the impact of rising feed ingredient prices on aquafeed with special reference to Asia and Europe

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Overview of aquaculture and impact in relation to soaring feed prices

Approximately 220 species of aquatic animals and plants are currently cultured worldwide, in a vast range of contexts and culture systems; from subsistence to commercial, extensive to intensive. In 2006, global aquaculture production reached 66.7 million tonnes, increasing at an annual rate of 9 percent/year with Europe accounting for only 3.2 percent of total reported global aquaculture production and Asia approximately 92 percent. The Asian contribution to total world aquaculture production drops to 24 percent in terms of quantity and 29 percent in terms of value when China is excluded, and therefore, currently aquaculture production is overwhelmingly concentrated in China.

The future pressure on demand for feed ingredients and fish feeds in its different product forms however, will depend on what proportions of fed and non-fed aquaculture are going to contribute to total aquaculture production, type of aquaculture species requiring aquafeeds and their farming intensities. Fed aquaculture includes mainly crustacean and finfish where farm-made or complete commercial diets are used to varying extents and non-fed aquaculture which does not depend on feeds includes mainly filter feeding finfish, molluscs and other invertebrates and aquatic plants.

Between 2000 and 2006, the production of crustaceans grew at an average annual growth of 24.5 percent, while finfish and molluscs grew at an average growth of 7.0 percent and 5.0 percent, respectively. All other sectors, namely, amphibians, invertebrates and aquatic plants showed a slowing down in their percentage annual production growth during the same period. If the recent trend of decreasing annual growth continues in the non-fed aquaculture sectors, while maintaining an increase in total aquaculture production in Asia, the pressure on demand for feed and their ingredients may significantly increase.

Globally, the main aquatic groups that tend to rely more on complete diets for their production are marine finfish, crustaceans and diadromous fishes. Between 1996 and 2006, the production of these groups increased by 30, 22 and 8 percent/year, respectively. Increasing pressure to improve production of freshwater finfish through intensification is also evident. Freshwater finfish production increased by 9 percent during the same period. In 2006, carps and other cyprinids, tilapias and catfishes accounted for 30, 5 and 3 percent, respectively, of global production. In addition, there are significant increases in growth, albeit from a smaller production base, of a number of carnivorous finfish and crustacean species over the same period. These include oriental river prawn, mandarin fish and Japanese eel. Thus, there is a trend in moving away from low to high-value species and these will rely heavily on complete commercial feeds, especially as the use of trash fish as aquaculture feed is unlikely to be sustainable due to the declining supply and its unacceptability due to the increasing consumer's concern. Though carps and tilapia are considered as low value species and understood to be cultured in less intensive systems and depending more on farm-made aquafeeds, their production in bulk will still place great stress on many of the land-based feed ingredients such as soybean, corn, rice, vegetable oils.

The pressure on aquafeed ingredients should also be viewed within the context of land and water resource limitations throughout many of the aquaculture producing countries in Asia. In these circumstances and pressure to increase fish production, improvement of productivity of such low (and high) value fish through intensification is inevitable. This trend to increase productivity of low

value herbivores and omnivores by switching from extensive to semi-intensive practice depending on farm-made aquafeeds, is illustrated by the trends in increasing use of aquafeed and number of farms dependent on aquafeeds. According to a recent estimate, based on seven leading aquaculture producing countries, 19.3 million tonnes of farm-made aquafeeds were used against 10.3 million tonnes commercial feeds during 2003-2004 in Asia alone (De Silva and Hasan, 2007). It is also predicted that the usage of farm-made aquafeeds may go up to 30.7 million tonnes over the next five years representing a growth of 60 percent increase from current level (De Silva and Hasan, 2007). However, an increasing trend to use complete commercial diets in semi-intensive farms is also evident. In two case studies carried out in India and China for different carp species, it was recorded that 74 and 46 percent of semi-intensive farms, respectively, use industrial feeds compared with farm-made feeds (Rola and Hasan, 2007). China and India together accounted for 90 percent and 92 percent of world's and Asia's carps and other cyprinids production, respectively, indicating a trend of mainstay of low value species in semi-intensive farms is complete commercial feeds as opposed to farm-made feeds. Overall, these trends suggest that an increasing trend towards intensification and consequent increasing dependency on complete commercial feeds.

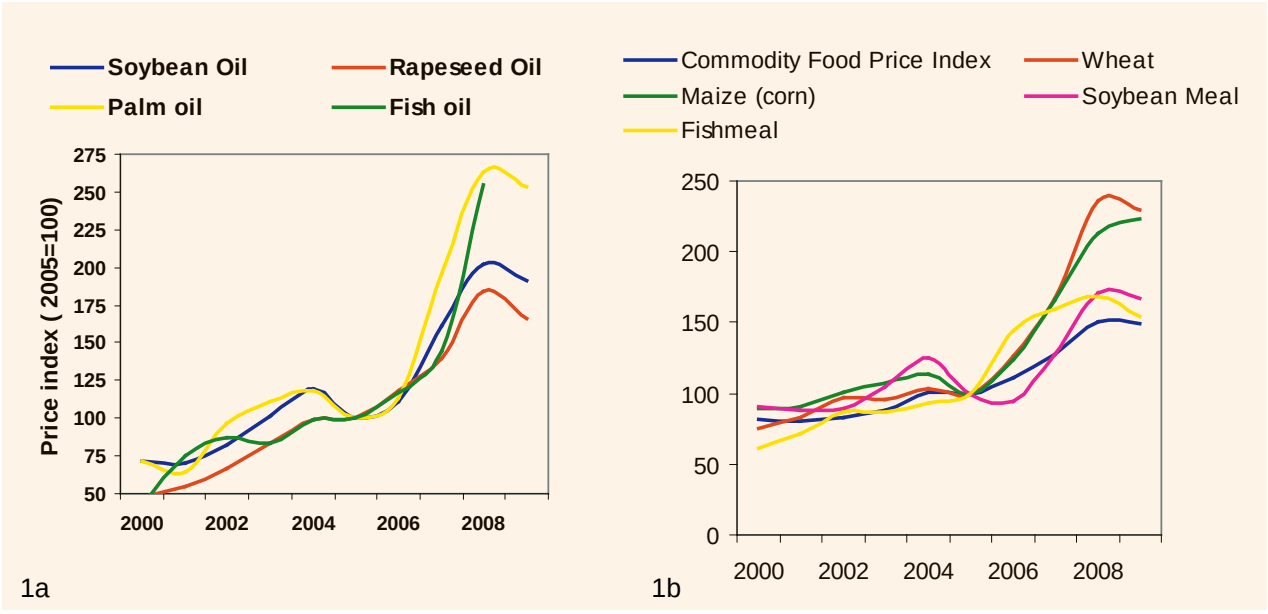
The recent rises in prices of ingredients used for either complete or on-farm feeds will therefore have a major impact on the ability of aquaculture to cope with these price rises. The increase in cost of production is inevitable but if productivity is not improved to offset these costs, fish prices may rise sharply when compared with other protein alternatives.

