



9-12 June 2010

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Invited editorial:

Managing health and ensuring food safety: a synergy in aquaculture

Aquatic animal health and safety of cultured aquatic products are equally important challenges facing aquaculture today. The volume of internationally traded aquaculture products are rapidly increasing and the risks of spread of trans-boundary aquatic animal pathogens and the risk of increasing health hazards to consumers are also on the rise.

As a result, major importing countries such as Japan, the United States of America and the European Union (EU) have been implementing more and more stringent trading standards for aquatic animal health (pathogens) and food safety (antimicrobial residues and harmful microorganisms) of aquaculture products.

The economic impact of the presence of human health hazards in aquaculture products can be devastating. For example, the EU alert system for food and feed indicated that 177 consignments of aquaculture products were detained or rejected in 2005 at EU borders, representing 48 percent of the fish and seafood consignments and an estimated cost of USD 9.3 million. The main causes of detentions/rejections were microbial hazards (38%), nitrofurans (27%), malachite green (20%), sulfites (13%) and other residues (3%). In 2004, EU aquaculture was worth more than Euro 2.5 billion, but financial losses due to disease were estimated at 20 percent of the production value (equivalent to Euro 500 million).

What are the contamination pathways of banned antimicrobials, pathogens and other microorganisms?

While harmful microorganisms in rearing waters can originate from off-farm resources such as water containing faecal bacteria, animal and poultry manure containing harmful microorganisms, in most cases, antibacterial residues result from their direct usage in the farm. It is also likely that some off-farm materials and products such as manure from animals fed with antimicrobials, water contaminated by livestock waste and effluents, etc., can lead to contamination of farmed products.

The inter-relationship between the use of antimicrobials and the presence of residues in products is so high, any effort to reduce contaminants and improve food safety should consider both aspects, i.e. maintaining animal health and improving food safety. In this respect, the role of the fish farmer in managing health should include both reducing mortalities and improving production at farm level and delivering safe, high quality products to the consumers.

Diseases in aquaculture are caused by pathogens introduced into the system from outside and/or weak biosecurity and poor husbandry practices. While some diseases related to general management can be controlled through good husbandry, sufficient nutrition, good water quality, other pathogenic diseases require interventions through therapeutics. They could well be antimicrobials, although banned substances should under no circumstances be used in production.

Hazards can be introduced into the food chain at the production stages, on and off-farm and spread during processing and preparation. Intervention strategies for assuring food safety are difficult to determine when microbial hazards causing human diseases do not manifest a disease condition in fish, as in the case of some naturally occurring pathogenic *Vibrio* spp. or unavoidable contamination by *Salmonella* spp. in some aquaculture systems.

Prudent use of antimicrobials and in particular, non-use of banned antimicrobials is a must, and should be done responsibly so that food safety risks are minimised. Risk assessment, an effective method of quantifying the risk posed by antimicrobial residues and microbial pathogens, could be used to assist in making risk management decisions, including the application of food safety assurance programmes based on Good Aquaculture Practice (GAP) and the Hazards Analysis and Critical Control Point (HACCP) system.

Such programmes represent a great challenge nowadays because a considerable portion of internationally traded high value aquatic commodities, such as shrimp, are produced by small-scale farmers (e.g. 55 to 69 percent in India, 70 percent in Thailand). These farmers are not always organized and have limited access to technical support, advice and financial resources for improving farming practices and marketing, to enable them to become competitive in the value chain. This poor segment of the chain is highly vulnerable, often faces production losses due to diseases, thus making them prone to regular use of drugs and chemicals during production. Organizing them into manageable groups or clusters can improve pond management efficiency, mainly by introducing management strategies such as fallowing, crop rotation, synchronised farming, etc., which can lead to better survival and production resulting to reduced reliance on drugs and chemicals.

In a cluster farm situation, water quality can be better managed through establishing reservoirs and holding areas, which otherwise may not be possible at the individual farmer level. Maintaining good water quality will undoubtedly reduce microbial contaminations and improve quality of fish. Cluster farming, thus, offers a significant opportunity for improving fish health as well as food safety in aquaculture. Application of better management practices (BMPs) in aquaculture, including biosecurity measures which help farmers managing health and improve food safety, is possible, and has been implemented with success. Well-designed BMPs are extremely effective and provide the basis for application of GAP and HACCP in aquaculture.

Can small scale aquaculture farmers adapt to new BMP that focus on both animal health and food safety? YES, THEY CAN. At a recent FAO/NaCSA (National Centre for Sustainable Aquaculture in India) workshop, in Kakinada, India, participants conducted practical exercises to address animal health issues and develop HACCP plans for shrimp and carp farming clusters. The exercise revealed significant synergies that can be created when both issues are addressed concurrently to make aquaculture economically profitable while providing optimum consumer protection.

**Rohana Subasinghe (FIMA) and
Lahsen Ababouch (FIU)**

COVER: An example of a Self-Sufficiency Project (SSP), where an integrated chicken-fish pond is an integral part, together with vegetable orchards. SSP is being implemented by the government of Thailand under "His Majesty the King's Sufficiency Economy Philosophy" which promotes self-sufficiency within communities. All photos courtesy of Dr M.B. Reantaso (FAO).

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FAO Regional Workshop on Development of an Aquatic Biosecurity Framework for Southern Africa

April 22 to 24, 2008, Lilongwe, Malawi

The recent incursion of a serious finfish disease, epizootic ulcerative syndrome or EUS, in the Chobe-Zambezi River, and now confirmed in Botswana, Namibia and Zambia, revealed biosecurity weaknesses in the southern African region. The Workshop on the Development of an Aquatic Biosecurity Framework for Southern Africa was convened by FAO as part of its continuing assistance to the region to understand the current situation, prepare a regional framework and identify capacity building needs to address aquatic biosecurity concerns which present potential risks to communities who are dependent on fisheries and aquaculture for food and livelihood.

This workshop, held from 22 to 24 April 2008 in Lilongwe, Malawi complements the ongoing FAO Technical Cooperation Programme TCP/RAF/3111 Emergency Assistance to Combat Epizootic Ulcerative Syndrome (EUS) in the Chobe-Zambezi River (participated by Angola, Botswana, Malawi, Mozambique, Namibia Zambia, and Zimbabwe) which commenced in October 2007 until September 2009 and is part of the Aquatic Biosecurity Project under the D.1 Objective of the Programme Cooperation Agreement with Norway.

Prior to the regional workshop, a questionnaire survey was undertaken between January

and March 2008 to evaluate national capacities for managing aquatic biosecurity (i.e. capacity to manage risks associated with exotic or emerging pathogens of aquatic animals and invasive aquatic species). Nine countries (Angola, Botswana, Kenya, Malawi, Mozambique, Uganda, Tanzania, Zambia and Zimbabwe) participated in the survey which covered a number of areas with direct relevance to assessing aquatic biosecurity performance (see Box 1).

The outcomes of the survey were presented during the above regional workshop and attended by 18 representatives from the nine countries participating in the survey, including representatives from the World Animal Health Organisation or the Office international des epizooties (OIE) and FAO. The workshop identified a number of key regional capacity building activities and actions to address aquatic biosecurity gaps or lapses in the southern African region. Foremost is a request to FAO to develop a

follow-up project, possibly to be funded under FAO's Technical Cooperation Project modality, to assist in reviewing institutional and legal frameworks to enable countries to better address current aquatic biosecurity issues, especially aquatic animal health management, trans-boundary movement of live aquatics and maintaining aquatic biodiversity. Additional recommendations include the following: (i) countries in the region to work closely in collaboration with FAO and OIE and regional partners to collectively address matters pertaining to aquatic animal health and biosecurity; (ii) recognize the University of Zambia's School of Veterinary Medicine as a potential regional diagnostic centre and Uganda as a regional coordinating centre; (iii) development of a regional model/template on import risk assessment for introductions and transfers of live aquatic animals; and (iv) holding of a ministerial level meeting for southern African countries to raise the issue of aquatic animal biosecurity. This



Dr Patrick Bastiensen (OIE), second from left, with regional participants from Zambia, Kenya, Uganda and Tanzania

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M. REANTASO, FAO

Eighteen participants representing nine countries (Angola, Botswana, Kenya, Malawi, Mozambique, Tanzania, Uganda, Zambia and Zimbabwe) participated in this regional workshop

workshop also recommended that the FAO focal points on aquatic animal health participate in the OIE Regional Workshop on OIE standards, a lever for growth in the fisheries and aquaculture sector in Southern Africa”, held in Maputo, Mozambique from June 10 to 12, 2008.

More information can be obtained by writing to Dr Melba Reantaso by email at Melba.Reantaso@fao.org.

Box 1. Topics covered by the Aquatic Biosecurity Capacity and Performance Survey

- International affiliations
- Trade activity
- Border control
- Surveillance/monitoring
- Incident/emergency response
- Diagnostic capacity
- Research/training
- Expertise (knowledge base)
- Challenges



Regional Workshop of TCP/RER/3206 “Assistance to Western Balkan Countries for Improving Compliance with International Standards for Aquatic Animal Health”
7-9 September, Zagreb, Croatia

Information: Melba.Reantaso@fao.org

High Level Meeting on Southern Africa Aquatic Biosecurity Strategy Development (back-to-back with a Training/Workshop) organised by FAO in collaboration with OIE and Namibia Ministry of Fisheries and Marine Resources
13-14 October 2009 (meeting); 15-17 October 2009 (training/workshop), Namibia

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FAO Expert Workshop on Improving Fish Farm Biosecurity through Prudent and Responsible Use of Antimicrobials and Chemotherapeutants
23-27 November 2009 or 14-18 December 2009, Thailand

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FAO Workshop on Methods and Indicators for Evaluating the Contribution of Small-scale Aquaculture (SSA) to Sustainable Rural Development

November 24 to 28 2008, Nha Trang, Viet Nam

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The contributions of small-scale aquaculture to global aquaculture production as well as rural livelihood development are generally recognized. These include providing livelihoods and income generating opportunities for rural communities, enhancing food security, improving social equity and enhancing the quality of life of rural poor communities. In the past, a number of projects/studies attempted to assess and review the current status of small-scale and/or rural aquaculture at the country level as well as the various issues (potential, limitations, constraints) affecting the sector. In addition, some methods/frameworks (e.g. rapid rural appraisal, participatory rural appraisal, socio-economic impact assessment, etc.) for assessing the impacts of aquaculture, useful tools for sectoral planning and development, have been initiated. However, there has not been a systematic assessment of how much and how small-scale aquaculture is contributing to aquaculture and rural livelihood development. Assessment indicators will help measure the sector performance and will assist local, regional and national policy makers to account for the level of performance of the sector (good or poor), understand the risks and the threats and thereby assist in determining appropriate interventions (e.g. highlighting the positive aspects, preventing or mitigating the negative aspects), and aid in setting priorities and allocating resources. This project on Methodologies and Indicators for Evaluating the Contribution of Small-scale Aquaculture to Sustainable Rural Development is being carried out through a combination of commissioned thematic papers, an expert workshop and implementation of case studies.

WORKSHOP HIGHLIGHTS

The FAO Expert Workshop on Methods and Indicators for Evaluating the Contribution of Small-Scale Aquaculture to Sustainable Rural Development, locally hosted by Nha Trang University, was successfully conducted from 24–28 November 2008 at the Nha Trang University in Viet Nam. Twenty five experts with a wide range of specialization, in Asia and Africa, in the field of aquaculture, rural development, ecology,



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Prof. Mr Hoang Hoa Hong, Vice-Rector of the Nha Trang University welcoming the expert to this FAO workshop

economics, sociology and geography participated in the expert workshop.

The expert workshop achieved the following expected outputs: (1) better understanding of the general concepts and principles behind sustainability indicators, their application to various sectors and specifically to the SSA sub-sector of aquaculture; (2) agreed definition of SSA as basis for selecting the SSA types that will be used for the pre- and pilot-tests; (3) a list of indicators that will assess the contribution of SSA to sustainable rural development; and (4) case study concepts.

Session 1 (setting the scene) presented 12 review and experience papers on various aspects of sustainability indicators and general SSA; reviewed a number of terminologies; revisited the definition of SSA including important attributes, positive and negative features; and drew up a number of guiding principles for sustainable aquaculture development as relevant to SSA.

Session 2 (drawing up of sustainability indicators) considered an appropriate conceptual framework (from a list including pressure state framework; ecosystem service; sustainable livelihood approval (SLA) framework – (natural, physical, human, financial, social capital); triple bottom line framework (economic, social and environmental); SMART framework (specific, measurable, accurate, relevant and timely) which formed the basis for free listing of more than 60 indicators. This

free list was short-listed to about 20 (see box) based on agreed conceptual framework (i.e. SLA) and agreed criteria of measurability (quantifiable or qualitative), accuracy, efficiency (cost effectiveness) and including means of verification. The workshop participants had a long debate and it took several iterations to agree that the outcome of the workshop would be contribution indicators. For each of the identified indicator, a brief description of its contribution, means of verification and methods of data collection are indicated.

Session 3 (preparation of country case concepts) agreed on the general table of contents of the survey and deliberated on the different types of SSAs which may be included in the country case studies.

PROGRESS SO FAR

Since the convening of the expert workshop in November 2008, a number of developments took place. Due to limited budget, only three countries (Philippines, Thailand and Viet Nam) were selected to participate in the pre- and pilot tests. The work is being undertaken by the University of the Philippines at Los Banos (UPLB), Kasetsart University and Nha Trang University, respectively. A Project Team meeting held in Bangkok end of March 2009 further refined the Nha Trang SSA contribution indicators (now narrowed down to 14 and subdivided into 5 based on its contribution, using the sustainable livelihood framework (natural, physical, financial capital and social capital) based on initial pre-test done in Thailand. The ongoing pilot testing are expected to be completed by end of June at the latest to be followed by cross-country analysis and synthesis.

A second expert workshop will be organized by FAO with UPLB Foundation in August 2009, in the Philippines. The objectives of this expert workshop



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25 experts with wide ranging fields of specialization participated in the development of an indicator system for measuring SSA contribution to rural development

are:

- (1) to present the outcomes (results and analysis) of the pilot testing of Nha Trang SSA contribution indicators to various types of SSA in Bangladesh, Philippines, Thailand and Viet Nam.
- (2) to present the cross-country analysis and synthesis based on the outcomes of pilot testing of Nha Trang SSA contribution indicators
- (3) to refine and validate the indicators and evaluate their robustness, replicability and applicability in helping measure SSA sector performance for wider adoption and use based on the outcomes of the case studies and cross-country analysis
- (4) draw up a list of recommendations to further support (.e.g appropriate interventions, priority setting and resource allocation) to the SSA sub-sector of sustainable aquaculture and rural development programmes based on a broad understanding of sector performance (as measured by indicators) as well as risks and threats.

More information about this project and its outcomes can be obtained by writing to Dr Melba Reantaso by email at Melba.Reantaso@fao.org.

List of potential indicators which can measure the contribution of small-scale aquaculture (SSA) to sustainable rural development, drawn in Nha Trang

- flows/enterprises
- off-farm nutrient use/farm products (input/output ratio)
- enterprises' contribution to cash income
- productive use of pond water
- return to land capital and labour
- trends in physical asset used for SSA
- income from SSA and derived from SSA
- SSA contribution to gross domestic product
- farmers who are members of active farmer associations or community organizations
- household consumption of fish
- seasonal distribution of fish consumption
- women access to resources and benefits of SSA
- women engaged willingly and as active decision-makers in SSA (including post-harvesting)
- batch testing for banned chemicals or poor quality aquatic products aquatic
- farmers adopting better management practices (BMPs)
- farmers involved in traceability system
- export earnings, employment generation
- disease
- vulnerability
- resource use conflicts

FAO Expert Workshop on “Guidelines for the implementation of an ecosystem approach to aquaculture (EAA)”

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Since 2006, the Aquaculture Management and Conservation Service (FIMA) of the FAO Fisheries and Aquaculture Department has been in the process of developing a framework for an “Ecosystem Approach to Aquaculture” (EAA). This is one component of the FAO project “Towards sustainable aquaculture: Selected issues and guidelines” (GCP/INT/936/JPN), which is being implemented by FIMA, with the generous support of the Government of Japan. The process included organizational and brainstorming meetings within FAO, with groups of experts and other partner institutions. Within the planned activities, there was a workshop coorganized with the Universitat de les Illes Balears that took place from 7 to 11 May 2007 in Palma de Mallorca, Spain on “Building an ecosystem approach to aquaculture”.