This preliminary note investigates and evaluates the underlying reasons for the recent dramatic rise in prices of these commodities used in aquafeeds production and its consequences for the aquafeed industry in particular and on demands and expectations on aquaculture in securing current and future fish supplies.

Recent situation of price of major commodity prices

Aquaculture is reliant on a basket of common input ingredients such as soybean, corn, rice, wheat, fishmeal and fish oil for which it competes with other animal protein production sectors such as beef, poultry and pork as well with direct human consumption. Many of these key ingredients traditionally used in recipes for commercial or on-farm aquaculture feeds are internationally traded commodities and therefore aquafeed production is also subjected to any global market shocks and volatility. Since 2005, the basket commodity price index (CPI) rose by about 50 percent (Figure 1a). During the same period, the price of soybean meal, fishmeal, corn, and wheat rose by 67, 55, 284, 225 and 180 percent, respectively. Similarly, the cost of major oils used in the feed industry has increased by about 100 to 156 percent (Figure 1b). The price of these ingredients has increased dramatically since the millennium but the rate of price increase has occurred in two phases: a steady

Figure 1. Price index (2005=100) of key (a) food commodities and grains and fishmeal and (b) plant and fish oils, used for animal feeds and human consumption



gradual increase in prices to around 2004 followed by a dramatic exponential rise and slight fall in latter half of 2008 (Figure 2). The major drivers impacting on the ingredients commonly used in aquafeeds are outlined below.

What are global drivers fuelling price rise of aquafeeds?

The price shocks were an unusual confluence of several primary and secondary factors which disrupted the global demand and supply balance of these commodities, the impact of which was greatest since the millennium. Over the last decade the strong increase in the economic growth, especially in developing countries together with the increase in population size has increased the demand for food. Whilst the economies of advanced economies declined from 3.6 to 2.2 percent/year between 2000 and 2007, the economies of developing, especially Asian countries, grew at a staggering rate of 7 to 10 percent/year during the same period (IMF, 2009, http://www.imf.org/external/index.htm). This increase in disposable income and prosperity was also accompanied by a notable shift in the dietary preferences in these countries as consumers diversified their diets to consume more meat, fish and milk products which consequently increased the demand for grains, the principal ingredients used in animal feeds. The poorer conversation rations of feed to meat of around 2-8:1 compared to fish of around 1-2:1 amplified the demand for these common aquafeed ingredients. In addition, the demand of oils (soybean, rapeseed and palm oil) also increased dramatically in these economies. Moreover, these changes occurred in the most populous countries in the world notably China, having the greatest impact, skewing the global distribution of such commodities.

Against this backdrop of sharply rising demand in China as well as in other populous developing economies such as India, the demand for all ingredients used in aquafeeds faced significant upward pressure in price.

These price rises were further compounded by a series of concomitant short-term shocks. Since 2004, however, as world stocks of grains used in aquafeeds began to decline, countries like China that have huge foreign reserves began to stockpile fishmeal and other proteins and oils through imports to secure supplies and this in turn exasperate the prices of these commodities, on the world market since 2004.

This escalation in demand for commodity feed ingredients coincided with the dramatic increase in fuel prices since 2004 peaking at over USD 130/barrel in July 2008 (Figure 2). Since 2005, the price index for crude oil soared to 250 percent but has since slipped back to around USD 50/barrel by the end of 2008. This rise in fuel costs impacted heavily on transportation and production costs of these feed ingredients and other commodities thus increasing their landed cost. The key commodities that impacted on aquafeed ingredients were corn, soybean and fishmeal and oil all of which are largely sourced from the Americas notably, Brazil, United States of America, Chile

Figure 2. Escalation of crude oil prices over the period of 2000 and 2008

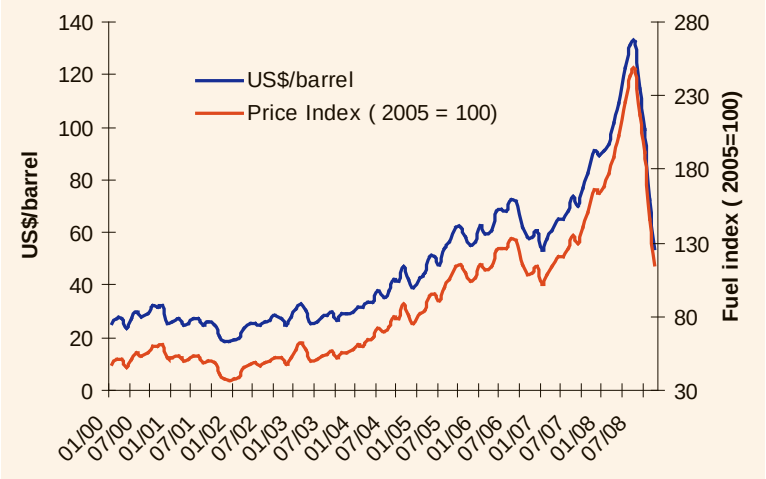
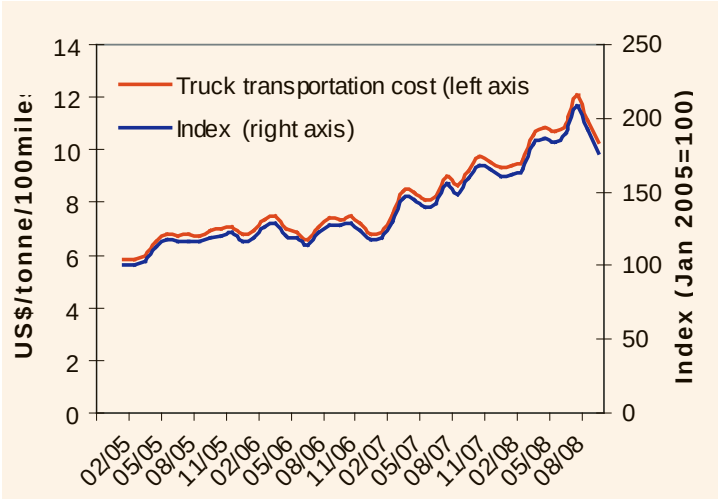


Figure 3. Increase of transportation cost of soybean in Brazil over the period of 2005 and 2008



and Argentina and have to be transported to major markets. In Brazil where production areas can be over 1 000 miles away from sea ports, trucks are predominantly used to transport soybean. The cost of this transportation has escalated due to rising fuel prices and is illustrated in Figure 3. Since January 2005, the cost of land transport has doubled from USD 6/100 miles in January 2005 to over USD 12/100 miles in July 2008 (Figure 3). Similarly, the fuel prices further impacted on the landed costs of feed ingredients due to increased sea freight costs thus total transport costs has increased substantially.