The main result of this activity is an FAO publication¹, presenting the output of this workshop and including contributed papers on: definitions, principles, scales concerning EAA and some management measures. The proceedings additionally addressed the human dimensions, and the economic and legal implications that are relevant for an ecosystem-based management of the sector. Two comprehensive review papers covered the status of brackish, marine and freshwater aquaculture in the light of an ecosystem-based management, indicating the major shortfalls and opportunities for such an approach.

Based on the above expert workshop and desk studies/reviews, it became clear that the implementation of the EAA will require changes in human behaviour and improved understanding of ecosystem’s functioning. It will also require the development of institutions capable of integrating different sectors including aquaculture, especially in terms of shared agreed objectives and standards. As some of the reviews pointed out, scarce participatory processes, poor understanding of social sustainability requirements

and poor governance hinder the widespread adoption of EAA and therefore require more guidance.

As part of continuing the process, FIMA prepared draft general guidelines for EAA during 2008 targeting policy and decision makers, with the assistance of an expert and in consultation with many other relevant persons and institutions. In order to review this first draft of these guidelines, FIMA organized an expert workshop on “Guidelines for the implementation of an ecosystem approach to aquaculture (EAA)” that took place in FAO Headquarters, Rome, Italy from November 24 to 26, 2008. The specific objectives of the expert workshop were to review, improve and reach agreement on the proposed general guidelines to make EAA operational and draw the way forward for its implementation.

The workshop brought together 24 internationally-recognized experts representing different regions of the world and providing a wide range of expertise in the areas of aquaculture environmental, social and economic issues.

The workshop consisted of plenary presentations of case studies which highlighted the difficulties and opportunities in the implementation of EAA. This was followed by three working group discussions,



Fish ponds in Cameroon, Oreochromis niloticus, Clarias gariepinus and Heterotis niloticus

each focussed on one of the three EAA scales (farm, waterbody, global) and one environment (freshwater, marine and coastal) to define key issues and recommendations on the scope and content of draft guidelines. The results of these working group discussions were then summarized and presented at the plenary for final discussion.

The final general guidelines derived from the workshop are currently being improved and are being initially tested in different situations such as workshops and country projects. Improved guidelines will be published as CCRF technical guidelines by the end of 2009.

These general EAA guidelines will be used in different countries and regions during the next biennium which will serve as basis for the development of more specific guidelines, such as aquaculture site selection and carrying capacity within an EAA framework.

¹Soto, 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.



D. SOTO, FAO

Integrated farming: salmon (to the left) and mussels (right)



D. SOTO, FAO

Harvesting native farmed fish in an aquaculture training institution, Iquitos, Peru



FAO/NACA Expert Meeting on the Use and Exchange of Aquatic Genetic Resources Relevant for Food and Agriculture

31 March to 2 April 2009, Chonburi, Thailand

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FAO Meeting on Initiative to Create an Aquaculture Network of the Americas (RAA)

10-12 June 2009, Guayaquil, Ecuador

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GFCM/CAQ Working Group Sustainable Aquaculture Meeting

July-September 2009

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Cage Aquaculture in the RECOFI Region – Highlights on a Recent Technical Workshop held in Oman

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During the fourth session of the Regional Commission for Fisheries (RECOFI), held in May 2007, in Jeddah, Saudi Arabia, the Commission endorsed the organization of a “Regional technical workshop on sustainable marine cage aquaculture development” in view of the growing interest of this aquaculture sub-sector. The workshop organized in Muscat, Oman, from 25 to 26 January 2009, focused on issues related to site selection, environmental impact assessment and monitoring, and licensing specific to finfish cage aquaculture.

In preparation for the workshop, RECOFI countries submitted national reviews on marine cage farming which provided an insight on the status of the industry and the technical and policy-related constraints challenging cage mariculture as well as highlighting the different development potential among the countries in the region. In addition, two background documents, one on the regulations governing Norwegian cage fish farming, with specific emphasis on environmental impact assessment (EIA) and monitoring procedures, and one on cage aquaculture licensing procedures were commissioned.¹

OPENING OF THE WORKSHOP

Mr Saoud Hamood Al-Habsi, Director General, Directorate General for Fisheries Research of the Ministry of Fisheries Wealth, Oman, officially opened the workshop. In his opening address, he recalled that the RECOFI Working Group on Aquaculture (WGA) was established by the Commission in recognition

of the growing importance of aquaculture at both global and regional levels. He underlined that the support granted to the WGA by the Commission reflected the common understanding that for the sector to grow sustainably and competitively there is a need to strengthen communication in the region.

The workshop was attended by experts from seven members of the Commission with a total of 31 participants including selected WGA focal points (Bahrain, Iraq, Oman, Qatar, Saudi Arabia, and the United Arab Emirates), scientists from the Ministry of Fisheries Wealth and Sultan Qaboos University (Oman), members of the private sector (Asmak Quriyat International LLC, Oman), a representative from the Fish Farming Centre in Jeddah, Saudi Arabia, and members of the Secretariat.

CAGE AQUACULTURE IN THE RECOFI AREA

The status of cage culture in the region and the technical, physical and policy constraints currently faced by individual countries in support of the sector were presented at the opening of the workshop.

The major constraint identified in the establishment of fish cages has been the limited availability of suitable farming sites characterized by shallow waters (particularly in the north-eastern shores of the Gulf), highly fluctuating salinity and temperature levels and inadequate sea currents. Other limitations identified included price competition from wild-caught fish, inadequate farming technologies for the region and the limited availability of endemic candidate species of commercial importance suitable for cage aquaculture. The issue of seed supply of commercial finfish species was also recognized as hampering the growth of the sector with only few existing hatcheries mainly operated by the public sector.

From an institutional point of view, the experts acknowledged that not all countries in the region had progressed with developing targeted policy frameworks, rules and regulation to adequately encourage the private sector to invest in cage culture. In fact, many countries in the region lack in-depth regulations focused on governing cage aquaculture, from licensing application process, environmental impact assessment



Group photo of the workshop participants

A.LOVATELLI, FAO

and monitoring requirements, to site selection procedures. It was further recognized that in some of the RECOFI countries, where environmental impact assessment regulations exist, these are not tailored for cage aquaculture.

The experts noted that recommending and finding suitable sites for cage aquaculture in the region has been and will be a challenge for the authorities and the industry. It was agreed that although coastal zoning, through the use of appropriate spatial tools, can be a time consuming and resource demanding process, it would allow for the identification and allocation of specific geographical areas to aquaculture practices and hence simplifying the process of farm site selection

CAGE AQUACULTURE – ENVIRONMENTAL IMPACT AND MONITORING

The experts at the workshop discussed at length the procedures and contents of an EIA and site selection criteria, particularly as some countries in the region require a mandatory EIA prior to establishing a cage operation. It was noted that the existing protocols have not been specifically designed for cage aquaculture projects. The experts further acknowledged that there is a need for the region and individual Commission members to develop an *ad hoc* EIA format based on the conditions of the local marine environment as this would determine the level of detail and elements needed to complete a thorough and useful EIA study. At the end of the agenda item, the content of an EIA format was developed which will enable individual countries to adapt the format to the national regulations and needs by selecting those elements of relevance.

In terms of monitoring, the participants indicated the need to obtain information on how to monitor cage fish farms with regard to both their benthic and pelagic impacts. It was suggested that

monitoring programmes from other cage culture farming countries be used; however, these would need to be adapted to local conditions. A monitoring programme consists of a number of parameters to be measured, but also specifies how, where and how often samples should be taken and analysed. Furthermore, the importance of monitoring results against threshold impact limits (EQS) was emphasized. In order to develop and establish a standard and specific fish cage culture monitoring protocol for the region, it was recommended that selected biologists from the RECOFI countries be responsible for the adaptation of an existing monitoring programme and EQS by establishing contacts and undergoing training with a research institute that holds expertise in cage farming impact and monitoring.

CAGE AQUACULTURE – LICENSING

The workshop participants discussed the licence application process outlined in a review paper prepared for the meeting and those currently adopted in selected countries in the region. It was agreed that potential investors require access to different types of information in order to adequately complete and submit an application form as well as a clear understanding of the application procedures. Furthermore, it was agreed that the legislation involved and process in aquaculture licensing should be transparent, readily available and include information on processing time, payable fees, if any, and whether there is a need for financial coverage in order to ensure that a site is cleared and cleaned in the event the culture operation is interrupted. A proposed cage aquaculture licence procedure was discussed and developed at the workshop based on a format developed and adopted by Oman.