In addition to fuel hikes, the sharp rise in sea freight was compounded by the concurrent increasing demand for dry and container cargo ships mainly by China for transportation of coal, iron ore and grain. The Baltic Exchange Dry Index, an internationally recognised measure of sea freight cost, rose from 5 000 in January 2005 to over 11 000 in July 2008.

In addition to these high base prices due to availability on the global market, competition between aquaculture industries for key ingredients such as fishmeal with cattle, poultry, pigs placed added upward pressure on price. In 2002, aquaculture used 46 percent of the marketed world fishmeal, while pigs and poultry used 24 percent and 22 percent, respectively (FIN, 2007). It is expected that aquaculture may use 56 percent of the market share of fishmeal by 2010.

Factors affecting supplies of key ingredients for aquafeeds

Production was limited due to (i) gradual decline in acreage under cultivation, (ii) uncertainties in water availability for agriculture, (iii) reduction in state research in crop yields, and (iv) adverse weather conditions and disease resulting in crop loss and destruction of infrastructure for fishmeal processing plants. Nonetheless, the demand for ingredients for aquafeeds increased gradually until around 2004, even though farm yields increased supply could not keep pace with demand.

Whilst the production of grains increased, albeit well below demand levels, the supply of fishmeal and fish oil from main producers, such as Peru, Chile and Scandinavian countries, into the world market had reduced putting greater pressure on price. Overall the fish catch going to reduction for fishmeal have been declining in favour of direct human consumption. In addition, lower quotas for fish such as capelin, mackerel and blue whiting in Scandinavian countries contributed to decline in exports from 504 000 tonnes in 2005 to 429 000 in 2008. Similarly, in South America, exports declined from 1.96 million tonnes to 1.51 million tonnes over the same period.

Increased prices and availability has compelled aquafeeds manufactures to mitigate against these uncertainties to secure ingredients. In Europe where aqua farming practices is predominately intensive and in Asia where many economically important species are farmed intensively, it is helpful to understand the structure of the commercial aquafeed industry and the sector segment they serve.

Profile of the aquafeed industry in Western Europe

Unlike Asia, the farming of finfish in Western Europe is exclusively intensive and is dependent and driven by the use of compounded industrial feeds. Four key species such as Atlantic salmon, rainbow trout, European seabass and gilthead seabream dominate European aquaculture. In 2006, the output of these species totalled over a million tonne and accounted for 81 percent of total finfish production in Europe. Moreover, salmon accounted for 54 percent (783 000 tonnes) of European finfish production. Feed manufacturers therefore strategically monitor such developments to position themselves in geographic production hotspots and historically around centres of key raw ingredients e.g. fishmeal and fish oil.

The feed industry in Western Europe has largely followed the market development of Atlantic salmon (and to a lesser extent rainbow trout) which is predominantly concentrated in Norway, Scotland, and to a lesser extent in Faroe Islands and Ireland. These four north European countries collectively accounted for 890 000 tonnes of salmonids in 2006 and over a million tonne in 2007.

The aquafeed industry in Western Europe serving these markets is highly consolidated with three companies, Skretting, Ewos and BioMar, dominating the salmonid feed market sector (Table 1). In 2007, these companies accounted for over 96 percent of the feed used for salmon and trout production in northern Europe providing around 1.3 million tonnes of industrial feeds. In 2007, more than 2.1 million tonnes of feed was used in Western Europe (Table 1). Details on translation of the impact of rising ingredient prices are difficult to obtain due to company confidentiality. In 2004, and 2006, 7 and 13 percent of revenue increases were attributed to higher feed prices and this is largely attributed to higher ingredient costs since raw ingredients account for 75 percent of feed production costs (Nutreco Annual Reports, 2004 & 2006

Table 1. Estimated industrial aquafeeds produced by key feed manufactures3 and their market share

	Market share in 2007 (%)	Production in 2006 (tonnes)	Production in 2007 (tonnes)
North Europe (NE)[1]			
BioMar	23	300 000	316 250
Ewos	30	412 500	412 500
Skretting	43	500 000	591 250
Others	4	37 500	55 000
Total (tonnes)		1 250 000	1 375 000
NE (% of total)		65	65
Rest of Europe (RE)[2]			
BioMar	18	128 250	137 000
Skretting	18	128 250	130 500
Prov imi	9	60 750	65 250
Persus	7	47 250	50 750
Dida q	6	40 500	43 500
Aller aqua	5	33 750	36 250
Feedus	4	27 000	29 000
Others	33	209 250	239 250
Total (tonnes)		675 000	725 000
RE (% of total)		35	35
Total aquafeeds in NE + RE (tonnes)		**1 925 000**	**2 100 000**

1 NE = Norway, Scotland, Ireland and Faeroe Islands
2 RE = >1000 tonnes: Denmark, Finland, France, Greece, Italy, Poland, Spain, Sweden, Germany, Russia, Turkey, Czech Rep., Croatia, Switzerland, the Netherlands
3 Estimates extrapolated from Biomar Annual Report (2000)

available at http://www.nutreco.com/; BioMar Annual report, 2007 available at http://www.biomar.co.uk/)

Profile of the aquafeed industry in Asia

Unlike Europe, aquaculture in Asia is very diverse with over 200 species being reportedly farmed in a range of culture systems using extensive to intensive practices. The trend on the mainstay of national aquaculture output from Asia, however, is similar to Europe. In common with Europe, however, reported aquaculture output at a national level is dominated by a few species/species-groups (Table 2). In ten major aquaculture producing countries in Asia, over 80 percent of production originates from just 3-4 species or species-groups (Table 2). In 2006, around 97 percent or 31 million tonnes of production originated from around 15 or more species/species-groups (Table 2).

Dependency of feed ingredients and hence vulnerability to price shocks

Mass production of these species in Asia is also dependent on aquafeeds and some species are almost exclusively dependent on commercial aquafeeds and under semi-intensive to intensive conditions. Although the current debate on feed ingredients till largely focuses on the major constraints of the well documented and known finite fishmeal and fish oil recourses, the sustainability of aquaculture is more likely to be linked with availability and accessibility of plant proteins, oils and carbohydrate supplies for aquafeeds. In the coming years, developing countries are more likely to be adversely impacted, if these terrestrial plant ingredients for aquaculture are not produced and sourced locally. The rising prices of key plant ingredients used in the aquafeeds industry on the international market are illustrated in Figure 1. In view of current trends the local competition for these plant-based aquafeed ingredients will also increase as populations and disposable in developing countries increase and as evident demand for meat and milk products which require substantial volumes of grains, etc., continues to rise especially in populous countries.