ALGAL BLOOMS

The damage resulting from algal red tides to fish farming was also raised by the experts. It was reported that the industry in the region had recently suffered a serious setback due to a red tide event that killed the



Commercial cage aquaculture using imported circular and flexible structures off the coast of Dibba, UAE



Cage aquaculture using a rigid cage culture structure, UAE

fish in cages off the coast of Oman and the United Arab Emirates. The question raised was how to tackle the problem, protect and prevent disasters in the mariculture industry. It was generally agreed that there is a need to develop the ability to anticipate such events, monitor water quality conditions, establish warning procedures and develop contingency plans. The experts recommended that the WGA consider organizing a workshop on the impact of hazardous algae on aquaculture in collaboration with the Regional Organization for the Protection of the Marine Environment (ROPME).

¹The full report of the workshop is available from the RECOFI Secretariat and FAO Web site and contains the background documents. FAO/Regional Commission for Fisheries. Report of the Regional Technical Workshop on Sustainable Marine Cage Aquaculture Development. Muscat, Sultanate of Oman, 25–26 January 2009. *FAO Fisheries and Aquaculture Report*. No. 892. Rome, FAO. 2009. 135p.

FAO supported a symposium on “Small-scale aquaculture for increasing resilience of rural livelihood in Nepal”

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The Prime Minister of Nepal, Mr. Puspa Kamal Dahal, giving the inaugural address to the Symposium on Small-Scale Aquaculture for Increasing Resilience of Rural Livelihood in Nepal, held in Kathmandu from 5 to 6 February 2009

Nepal is a landlocked country. Inland capture fisheries and aquaculture are the sole domestic source of fish products for Nepalese people who have traditional preference for fish and other aquatic products. Over the years, aquaculture has developed as the fastest growing food production sector of Nepal although it is a relatively new farming activity in the country. Aquaculture production increased from 3 265 metric tonnes in 1985 up to 25 409 metric tonnes in 2006 (FAO, 2008)¹. It has become the major supplier of fish products accounting for 55.94 percent of the total fish production for the Nepalese people in 2006. Aquaculture in Nepal is basically small scale, contributing not only to the national fish supply but also contributing significantly to rural livelihood with about 2.47 percent contribution to the agricultural gross domestic product (AGDP). Small-scale aquaculture operations, such as

integration of pond aquaculture to existing crop/livestock-based farming system is believed to be effective in increasing local fish supply and diversifying livelihood options of small-holder farmers in terai and mid-hill valleys, thereby also increasing resilience of rural livelihoods in Nepal.

The role of small-scale aquaculture in household food security and nutrition, income generation and empowerment of women and marginalized communities has been increasingly appreciated in recent years. A few pilot projects implemented in terai and mid-hill valleys have been successful in demonstrating the viability of small-scale aquaculture systems in the country.

In order to provide a forum for presenting recent findings in research and development initiatives on small-scale aquaculture and discussing key policy issues and research needs for collaboration in support

of the small-scale aquaculture sector amongst policy makers, researchers and other stakeholders, a symposium on “Small-scale Aquaculture for Increasing Resilience of Rural Livelihoods in Nepal” was jointly organized by a number of national and international institutions from 5 to 6 February 2009 at the Radison Hotel in Kathmandu.

The symposium was turned into a real bright-spot event of aquaculture development in Nepal largely due to the great importance attached by the Nepalese government. The Honourable Prime Minister, Mr. Puspa Kamal Dahal, formally inaugurated the symposium with an opening address, a great demonstration of the strong political will on the part of the Nepalese government to promote small-scale aquaculture in Nepal. The Prime Minister indicated, in his speech, that small-scale aquaculture may solve the problems associated

with malnutrition and poverty, giving rural populations with self-employment opportunities. The symposium attracted wide interest from a large number of government institutions and international, regional and non-governmental organizations. The symposium accommodated nearly 40 presentations which covered policy issues, recent findings of research and development activities on small-scale aquaculture in Nepal and the region. The symposium also provided an important platform for identifying key constraints to the development of small-scale aquaculture in Nepal and the appropriate coping strategies.

As support to the symposium, FAO's Regional Aquaculture Officer for Asia and the Pacific participated in the symposium and made a presentation entitled "Development of Small-scale Aquaculture in Highland and Remote Areas: An Opportunity for Aquaculture Development in Nepal", which covered major aspects related to small-scale aquaculture development from FAO point of view, such as concept and roles of small-scale aquaculture and constraints to and coping strategies for small-scale aquaculture development in Nepal and the region. He also assured that FAO would provide technical

and policy support to the efforts of the Nepalese government in promoting small-scale aquaculture whenever possible.

The symposium identified inadequate supply of high quality fish seed as the key technical constraint and weak coordination between the different sectors in using water resource for aquaculture development as the key institutional constraint to developing small-scale aquaculture for increasing resilience of rural livelihood in Nepal. An appeal was made to the government, national and international organizations to take harmonized efforts to overcome the constraints. This symposium was a historical event in the development of aquaculture. It is going to have great impact on the development of the industry and contribute to national food and nutritional security and rural livelihood in Nepal.

¹FAO. 2008. FAO Fishstat. FAO, Rome

NEW STAFF PROFILE



Mr Xiaowei Zhou is a Chinese national. He graduated with his degree in fisheries and aquaculture from Shanghai Fisheries University (renamed as Shanghai Ocean University now) in 1983. In 1986 he finished his postgraduate study with a M.Sc. in aquaculture from the Fisheries College, University of Philippines. He worked as a research assistant and then research associate at the Freshwater Fisheries Research Centre, Chinese Academy of Fisheries Sciences from 1986-1993. The major research projects he was involved include the nutritional studies of major freshwater aquaculture species in China, feed formulation and feeding strategy for various polyculture farming models. As his part time duty during that period, he also served as coordinator and as well as trainer for the annually offered international training programme on integrated fish farming initiated by the Aquaculture Development Coordination Programme of FAO and the Chinese Government.

Since 1994, Xiaowei has worked as Programme Officer and then one of the Programme managers at the Secretariat of an regional inter-governmental organization, the Network of Aquaculture Centres in Asia-Pacific (NACA) which is based in Bangkok, Thailand. As one of the core professional staff at NACA for the past 15 years, he was closely involved in various projects development, planning and implementation in the Asia-Pacific region, covering a wide range of technical areas of aquaculture and related subjects. During his service in NACA, he participated and implemented many FAO-NACA joint activities in aquaculture. In recent years, he helped in organizing a number of workshops for FAO, such as the FAO workshops on use of alien species in aquaculture, review of mariculture status and development needs, and global review of status and trends of aquaculture.

In March 2009, Mr. Zhou was appointed the Fishery Statistician (Aquaculture) at the Fisheries and Aquaculture Information and Statistics Service, Fisheries and Aquaculture Economics and Policy Division, Fisheries and Aquaculture Department at FAO Headquarters. Within the fishery and aquaculture statistical group, he is responsible for FAO aquaculture production statistical data. He can be reached by email at xiaowei.zhou@fao.org or by telephone at +39 06 5705 5244.

Fourth meeting of the RECOFI Working Group on Aquaculture: A proposed work plan for the next biennium

Alessandro Lovatelli¹ and Dawood Suleiman Al-Yahyai²

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The fourth meeting of the Working Group on Aquaculture (WGA) of the Regional Commission for Fisheries (RECOFI) held in Muscat, Oman, in January 2009, was attended by seven countries of the Commission¹. The main objective of the meeting was to draft the new WGA work plan for submission at the Fifth session of the Commission (May 2009, Dubai, UAE). The proposed work plan activities listed below are based on recommendations and needs resulting from the implementation of activities during the last biennium, and emerging issues of importance for the region.

Risk analysis in aquaculture.

The WGA identified during the Regional technical workshop on aquatic animal health (6–10 April 2008, Jeddah, Saudi Arabia) a number of capacity building themes. The application of risk analysis to aquaculture was proposed as a priority activity. The WGA concurred that an integrated approach to risk analysis and application of risk management measures would assist the sector in reducing risks to successful operations from both internal and external hazards and could similarly help to protect the environment, society

and other resource users from adverse and often unpredictable impacts. The activity proposed is the organization of a training workshop on the introduction of risk analysis as applied to the aquaculture sector.

Environmental monitoring in cage aquaculture.

At the WGA Regional technical workshop on sustainable marine cage aquaculture development (25–26 January 2009, Muscat, Oman) several follow-up actions had been recommended. One priority activity concerned the development of a specific fish cage culture monitoring programme for the region. It was recommended that the adaptation of an existing

monitoring programme be carried out in collaboration with a recognized research institution that holds expertise in cage farming environmental impact and monitoring.

Hazardous algal blooms. In view of a recent major red tide event in the region that seriously affected fish cage aquaculture, the WGA recommended the organization of a workshop on the impacts of hazardous algae on aquaculture with a focus on how the fish cage culture sector could handle the problem by developing suitable counter measures in case of an outbreak.



A LOVATELLI, FAO

Indoor broodstock and research tanks used at the KISR research facility in Kuwait

National strategy on aquatic animal health. At the Regional technical workshop on aquatic animal health (6–10 April 2008, Jeddah, Saudi Arabia), it was also agreed that national and international aquatic animal health programmes are becoming essential to ensure the sustainable development of aquaculture. Such national programmes need to be harmonized at both regional and international levels and particularly with programmes of neighboring and major trading partners in order to achieve maximum effectiveness particularly for the safe transboundary movement of aquatic animals. A planning workshop is proposed to elaborate on the essential elements of a national strategy and the steps required in its development and implementation.

Spatial tools and aquaculture zoning. The WGA concurred that recommending and finding sites for fish cage farming or other aquatic practices in the region has been and will be a challenge for the authorities and the industry. The WGA acknowledge that coastal zoning through the use of appropriate spatial tools would allow the identification and

possible allocation of specific geographical areas to aquaculture practices. It is proposed to review the regional competence in the use of spatial planning tools and organize an inception workshop that would synthesize the knowledge acquired in the region and to recommend a road map on how to move forward in aquaculture zoning.

Aquaculture recirculation technologies. In view of the geographical conditions in the region and limitations of specific resources, the WGA felt that there is a need to introduce alternative fish farming technologies in the region such as recirculation. The WGA recommended the organization of a technical workshop on recirculation systems by inviting experts from the private sector including from those commercial companies that provide such technology.

¹FAO/Regional Commission for Fisheries. Report of the fourth meeting of the Working Group on Aquaculture. Muscat, Sultanate of Oman, 27–28 January 2009. *FAO Fisheries and Aquaculture Report*. No. 895. Rome, FAO. 2009. 44p.



View of the Fish Farming Centre in Jeddah, Saudi Arabia. Currently many culture structures are under renovation



Current Chairman of the RECOFI Working Group on Aquaculture, Mr Dawood Suleiman Al-Yahyai



GFCM/CAQ Meeting on National Legislation on Siting, Monitoring Programmes and EIA Regulatory Framework for Finfish Marine Aquaculture (ShocMed)

7-8 July 2009, Vigo, Spain

Information: Fabio.Massa@fao.org/rchapela@cetmar.org

GFCM/CAQ Multistakeholder Workshop on Siting and Carrying Capacity

21-22 October 2009 (Venue to be decided)

Information: Fabio.Massa@fao.org/karakassis@biology.uoc.gr

TCP/ALG/3103

Support to the development of desert aquaculture and management of brackish water basins in Algeria

Valerio Crespi

Aquaculture Management and Conservation Service (FIMA)
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Valerio.Crespi@fao.org

This short narrative enriched with photos presents the activities undertaken by the project TCP/ALG/3103 “Support to the development of desert aquaculture and management of brackish water basins in Algeria”. This ongoing project started in November 2008 and will last until October 2009.

The overall objective of the project is to assist the Algerian government, represented by the Ministry of Fishery and Fisheries Resources, in promoting the development of rural aquaculture in two selected sites located in the Wilaya (District) of Ouargla, 800 km south of the Algiers.

The main outputs of the project include: (1) a coherent plan for the development of desert aquaculture in the Wilaya of Ouargla which could be further extended to other Wilayas; (2) elaboration of a robust plan for fish feed production which will reduce dependence on costly imported fish feed; (3) use of local population of *Artemia* present in the brackish water basins for marine aquaculture.

The project provided the services of three international consultants with expertise on: (i) Nile tilapia production in desert areas; (ii) fish feed formulation; and (iii) biology and utilization of *Artemia* for aquaculture. A National Task Force composed of a national coordinator, two national consultants and two technicians was established to strictly follow all ongoing activities.

A total of 25 small-scale farmers (Figure 1) have been identified in two sites: “Périmètre des Jeunes N° 01” and Périmètre des Palmerai”, 20 km east of the town of Ouargla. Each farmer has a plot of 1-2 ha (Figures 2-3) and one or two earthen ponds (Figures 4, 5 and 6), with an average of about 150 m² and depth of 1 m, supplied by well water (Figure 7) mainly used for irrigation (Figure 8). About 35 ponds have been rehabilitated for fish production ensuring the construction of correct water inlet and outlet for efficient circulation. In many cases, ponds are located close to agricultural crops and the water fertilized by the fish will be used for irrigation.

The project is carrying out several fish stocking promotions (Figures 9 and 10). A total of 27 000 juveniles (3 to 5 g) will be freely distributed in the two selected sites of the project for the first production cycle. Ten fish ponds are already in operation using a stocking density of 0.09 to 0.68 kg/m³. The main cultured species are Nile tilapia (*Oreochromis niloticus*) (Figure 11) and the hybrid red tilapia (Figure 12) mainly coming from the National Studies and Documentation Research Centre for Fisheries and Aquaculture (CNRDPA) based in Bou Ismail, Tipaza.

The work carried out by the feed formulation expert resulted to a list of local ingredients (from agricultural products) to be used for the production of fish feed (Figures 13 and 14). This will reduce

the current practice of purchasing imported feeds which are also costly.

A second component of the project is focused on the analysis on the potential use of *Artemia* present in the Algerian brackish water bodies (Figures 15). An *Artemia* specialist, has recently undertaken a mission to Algeria to collect biochemical data and *Artemia* cysts in two salt lakes (chott): Chotts Melriir in the Wilaya of Ouargla and El Oued and the Grand Sebkhia d’Oran in the North.

So far the project implementation generated great enthusiasm amongst the beneficiaries who applied the proposed aquaculture techniques; positive results were demonstrated through fish pond construction and water and land management.

The FAO Representative in Algeria, Mr Guy De Lannoy, and Project Assistant, Ms Ratiba Sengui, provided valuable assistance and support during this phase of project implementation. Mr Abdelkader Bounouni (Chief of the Aquaculture Department), Mr Toufik Boutouchent (Project National Coordinator), National Task Force members and the international consultants are also commended for their valuable contribution.



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All photos V. Crespi, FAO

Central Asia: TCP/RER/3205

Advice to Central Asian governments on the feasibility of commercial fish and livestock feed production

TCP/RER/3205 Advice to Central Asian Governments on the Feasibility of Commercial Fish and Livestock Feed Production was approved by FAO in January 2009. This project was requested in 2008 by the governments of Kazakhstan, Kyrgyzstan, Tajikistan and Uzbekistan.

The requests were made in the light of the dramatic decline in fish production in Central Asia since the collapse of the Soviet Union at the beginning of the 1990s, when the five transition economies in Central Asia became independent. Inland capture fisheries and aquaculture production decreased, over that period, between 70-80 percent in Kazakhstan, Turkmenistan and Uzbekistan; while Tajik production dropped by 94 percent and the Kyrgyz production is now about 2 percent of its production in the 1980s.

Various regional and national level fisheries and aquaculture sector initiatives in recent years showed that one of the main constraints to development of the aquaculture sector is the lack of availability of and access to high quality fish feeds for aquaculture in the region. A similar situation was found in the livestock sector. This barrier to development is one of the most striking, particularly in view of the fact that the fish and livestock feed industry was well-developed in the pre-independence period in the countries of this region.

The governments of the above mentioned Central Asian republics consider it necessary to support the establishment of an enabling environment for the fisheries and livestock sectors. This project will enable the agriculture ministries, responsible for fisheries, aquaculture and livestock, to support the development and management of the aquaculture and livestock sectors in a responsible manner.

The project aims to strengthen capacity of the agriculture ministries to take the most appropriate decisions and formulate adequate policies in support of increasing access to and availability of high quality commercial fish and livestock feeds in Central Asia.