Table 2. Number and % contribution of major aquatic species/species-groups to national production in ten leading Asian countries in 2006

Country	Number	Total production (thousand tonnes)	Main species/ species - groups production (thousand tonnes)	% contribution
Japan	3	302	293	82
Myanmar	3	575	558	85
Viet Nam	3	1 512	1 466	97
India	3	3 123	3 029	92
Bangladesh	4	893	866	93
Philippines	4	587	569	95
Thailand	4	1 021	991	84
Taiwan province of China	6	217	210	85
Indonesia	6	1 293	1 254	81
China	7	22 650	21 970	80
Total		**32 173**	**31 206**	**97**

Acknowledgements

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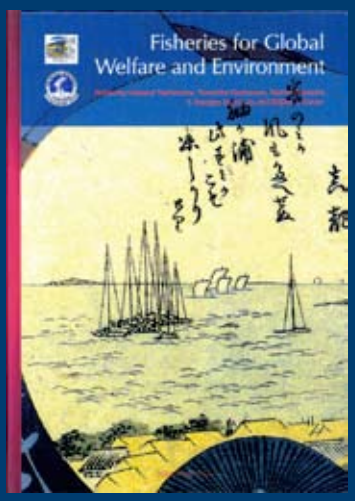
FAO supported the 5th World Fisheries Congress 2008 (WFC2008)



The Fisheries and Aquaculture Department of FAO supported WFC 2008 held at the Pacifico Yokohama in Yokohama, Japan from 20 to 25 October 2008. This huge scientific event, with 1600 registered participants from 63 countries delivered about 726 oral presentations (keynote and oral presentations) and 549 poster presentations and was supported by 6 satellite symposia (2 before and 4 after WFC2008) and 2 training courses on GIS. A major highlight of the WFC2008 was a Commemorative Ceremony graced by the Emperor and Empress of Japan with a taped messaged from Japan's Prime Minister. FAO's Assistant Director General for Fisheries and Aquaculture, Mr Ichiro Nomura, delivered a Plenary Lecture entitled *Fisheries management :status and challenges* while FAN Editor-in-Chief and Fishery Resources Officer Dr Melba B. Reantaso delivered a Keynote Paper at the Aquaculture Session entitled *Meeting the future demand for aquatic food through aquaculture: the role of aquatic animal health.* Both presentations are included as full papers in the Memorial Book of WFC2008 – Fisheries for Global Welfare and Environment – which was released during the conference (available for download at http://www.terrapub.co.jp/onlineproceedings/fs/wfc2008/index.html). Dr Reantaso also gave a Keynote Paper - *International trade and aquatic animal health: what did we learn so far in managing the risks?* – in one of the satellite symposia (5th International Symposium of the Japanese Society for Fish Pathology, held from 18-19 October 2008 at the University of Tokyo, Tokyo, Japan).

Strategic review of aquaculture extension in Tanzania

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INTRODUCTION

Aquaculture is an activity of growing importance for families and investors living along the coastline and inland areas of Tanzania. As the economy evolves to meet the needs of the 21st Century, aquaculture is receiving increased attention from the public sector for its positive economic and social potentials. As well, aquaculture receives significantly greater attention from investors as prices for aquatic products increase and it becomes an increasingly attractive business opportunity. To support this growing interest and to provide guidance for sustainable development and attribute roles and responsibilities to major stakeholder groups, the Government of Tanzania has developed a National Aquaculture Development Strategy - NADS (Box 1). A National Task Force undertook this activity with assistance provided under an FAO TCP Facility. Within the context of NADS, a major challenge facing the expansion of the sub-sector is that of designing and implementing sustainable and cost-effective aquaculture extension.

Box 1. The Tanzanian National Aquaculture Development Strategy (NADS)

The purpose of the NADS is to provide a framework in which the aquaculture industry in Tanzania can be developed in an economically, socially and environmentally sustainable manner. The main purpose is to increase the levels of production and benefits from the aquaculture industry. The strategy covers a period of 15 years and is expected to play a role in meeting national objectives including National Strategy for Economic Growth and Poverty Reduction (NSEGPR) which aims at reducing poverty through increased income and food security of the Tanzanians.

The vision of NADS is to:
Establish vibrant diversified sustainable aquaculture businesses which will last for 15 years, starting from 2008/09 to 2022/2023.
The mission of NADS is to:

- Promote private - public - government partnership which will expand aquaculture sub-sector hence creation of employment
- Develop sustainable aquaculture business which will contribute to social-economic welfare of national and coastal communities

GOVERNMENT EXTENSION

Since 1961, aquaculture extension services have been mainly provided by the government with the intent that increased production would lead to increased food availability, lower purchase prices, increased returns for the government through subsequent taxation. Aquaculture development efforts focused on public infrastructure (e.g. stations, hatcheries or centers) to serve as hubs around which aquaculture would develop. The stations were to provide inputs, be the base for extension support, serve as training and demonstration centers and undertake research. Additionally, government extension agents were trained to transfer the acquired knowledge through field visits undertaken with transport provided by extra-budgetary sources. Prior to 1990, aquaculture or fisheries officers existed in all regions and districts, down to the village level.

Although this approach was able to increase solicit some modest increases in aquaculture production, it proved to be unsustainable. The costs of operation were high and, in the absence of external support, after 1990, the government was unable to keep the programme functioning. Moreover, when limited public resources were available, these were at times used for other purposes. The situation was exacerbated following retrenchment in 2000, leaving only District Fisheries Officers existing in most districts combined with a very low priority given to fisheries extension by District Councils. As a result, fish farming declined.

DONOR-FUNDED EXTENSION PROGRAMMES

Extension support has been received from a variety of external sources. The FAO ALCOM[1] Programme, for example, tried to improve aquaculture extension by using general agriculture extensionists. However, inspite of some isolated successes, this did not provide a sustainable solution. Donor-funded programmes in general have been instrumental in supporting and even fostering aquaculture extension, but have been accompanied with a number of problems that may have actually created more harm than good. Most of these programmes focused on poor farmers who did not have resources required to establish and sustain aquaculture. They introduced showcase programmes on the community using material and equipment that were not available to the villagers and introduced a technology that was not compatible to the existing farming system. In addition, donor-funded programmes were short-lived and created "dependency syndrome". They mistakenly provided inputs in cash or kind which could not be obtained locally or were not necessary. Extension agents were paid high allowances and farmers were paid allowances to attend their own training and field visit. Furthermore, the programmes provided inputs like shovels, pickaxes, wheelbarrows, measuring tapes and PVC pipes for pond construction even when they were not needed. This type of assistance did not complement, rather it substituted local people's efforts and was unsustainable. It has now been realized that such donor-induced strategies have eroded farmers self-help spirit.