The following outputs are foreseen from this project:

- a neutral and balanced feasibility analysis report with comprehensive advice, and clear conclusions and recommendations to the governments in Central Asia on the opportunities for commercial animal feed production in their countries and how the governments could stimulate the development of this subsector;
- an information package for private sector investors, to generate their interest in establishing commercial animal feed production capacity in Central Asia or in creating more efficient and cost-effective feed supply chains;
- at least 60 public and private sector specialists in the region (15 per participating country), able to provide business planning advice based on economic analyses to fisheries, aquaculture, livestock and feed companies;
- increased awareness and understanding among the governments, animal feed industries and potential investors on the needs and requirements of aquaculture and livestock producers in Central Asia, with respect to high quality commercial feeds, and the opportunities for investment in aquaculture and fish and animal feed production in the region.



Old soviet style fish hatchery in Uzbekistan, near Tashkent



A huge feed storage facility built during period of Soviet era, Kairakum, Sugd, Tajikistan. Unavailability of quality feed has been identified as the most critical factor for expansion of aquaculture; it is obviously the one of the most important factor, but probably not the only factor. This probably stems from mindset of centralized economy, where cost and economic viability of feed-based aquaculture was not taken into consideration.

The USD 342 000 project started its implementation in June 2009 with a Project Inception Workshop in Tashkent, Uzbekistan, and is likely to be completed by October 2010. More information on the project, its activities and achievements will follow in future issues of FAN.



Feed used for feeding of trout, Forel Farm, Wahdat district, Tajikistan. Trout feeds are imported from Iran with crude protein content varying between 40-50%. Cost of these imported feeds is around USD 2.0-5.0 per kg depending upon the size and protein content.

More information can also be obtained from Mr Raymon van Anrooy (FAOSEC) at Raymon.vanAnrooy@fao.org; or Mr Mohammed Hasan (FIMA) at Mohammed.Hasan@fao.org.



FAO Expert Workshop on Indicators for Assessing the Contribution of Small-Scale Aquaculture to Sustainable Rural Development

6-8 August, Tagaytay, Philippines

Information: Melba.Reantaso@fao.org

GFCM/CAQ Workshop on Guidelines and Application on Sustainable Indicators in Aquaculture (InDAM)

18-19 November 2009 (Venue to be decided)

Information: Fabio.Massa@fao.org/sklaoudat@uth.gr

Training Workshop on Aquatic Animal Health and Feed Management under OSRO/IRQ/704/UDG: Towards sustainable development of inland fisheries in Iraq

20-27 September 2009, Amman, Jordan

Information: Rohana.Subasinghe@fao.org/Mohammad.Hasan@fao.org/Melba.Reantaso@fao.org



Global Conference on Aquaculture 2010

Farming the Waters for People and Food

9-12 June 2010, Bangkok, Thailand

BACKGROUND

By providing nearly 50 percent of fish consumed globally and creating more than five million livelihood opportunities worldwide, aquaculture increasingly contributes to global food fish supplies and to alleviation of malnutrition, hunger and poverty, especially in developing countries. It has been estimated that to maintain the current global per capita fish consumption of 16.7 kg/year, aquaculture needs to produce more than 78 million tonnes by 2030, i.e., 20 years from now, aquaculture will need to produce 27 million tonnes of more fish than the current annual production. This also means that the sector will have to continue its fast growth to sustain the projected demand for aquatic food, whilst ensuring environmental integrity and social responsibility. Emerging issues and other challenges will need to be addressed in a timely manner along the development paths as well in order for the industry to fully utilize its potential and contribute to the Millennium Development Goals.

In 1976, the Food and Agriculture Organization of the United Nations (FAO) held the first ever global conference on aquaculture in Kyoto, Japan, known as the Kyoto Conference. This conference explored a variety of opportunities for aquaculture development, including technology, science, networking, and manpower and institutional strengthening. It triggered the recognition of aquaculture into higher prominence. Almost 25 years later, in 2000, the Network of Aquaculture Centres in Asia and the Pacific (NACA) and FAO

along with the Thai Department of Fisheries organized the “Conference on Aquaculture in the Third Millennium”, in Bangkok, Thailand. Similar to the Kyoto Conference, the Bangkok Millennium Conference reflected on the 25 years of aquaculture development globally, and examined the role of aquaculture and its likely role in the overall development context. The Bangkok Millennium Conference resulted in a global consensus, “The Bangkok Declaration and Strategy for Aquaculture Development” (Bangkok Declaration), a document which provided the much needed technical and political vision and guidance for sustainable development of the sector.

It has been a decade since the Bangkok Millennium Conference. Aquaculture is now recognized as the emerging agriculture, the fastest growing food producing sector and the future of fisheries. Therefore, it is timely to evaluate where the sector stands today, how far it had travelled since 2000, and what challenges and opportunities are encountered by the various stakeholders and to consider collectively the common quest for its continued sustainable development.

Cognizant of the guidance from the 1995 FAO Code of Conduct for Responsible Fisheries and the 1996 FAO World Food Summit and the above in mind, FAO, NACA and the Kingdom of Thailand endeavour to hold the “Global Conference on Aquaculture 2010”. The Conference will be held from 9 to 12 June 2010 and back-to-back with the 5th Session of the FAO

Committee on Fisheries, Sub-Committee on Aquaculture. The latter, which will also be hosted by the Royal Thai Government, will be held just after the Conference, from 14 to 18 June 2010. This arrangement will enable a wider participation of key policy decision makers in aquaculture development and management.

With a broad-based participation and a wide-ranging involvement of stakeholders that this conference and the events leading up to it have provided in its development, a final outcome of the conference - the Consensus and Strategy document - will provide critical guidance for all with an interest in aquaculture - planners, investors, donors, technical assistance agencies, producers, civic organizations, community advocacy groups, and consumers - in their common efforts to attain the envisioned state of sustainable aquaculture development.

PURPOSE

The objectives of the Conference are to:

- review the present status and trends in aquaculture development including an evaluation of the successes and limitations in implementing the Bangkok Declaration and Strategy;
- identify and address emerging issues in aquaculture development;
- assess opportunities and challenges for future aquaculture development; and
- build consensus on the way forward to advance the agenda of aquaculture as a global,



Global Conference on Aquaculture 2010

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sustainable and a competitive sector.

PARTICIPATION

Stakeholders interested in aquaculture development and management including the public sector, private industry, academia, development partners, civil society, etc. are cordially invited to participate in this important global conference.

PROCESS

The organization of this four-day global conference will be driven by different committees (i.e. an International Organizing Committee, an International Programme Committee, a Local Organizing Committee, a Conference Consensus and Strategy Drafting Committee and a Conference Secretariat).

The Conference Programme follows a process comparable to that of the 2000 Bangkok Millennium Conference. It will consist of introductory Plenary Keynote Presentations and Invited Guest Lectures. Plenary Keynote Presentations will provide a scenario of the state and prospects of aquaculture and requirements for its development while Invited Guest Lectures will address salient issues on aquaculture, and its relevance as a major food production sector in the current context of globalization and other developments. The plenary presentations will set the scene for the subsequent two parallel sessions on thematic areas that will form the basis for achieving the objectives of the conference. The parallel sessions will present the Thematic Reviews to be followed by a panel of expert discussions,

Box 1. Tentative session themes

- Aquaculture and the environment
- Enhancing the contribution of aquaculture to poverty alleviation, food security and rural development
- Improving knowledge and information sharing, research and extension in aquaculture
- Responding to market demands and challenges
- Resources, technologies, and services for future aquaculture
- Sector management and governance in aquaculture

Box 2. Tentative thematic topics

- Addressing human capital development and gender issues in aquaculture sector
- Alleviating poverty through aquaculture: how can we improve?
- Aquaculture and socio-economic growth and development: enabling policies, legal framework and partnership for improved benefits
- Aquaculture feeds: addressing the long-term sustainability of the sector
- Consumer assurance: market-based quality schemes, certification and traceability, ecolabeling, retailer specifications
- Ecosystem approach to aquaculture, including interactions between fisheries and aquaculture
- Enhancing the contribution of aquaculture to poverty alleviation, food security and rural development
- Facilitating market access for producers: addressing market access requirements, evolving consumer needs, and trends in product development and distribution
- Information and data needs: a strategy for improving aquaculture statistics
- Improving aquaculture governance: what is the status and who is responsible for what?
- Improving biosecurity: a necessity for aquaculture sustainability
- Improving knowledge and information sharing, research and extension in aquaculture
- Investing in research, communication, training/extension for responsible aquaculture
- Investment, insurance and risk management for aquaculture development
- Novel and emerging technologies: can they contribute to improving aquaculture sustainability?
- Organic aquaculture: the future of expanding niche markets
- Progressing aquaculture in this knowledge economy through virtual technology and novel management and decision-making tools
- Promoting responsible use and conservation of aquatic biodiversity for sustainable aquaculture development
- Protecting small-scale farmers: a reality within a globalised economy?
- Responsible use of resources for sustainable aquaculture
- Servicing the aquaculture sector: role of state and private sectors
- Supporting farmer innovations, recognizing indigenous knowledge and disseminating success stories

and will develop conclusions and recommendations pertaining to the themes discussed that will be fed into the consensus and strategy document. A Concluding Plenary Session will present a Draft Consensus and Strategy document for discussion and adoption, in principle.

The Global Conference on Aquaculture 2010 uses a unique format, drawing from lessons learned from the previous 2000 Bangkok Millennium Conference, that will enable a consensus building on the strategy for future aquaculture development and management. The four-day conference will consist of two parallel sessions; each session logically following from the previous one and all thematic sessions covering both policy and technical issues. This format will enable a deliberate, participatory and iterative process that allows conference participants ample opportunity to contribute to the various technical sessions. The format is also designed to promote greater interaction and wider participation in the discussions on issues associated with the biological, technological, social, economic, environmental, policy, legal and other aspects of the development of aquaculture. A wide cross-section involvement of the stakeholders of aquaculture development will be sought before, during, and even after this conference.

Pre-conference activities include preparation of six aquaculture

development regional reviews (current status and future prospects in Africa, Asia-Pacific, Europe, Latin America and the Caribbean, Near East and North America) and a global synthesis on aquaculture development. For the thematic reviews, every attempt will be made to cover as many relevant issues as possible (see Box 1 for tentative session themes and Box 2 for tentative expert panel topics).

A Poster Session, to be incorporated in the conference programme, will allow individual participants to present technical and experience papers. Abstracts of these papers will be made available to the Chairpersons of thematic sessions as appropriate, and will eventually be published.

The Conference Programme, which will be available in May 2009 will provide more detailed information. The language of the conference is English.

PRODUCTS

Flyers and announcements will be prepared and a dedicated conference website will be established to facilitate and widely disseminate the procedures and outcomes of the conference.

A first major outcome of the conference will be a "Consensus and Strategy for Aquaculture Development" document. This document will encapsulate consensus, in principle, of the way forward for sustainable development and management of

aquaculture as well as a strategy, which provides guidance on broad and specific goals, and describe the agreed upon goals and the desired ways to achieve them.

A second major output of the conference is a technical proceedings document which will contain the plenary presentations, guest lectures and regional and thematic reviews presented during the conference. These two documentation outputs will be published after the conference.

A Conference Programme containing a synopsis of the keynote and invited guest lectures, regional and thematic reviews and a Book of Abstracts for the poster presentations will be distributed during the conference.

The major outcomes of the conference will facilitate the sustainable development of aquaculture in the long-term.

CALL FOR SUPPORT

Interested parties/individuals are encouraged to support this global conference through sponsorships (guidelines will be available soon); participation through self-funding or institutional-funding mechanisms, particularly funding by donors and development agencies for promoting participation from developing countries; through individual expert and/or corporate contribution to the preparation of aquaculture status and prospect reviews and thematic reviews; and through other appropriate funding support.

Contacts and Information

For further information, please contact the Conference Secretariat:
Conference Secretariat
Aquaculture Management and Conservation Service (FIMA)
Fisheries and Aquaculture Department
Food and Agriculture Organization of the UN (FAO)
Rome, Italy
E-mail: Aqua-Conference2010@fao.org
Fax: 0039-06-57053020
Web Site: www.aqua-Conference2010.org

A new web-based information system for aquaculture development: the regional aquaculture information system (RAIS)

A new Web site has been established by the Food and Agriculture Organization (FAO) under the aegis of the Regional Commission for Fisheries (RECOFI) to facilitate the exchange of aquaculture information in the Gulf area among regional experts and stakeholders, and to promote and develop a sustainable aquaculture industry.

RECOFI member countries (Bahrain, Islamic Republic of Iran, Iraq, Kuwait, Oman, Qatar, Saudi Arabia and the United Arab Emirates) are responsible for the timely data entry and validation along with the promotion of the information system at the national, regional and global level.

The new aquaculture information system is now up-and-running

and it is available at the following address:

www.raisaquaculture.net

The Web site is organized in nine databases (Annual aquaculture statistics; Aquaculture experts; Production centres; Suppliers of technology; Research institutions; Research and development programmes; Photo library; Virtual library and Selected links) to store regional aquaculture information.

RAIS is organized and maintained through a regional and national mechanism: (1) a Regional Centre located in Kuwait City and linked to the FAO in Rome and to the RECOFI Secretariat in Cairo, Egypt; and (2) a National Centre in each RECOFI member country under the supervision of an officially nominated RAIS National

Coordinator. All authorized users have the right to directly post new information through user friendly online submission forms.

The system has been conceived to be as user-friendly as possible and allows rapid data entry from the administrators and authorized users and easy data retrieval. Users who want to contribute by submitting new items are kindly requested to contact the RAIS Regional Centre or the RAIS National Coordinators. Full addresses are provided in the "Contact us" section accessible from the entry page.

Further details can be obtained by writing to:

Valerio Crespi at FAO
E-mail: valerio.crespi@fao.org

The new FAO aquaculture electronic bulletin

The FAO Aquaculture e-Bulletin delivers all the latest information from the FAO Fisheries and Aquaculture Department including upcoming key meetings and events, recent aquaculture publications, updates on technical cooperation programmes world wide and coverage of major news related to emerging aquaculture issues. FAO users are kindly invited to subscribe the FAO Aquaculture e-Bulletin by following the online instructions at:

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Aquaculture Information Management and Traceability System in Thailand

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Aquaculture development in Thailand has grown consistently for the past 25 years. Sectoral development policies of successive governments were directed towards intensification and expansion of the sector, as clearly evidenced by shrimp aquaculture development in coastal and, subsequently, inland areas. With expansion and growth, problems relating to environmental degradation and losses due to animal health emerged. The TCP-Facility (TCP/THA/3103 – Aquaculture zoning), requested by the Department of Fisheries, Thailand, (DoF Thailand), addressed these issues through creation of decentralized capacity for the DoF Thailand to better manage the environment, aquatic animal health and traceability of aquatic products through a comprehensive aquaculture management information system. The purpose of the FAO support through the TCP-F was threefold: (a) to identify key issues relating to the management of the aquaculture sector which could be resolved by a comprehensive aquaculture zoning and planning policy; (b) to liaise with stakeholders in the aquaculture production sector for their feedback regarding zoning needs and priorities for more effective regulation of the sector; and (c) to develop a project proposal document for FAO TCP support.

A TCP-F mission in February 2008, of the Project Team led by Mr Simon Funge-Smith (RAPI) and supported by Messrs James McDaid Kapetsky (FAO International Consultant), José Aguilar-Manjarrez (FIMA), Jesper Clausen, APO Aquaculture (RAPI), Uscharee Ruangdej, National Consultant (DOF/THA), and Ms. Suttinee Limthammahisorn (DoF Thailand), achieved the following outputs: (a) a national review on sector requirements covering aspects of environment, aquatic animal health, food safety and trade aspects ; (b) a short background

study covering requirements for an information system; and (c) a draft TCP project document “Aquaculture traceability and information management system” (Figure 1).

The above proposed project is aimed at improving sustainability and livelihood security of aquaculture stakeholders, improving quality and traceability of aquaculture products, and sustaining or expanding trade in aquaculture products. These goals correspond with a stated vision of DoF Thailand for sustainable aquaculture development.