FARMER-TO-FARMER EXTENSION

The combined problems of the above extension approaches meant that a more cost-effective and sustainable extension system was needed. Farmers rather than professional extensionist or researchers, were sought to meet that end through the promotion of farmer-to-farmer methodologies. However, like other systems of extension, farmer-to-farmer extension failed to meet its objectives. The main reasons for the failure of the system are: farmers selected for training were based on favoritism rather than model farmer, long served and trusted by other farmers; farmers were selected early before their interest was properly known; operation of extension system was based on volunteerisms (i.e. religious impetus) and status rather than economic motivation; and lack of strong support from the government to the system.

ALCOM experience (Box 2 and 3) has shown that when farmers are trained and supported, they could disseminate new technologies and production methods to other farmers in a sustainable manner and at lower operation costs. For instance, although ALCOM field activities were suspended in the study area, two years later, new fish ponds were still being constructed and distribution of fingerlings continued normally. This means that farmer-to-farmer extension established under ALCOM projectcontinued without any external help.

Nevertheless, fifteen years after ALCOMactivitieswereterminated most of the field activities were no longer in operation or were operating at a very low level. This is believed to be a common phenomenon in most farmer-led extension, whereby sooner or later, farmer extensionists start feeling that they had done their share and that the community needed to continue on their own. Farmer extensionists interviewed indicated that they stopped doing extension work because they lacked time and because they were not paid. Experience has shown that very rarely volunteer extensionists continued to work for more than five years. Often they get discouraged if not supported and/or visited by outsiders.

PRIVATE EXTENSION SERVICES

Production of high-value crops that are grown in well-defined areas can be assisted by private companies dealing with the marketing of these products. Marine products are particularly suitable to these arrangements as the producers are concentrated among the coastline as opposed

Box 2. Case Study: the Seed-Supplier Extensionist

In the villages in Mahenge District, there was a farmer who did a lot of fish farming extension. A follow-up on the issue revealed that he was doing it because he earned considerably more income through selling fingerlings than through selling food fish or other farming activities. Later, however, as more ponds were stocked and demand for fingerling decreased, so did his extension effort. Lack of consistent demand for fingerlings has been a hindrance to development of private fingerlings producers and distributors in many areas. In the present case, this lack of a sustainable demand also affected extension support. This case demonstrates the need to address practical issues when implementing strategic approaches such as those defined in NADS. Whilst private fingerlings (seed) production and distribution are certainly the order of the day, those providing these inputs need to be able to make a profit. This means that a supplier must have enough customers to make his seed business profitable and it also implies that farmers must be receiving the right extension support to harvest their ponds on a timely bases thereby increasing their own profits as well as ensuring the required consistent demand for the seed supplier.

Box 3. Case Study: the Net-Maker Extensionist

In the district of Mbozi, a farmer was making seine nets from worn out tire ropes. At that time, there was only one seine net at the district headquarters and therefore any farmer who wanted to harvest fish had to travel to the district headquarter to borrow this net. Farmers were not certain if they would get the net when needed and some farmers traveled to the district headquarters several times without getting the net. An ALCOM team observed that the net maker encouraged farmers to start fish farming, and actually visited fish farmers more often than the government extension officer because of economic motivation of ultimately having them as customers for his nets.

to being scattered within the locality. Tanzania has long been the Region's principal seaweed producer and the strong global market for seaweed products has promoted export companies to support village growers (Box 4). Mud crab, a luxury product in demand in international markets, is another marine crop where labour–intensive and technologically simple village-level culture systems are being extended to produce a high-value crop. At present, extension work is being undertaken by NGOs that are introducing and supporting crab culture. In the medium term, other extension arrangements will be needed, perhaps similar to those for seaweed. Other marine crops that attract attention of the private sector are pearl oysters and penaed shrimps. In the aggregate, the extension experiences for mariculture demonstrate how geographic concentrations of high-value commodity producers can facilitate extension and outreach support.

A NEW APPROACH TO AQUACULTURE EXTENSION

Faced with so much local and external financial uncertainties, the aquaculture sub-sector through NADS, had to devise a sustainable and cost-effective extension approach which will operate on its own with far less external support. This is based on the principle that aquaculture extension should operate as a business rather than a totally government-supported activity.

To achieve the above goal, there is a need to move beyond subsistence aquaculture and to deal with aquaculture as a business. This change in focus requires a shift in extension approach. The roles and responsibilities of the public and private sectors must change significantly. The government needs to divert expensive infrastructure and undeliverable services while establishing ways and means to control quality and impacts. The private sector, at all levels, needs to assume responsibility of delivering information in terms of quality, appropriateness, accessibility and cost.

CONCLUSION

For an effective and sustainable aquaculture system, the government will maximize extension benefits by focusing extension activities on farmer-to-farmer extension. Thus, the Department of Aquaculture extension should first design and support an institutional mechanism through which farmer-to-farmer extension will operate. The mechanism should incorporate profit motivation. Secondly, the department should strive to strengthen the capabilities of farmer-to-farmer research and extension through short- and long-term training programmes. The government and other organizations which previously dealt with extension should support farmer-to-farmer extension through sponsoring workshops, local study tours, further farmer organization and networking, publication of extension materials and technical training.

[1]The SADC Regional Aquaculture for Local Community Development Programme (GCP/RAF/277/BEL and GCP/INT/555/SWE)

Box 4. Case Study: Seaweed Farming in Tanga

Experience has shown that private sector can play a role in provision of inputs and extension advice to farmers. Companies dealing with seaweed farming enter into agreements with some villages and independent producers; legally binding producers through technical production assistance, inputs supply and sales contracts, providing farmers with inputs including ropes, tie-ties, floats, as well as extension assistance. In turn, producers agree to sell their entire seaweed harvest exclusively to the company; the latter bearing the risk of production. The price paid to farmers is determined mainly by the costs incurred by the companies.

When entering into such agreements care should be taken to avoid exploitative relations. Farmers do complain that they are paid low prices for their products but feel they are tied to the companies in order to obtain needed inputs. Since most seaweed farmers operate in groups, the solution is to find out how much farmers will loose or gain if they buy their own inputs or depend on companies and then choose whichever is best.

As seaweed farmers become more productive and generate more income, it is anticipated that they will have the ability to become independent producers, negotiate better prices and secure micro-credit loans. However, to date, the provision of services by companies has been regarded as a driving force behind the development of seaweed industry in Tanzania.

Dr Diego Valderrama

Dr Diego Valderrama, a Colombian national, earned in 2008 a Ph.D. degree in Environmental and Natural Resource Economics from the University of Rhode Island (USA). He has an M.Sc. in Aquaculture/Fisheries from the University of Arkansas at Pine Bluff (USA) and a B.Sc. in Marine Biology from the Universidad Jorge Tadeo Lozano (Bogotá, Colombia). His expertise is on the economics of aquaculture and marine resources. For his M.Sc. work, he conducted studies on the production economics of shrimp farming in Central America (Honduras and Nicaragua). His research, funded by the Pond Dynamics/Aquaculture CRSP, USAID and WB/NACA/WWF/FAO, tackled a variety of issues of vital importance to the industry, including the economic optimization of production practices and the economic analysis of Best Management Practices (BMPs). As part of his doctoral degree work, he conducted research on a number of issues in marine resource economics, including an analysis of rotational management for sea scallop fisheries in the U.S. Northeast and Mid-Atlantic coasts, a study of market interactions between the world salmon aquaculture industry and Alaskan salmon fisheries, and a formal examination of the effectiveness of targeted tariffs in the recent antidumping case against imported shrimp in the U.S. market.

He has also conducted extensive research on the production economics of catfish farming in the southeastern U.S., the economics of aquaculture effluent regulation, the economic potential and implications of offshore aquaculture development in the U.S., and the international shrimp market. His research has been published in a number of peer-reviewed journals; in addition, he has co-authored three book chapters on aquaculture economics issues.

In October 2008, he was appointed a Fishery Planning Analyst (Aquaculture Economics) at the Development Planning Service (Fisheries & Aquaculture Economics & Policy Division) of the Fisheries and Aquaculture Department at FAO. In his new position, he will contribute to the Division's work on social and economic aspects of policy and strategy development to ensure sustained livelihoods for all beneficiaries in aquaculture. He can be reached at diego.valderrama@fao.org and at +39-06-570-56505.

Dr Alejandro Flores-Nava

Dr Flores-Nava is a Mexican national with a B.Sc. in Aquaculture Engineering (1982) from the Marine Technologies Institute of Veracruz, Mexico, an M.Sc. in Aquaculture and Fishery Management (1983) and a Ph.D. in Aquaculture (1990), both from the Institute of Aquaculture of the University of Stirling, U.K.. His doctoral research focused on assessing the potential for aquaculture development in karstic freshwater bodies of Yucatan, Mexico, from the limno-biological, social and economic perspectives.

He has spent more than 25 years carrying out research on a range of topics in aquaculture which included aquaculture engineering and systems design, aquaculture systems ecology, culture of marine shrimp, native fish of Central America and anurans of commercial importance. The results of his research have been published in many peer-reviewed papers, book chapters and books in aquaculture-related fields. He has also been full professor, Head of the Marine Resources Department and Director of the Centre for Research and Advanced Studies (CINVESTAV) of the National Polytechnic Institute in Merida, Mexico. Also, he has been the founding Director of the School of Natural Resources and the M.Sc. in Aquaculture Business Management Programme of the Marist University of Mexico, where he was Rector (President) from 2004 to December 2008.

Dr Flores-Nava has served as technical cooperation expert on aquaculture of the Government of Mexico in a number of missions to Central America and a consultant to the EU-funded PRADEPESCA programme, aimed at building capacity in aquaculture and fisheries in all of the Central American countries. He carried out a number of regional reviews and analysis of key aquaculture issues in Latin America, as an FAO consultant. Recently, he participated as an FAO international expert in the formulation of the National Aquaculture Development Plan of Uruguay.
He was the Technical Director and share holder of an export-oriented aquaculture farm based in Southeast Mexico for six years. As a private consultant, he has provided technical assistance in aquaculture in countries of Central America, the USA and Spain.

In October 2008, he was appointed Fishery and Aquaculture Officer for Latin America and the Caribbean, based in the Sub Regional office of Santiago, Chile. He can be contacted by email: Alejandro.Flores@fao.org.

New FAO Publications

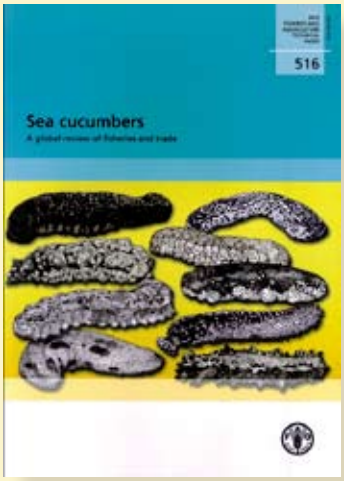
Lovatelli, A.; Farías, A.; Uriarte, I. (eds). Estado actual del cultivo y manejo de moluscos bivalvos y su proyección futura: factores que afectan su sustentabilidad en América Latina. Taller Técnico Regional de la FAO. 20–24 de agosto de 2007, Puerto Montt, Chile. *FAO Actas de Pesca y Acuicultura*. No. 12. Roma, FAO. 359 pp.

Los documentos en este informe se han preparado como material de apoyo para el Taller Regional sobre el Estrado actual del cultivo y manejo de moluscos bivalvos y su proyección futura: factores que afectan su sustentabilidad en América Latina. El taller organizado por la FAO se celebró en Puerto Montt, Chile, en agosto de 2007, con la colaboración de la Universidad Austral de Chile. El taller reunió a expertos con el objetivo de discutir aspectos técnicos y socioeconómicos relacionados con el cultivo y manejo de bivalvos; identificar las necesidades de investigación para el desarrollo futuro e inmediato; definir estrategias para aprovechar oportunidades y superar amenazas que enfrenta este tipo de producción animal; y recomendar medidas para la sustentabilidad de esta industria. El informe presenta los resultados del taller que se han agrupado en los temas que siguen: identificación de aspectos prioritarios, oportunidades de comercio y problemas enfrentados por el sector del cultivo y manejo de bivalvos; lista priorizada de los principales temas de investigaciones y desarrollo que requieren los cultivos y el manejo de moluscos bivalvos en América Latina y en cada país; lista priorizada de las principales políticas gubernamentales, científicas e industriales que contribuyan a una estandarización de la calidad de los moluscos bivalvos en términos de seguridad alimentaria; y, lista priorizada de responsabilidades sociales y políticas que permitan un desarrollo sustentable de la producción de moluscos bivalvos. Al final se proponen acciones estratégicas de nivel nacional y regional para lograr un desarrollo sustentable de la acuicultura y el manejo de moluscos bivalvos en la región.

Para mayor información contactar Alessandro.Lovatelli@fao.org

The FAO Fisheries and Aquaculture Department has supported the preparation of a poster on the "*Commercial holothurians of the tropical Pacific*" produced by the WorldFish Center and the Secre-tariat of the Pacific Community's Fisheries Information Section and Reef Fisheries Observatory.

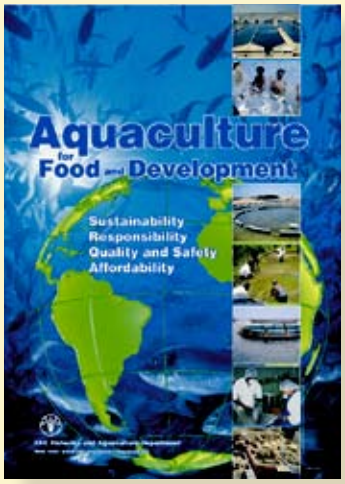
The poster provides information on 28 commercial species of sea -cucumbers, their geographical distribution in the region and their commercial value. Additional information on habitas and identification characteristics of each species is also provided. For additional information please contact the SPC Fisheries Information Section (BP D5, 98848 Nouméa Cedex, 95 Promenade Roger Laroque, Anse Vata, New-Caledonia; Tel.: +687 26.20.00; Fax: +687 26.38.18 or Mr Aymeric Desurmont, Fisheries Information Specialist at AymericD@spc.int).

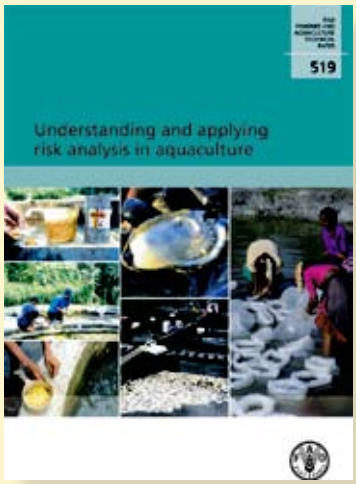


Toral-Granda, V.; Lovatelli, A.; Vasconcellos, M. (eds). Sea cucumbers. A global review of fisheries and trade. *FAO Fisheries and Aquaculture Technical Paper.* No. 516. Rome, FAO. 2008. 317 pp.

This paper reviews the worldwide population status, fishery and trade of sea cucumbers through the collection and analysis of the available information from five regions, covering known sea cucumber fishing grounds: temperate areas of the Northern Hemisphere; Latin America and the Caribbean; Africa and the Indian Ocean; Asia; and the Western Central Pacific. In each region a case study of a "hotspot" country or fishery is presented to highlight critical problems and opportunities for the sustainable management of sea cucumber fisheries. The hotspots are Papua New Guinea, the Philippines, Seychelles, the Galapagos Islands and the fishery for *Cucumaria frondosa* of Newfoundland in Canada. Together they provide a comprehensive and up-to-date evaluation of the global status of sea cucumber populations, fisheries, trade and management, constituting an important information source for researchers, managers, policy-makers and regional/international organizations interested in sea cucumber conservation and exploitation.

For more information please contact Alessandro.Lovatelli@fao.org





FAO. Report of FAO Workshop on Information Requirements for Maintaining Aquatic Animal Biosecurity Cebu City, Philippines, 15–17 February 2007. *FAO Fisheries and Aquaculture Report.* No. 877. Rome, FAO. 2008. 27 pp.

Infectious diseases are constraining the development and sustainability of the aquaculture sector through direct production losses and increased operating costs and indirectly, through restrictions on trade and impacts on biodiversity. Inadequate or poorly implemented biosecurity measures have lead to significant losses due to aquatic animal diseases in many countries around the world. Governments must implement the biosecurity obligations they have entered into under international agreements. In order to implement effective biosecurity at the national level, countries require strong global and regional coordination and interaction to identify and manage emerging risks. Information is a key element in any biosecurity programme and will be required to support national actions on surveillance and diagnostics, risk assessments for new and expanding aquaculture species, rapid response to aquatic disease emergencies, implementation of risk management measures and other national frameworks to manage biosecurity. The FAO Workshop on Information Requirements for Maintaining Aquatic Animal Biosecurity was aimed to increase awareness on general principles of biosecurity and to build capacity and deliberate on key information required for maintaining aquatic animal biosecurity focusing on aspects of risk analysis, diagnostics, health certification and quarantine, and epidemiological surveillance and reporting. The workshop was participated by a total of 37 delegates representing countries of the Association of Southeast Asian Nations (Brunei Darussalam, Cambodia, Indonesia, Malaysia, Myanmar, the Philippines and Thailand), South Asian countries (Bangladesh, India, Nepal), and China, and representatives from organizing and partner organizations (AusVet Animal Health Services, Philippine Bureau of Fisheries and Aquatic Resources and the Network of Aquaculture Centres in Asia and the Pacific). For further information, please contact Melba.Reantaso@fao.org

Poster to promote aquaculture

The FAO Fisheries and Aquaculture Department has published a poster to promote aquaculture for food and development. Aquaculture now accounts for almost 50 percent of the world's food fish and is perceived as having the greatest potential to meet the growing demand for aquatic food. The sector is developing, expanding and intensifying in almost all regions of the world, Global population demand for aquatic food products is increasing, the production from capture fisheries has levelled off, and most of the main fishing areas have reached their maximum potential. Aquaculture appears to have the potential to make a significant contribution to this increasing demand for aquatic food in most regions of the world; however, FAO is paying particular attention to inform and assist member countries to develop aquaculture in a sustainable manner in particular by following better management practices of producers.
Copies of the poster can be obtained by writing to Mr Valerio Crespi at FAO/HQ - E-mail: Valerio.Crespi@fao.org.

Bondad-Reantaso, M.G.; Arthur, J.R.; Subasinghe, R.P. (eds). Understanding and applying risk analysis in aquaculture. *FAO Fisheries and Aquaculture Technical Paper.* No. 519. Rome, FAO. 2008. 304 pp.

Risk analysis is an objective, systematic, standardized and defensible method of assessing the likelihood of negative consequences occurring due to a proposed action or activity and the likely magnitude of those consequences, or, simply put, it is "science-based decision-making". Risk analysis has mainly been applied in assessing risks to society and the environment posed by hazards created by or associated with aquaculture development, e.g. risks of environmental degradation; introduction and spread of pathogens, pests and invasive species; genetic impacts; unsafe foods; and negative social and economic impacts. Risk analysis provides insights and assists in making decisions that will help avoid such negative impacts and allows aquaculture development to proceed in a more socially and environmentally responsible manner. An integrated approach to risk analysis will assist the aquaculture sector in reducing risks to successful operations from both internal and external hazards and can similarly contribute to protect the environment, society and other resource users from adverse and often unpredicted impacts. This could lead to improved profitability and sustainability of the sector, while at the same time improving the public's perception of aquaculture as a responsible, sustainable and environmentally-friendly activity.

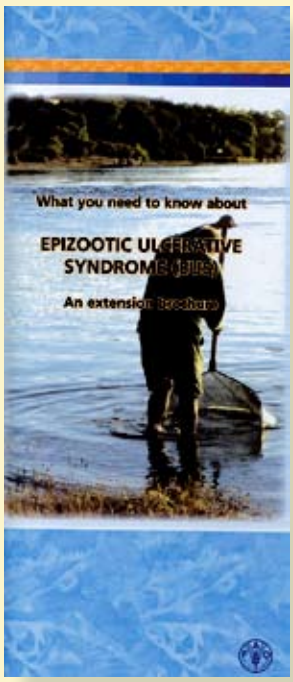
For further information, please contact Melba.Reantaso@fao.org

RAP/FAO. Lymer, D.; Funge-Smith, S.; Clausen, J.; Miao W. Status and potential of fisheries and aquaculture in Asia and the Pacific, 2008. RAP PUBLICATION 2008/15.

This publication, which is part of a series of biennial reviews, was prepared for the thirtieth session of the Asia-Pacific Fishery Commission (APFIC). APFIC is committed to improving the quality of information on the status and trends of fisheries and aquaculture in the region and to reviewing and analyzing this information regularly. The purpose of this document is to inform APFIC member countries of the current status and potential of fisheries and aquaculture in Asia and the Pacific region and the emerging issues facing the sector as it adapts to the continuously changing production and market environments. Two key areas identified by the Commission are also reviewed here, namely livelihoods in fisheries and the ecosystem approach to fisheries. The statistics contained herein are organized around key resources and attempt to show the trends in their production. Future volumes will aim to provide more information regarding the management status of these stocks and species groupings

FAO/Regional Commission for Fisheries. Report of the Regional Technical Workshop on Aquatic Animal Health. Jeddah, Kingdom of Saudi Arabia, 6–10 April 2008. *FAO Fisheries and Aquaculture Report*. No. 876. Rome, FAO. 2009. 119pp.

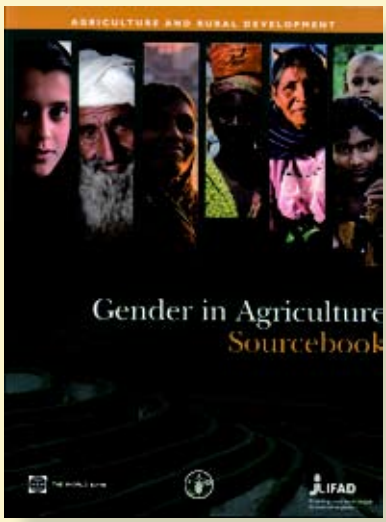
The Regional Technical Workshop on Aquatic Animal Health of the Regional Commission for Fisheries (RECOFI), held in Jeddah, Kingdom of Saudi Arabia, from 6 to 10 April 2008, was attended by 19 delegates from five member countries of RECOFI (Bahrain, Kingdom of Saudi Arabia, Oman, Qatar and the United Arab Emirates) and representatives from FAO. The workshop achieved the three objectives: (i) it presented the results and analysis of the "RECOFI regional aquatic animal health capacity and performance survey"; (ii) it prepared and finalized a "Proposal for a regional programme for improving aquatic animal health in RECOFI Member countries" based on the survey outcomes and workshop deliberation and brainstorming; and (iii) it created awareness and initiated capacity building through a technical seminar on basic concepts and emerging issues concerning aquatic animal health. The long-term vision of the regional programme for improving aquatic animal health capacity in the RECOFI member countries is: "To develop and maintain aquatic animal health capacity in the RECOFI region that will be able to support the sustainable development and management of the aquaculture sector while protecting regional biodiversity and aquatic ecosystems from the impacts of exotic pathogens and epizootic disease".

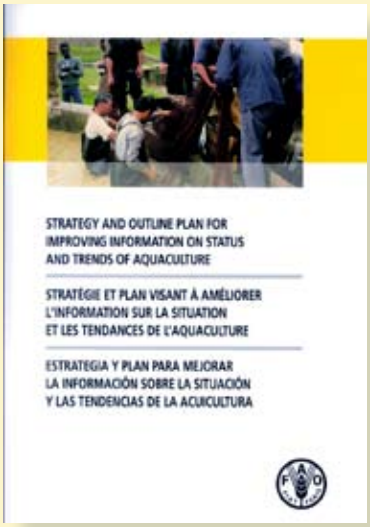


FAO. 2009. What you need to know about epizootic ulcerative syndrome (EUS): an extension brochure. Rome, FAO. 33pp.

This extension brochure – What you need to know about epizootic ulcerative syndrome (EUS) – provides simple facts or frequently asked questions about EUS such as: What it EUS?; Why it is a problem today?; What does it do to the fish; When does it occur?; How is it diagnosed?; Which species are susceptible or affected?; How is it spread?; What factors cause the fish to be infected with EUS?; Safety concerning eating EUS affected fish, simple biosecurity measures to prevent EUS?; What can be done in the event of an outbreak and simple procedures for collecting EUS samples for laboratory examination. This brochure is intended to a wide range of audience from fishfarmers and fishermen to extension officers as well as policy makers as a public information campaign to make available factual information about the disease so that awareness may be raised and for better understanding of the potential impact of the disease.

For further information, please contact Melba.Reantaso@fao.org





The World Bank, FAO and IFAD. Gender in Agriculture Source Book. 2008. 791pp.

Women play a vital role as agricultural producers and as agents of food and nutritional security. Yet relative to men, they have less access to productive assets such as land and services such as finance and extension. A variety of constraints impinge upon their ability to participate in collective action as members of agricultural cooperative or water user associations. In both centralized and decentralized governance systems, women tend to lack political voice.

Gender inequalities result in less food being grown, less income being earned, and higher levels of poverty and food insecurity. Agriculture in low-income developing countries is a sector with exceptionally high impact in terms of its potential to reduce poverty. Yet for agricultural growth to fulfill this potential, gender disparities must be addressed and effectively reduced.

The sourcebook includes a Module on Fisheries and Aquaculture.

For further information, please contact Melba.Reantaso@fao.org

Habib, M.A.B.; Parvin, M.; Huntington, T.C.; Hasan, M.R. A review on culture, production and use of spirulina as food for humans and feeds for domestic animals and fish. *FAO Fisheries and Aquaculture Circular.* No. 1034. Rome, FAO. 2008. 33pp.

Spirulina are multicellular and filamentous blue-green microalgae belonging to two separate genera Spirulina and Arthrospira and consists of about 15 species. Of these, Arthrospira platensis is the most common and widely available spirulina and most of the published research and public health decision refers to this specific species. It grows in water, can be harvested and processed easily and has significantly high macro- and micronutrient contents. In many countries of Africa, it is used as human food as an important source of protein and is collected from natural water, dried and eaten. It has gained considerable popularity in the human health food industry and in many countries of Asia it is used as protein supplement and as human health food. Spirulina has been used as a complementary dietary ingredient of feed for poultry and increasingly as a protein and vitamin supplement to aquafeeds.

FAO, 2008. Strategy and outline plan for improving information on status and trends of aquaculture. (trilingual English/French/Spanish).

The strategy and Outline for Improving Information on Status and Trends of Aquaculture is a voluntary instrument that applies to all States and entities. its overall objective is to provide a framework, strategy and plan for the improvement of knowledge and understanding of status and trends of aquaculture as a basis for plicy-making and managment. Required actions are specified, with a primary emphasis on the need for capacity building in developing countries.

FAN

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

It is also available on the FAO Web page:
www.fao.org/fi/newslet/newslet.asp.

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