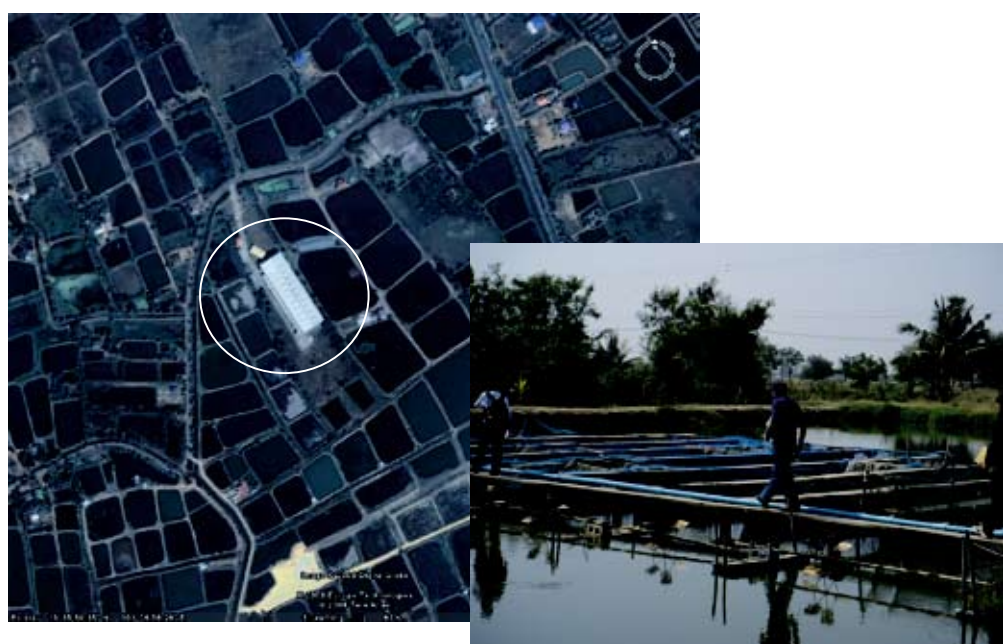


Figure 1. Map showing location of Nile tilapia (*Oreochromis niloticus*) farm and many other adjacent tilapia and giant river prawn (*Macrobrachium rosenbergii*) farms in Chachoengsao province, Thailand. Dr Kapetsky conducting a field visit to one of these farms in the centre of the map

A successful implementation of a full-scale project would lead to improved operational decision-making on aquaculture management and development and enhanced aquaculture planning and policy capabilities. An Aquaculture Management Information System would be operated mainly by provincial and district DoF personnel and research centers, with wider application and participation by personnel at all levels the fisheries department as well as other departments, ministries and NGOs. The system will support the development of tools for increased traceability and improved management of aquaculture information in Thailand.

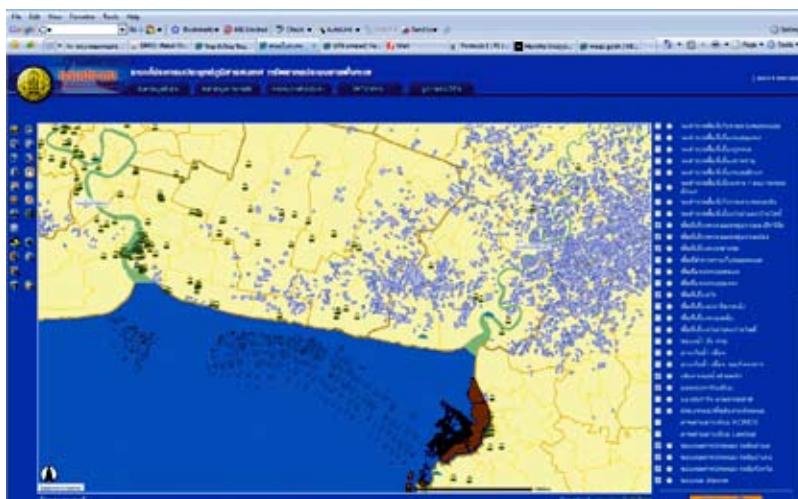


Figure 2. Map showing coastal aquaculture and fisheries structures (ponds, cages and traps) in Thailand. Source: Fishery Information Technology Center, Department of Fisheries Thailand (<http://gis.fisheries.go.th>)

The proposed information system is relatively generic, applicable in other countries with significant aquaculture production systems, and provides an opportunity for utilising an operational GIS to support a comprehensive Aquaculture Management Information System. This is a

timely initiative as DoF Thailand is committed to secure/sustain the use of GIS for fisheries and aquaculture at all administrative levels. The Fishery Information Technology Center, well-equipped with skilled manpower and data (Figure 2), could provide strong support to the project.

It is anticipated that some of the key recommendations and concepts that will be developed as a result of this assistance will be implemented under the recently approved FAO TCP/THA/3202 “Certification of small-scale aquaculture in Thailand”.



Expert Workshop for Drafting CWP Handbook on Standards of Aquaculture Statistics
10-13 November 2009, Viet Nam

Information: Xiaowei.Zhou@fao.org

Regional Workshop on Capacity Building Needs for Improving Aquaculture Statistics and Data Collection in Asia
16-18 November 2009, Viet Nam

Information: Xiaowei.Zhou@fao.org

GFCM/CAQ Workshop on Harmonisation Standards for Mediterranean Aquaculture Data Collection
8 December, Trabzon, Turkey

Information: Fabio.Massa@fao.org; HadjAli.Salem@fao.org; Matthew.Camilleri@fao.org

FAO provided support to Malaysia through TCP/MAL/3201 (D): Identification of capacity building needs of the Malaysian fish inspection system to meet international market requirements



Fifty four participants representing both government and private sectors participated in the Stakeholder Workshop held on 15 August 2008

M. REANTASO, FAO

This project, approved in July 2008, has two main objectives: (i) to identify capacity building needs of the fish inspection system in Malaysia to meet international market requirements; and (ii) to develop a plan of action to improve market access for Malaysian fish and fishery products.

An important economic sector in Malaysia, fisheries account for 1.73 percent of the country's GDP, provides employment to 90 000 people, with a total production of 1.5 million tonnes of which 200 000 tonnes come from aquaculture. Malaysia's fishery product exports (shrimp, cephalopods, dried and value added products) were worth USD 632.5 million in 2005; while the ornamental fish export was about 9 percent of the global share in 2006, being the second largest producer of ornamental fish next to Singapore. A recent mission by the EU Food and Veterinary Office (FVO) in April 2008 highlighted a number of areas where strengthening of the official control system is required in order to meet international

market requirements. The areas of concern included quality and safety aspects (e.g. onboard handling of fish, cold chain, microbiological and chemical monitoring of products) as well as animal health aspects.

In order to achieve the objectives of this TCP facility, the following activities were undertaken: (i) two internal meetings with staff and officials of Malaysia's Department of Fisheries (DOF) and other government representatives; (ii) visits to fish landing sites, prawn farm and processing plant, ornamental fish farms and exporter's facilities, and quarantine facilities; and (iii) national stakeholder workshop.

The National Workshop was held in Kuala Lumpur on 15 August 2008 and participated by more than 50 representing the government and private sectors. After the plenary presentations on Fish Quality and Safety – Market Access Requirements presented by Dr I Karunasagar of FAO's Fish Utilization and Marketing Service

(FIU), and Aquatic Animal Health: International Regulations presented by Dr M Reantaso of FAO's Aquaculture Management and Conservation Service (FIMA), the workshop participants were divided into groups to participate in the two parallel sessions: Session 1: Food quality and safety, food safety action plan and capacity building needs of the industry; Session II: Aquatic animal health, aquatic animal health action plan and capacity building needs of the industry.

Session 1 discussed the various aspects of the food chain; the industry sought clarifications on Codex Standards and Guidelines regarding temperature maintenance at different segments of the food chain. Regarding the issue of certifying aquaculture farms, the participants were informed of the recently completed FAO technical guidelines for aquaculture certification. The need for training crew, staff at landing jetties and transporters on hygienic fish handling practices, cold chain maintenance and recording was emphasized.



Malaysia's fishery product exports (shrimp, cephalopods, dried and value added products) are worth USD 632.5 million in 2005; while the ornamental fish export is about 9 percent of the global share in 2006, being the second largest producer of ornamental fish next to Singapore

Session II deliberated on the Action Plan of the DoF with respect to fulfilling the recommendations of the EU FVO Mission. The official control in the ornamental fish value chain as contained in the plan of action consists of 6 steps: (1) listing or inventory of farms, brokers and exporters; (2) pre-registration application; (3) inspection, screening and laboratory analysis; (4) registration; (5) official control; and (6) official guarantee. Four main components are involved in the process. These include: (1) official control (registration, inspection, audit, visit, sampling, notification and contingency planning); (2) surveillance (passive, active, targeted); (3) official analysis (laboratory examination, validation, verification and endorsement); and (4) official guarantees (certification and reporting). The major recommendations coming out of the Session II include the following: (1) participants expressed strong support to assist in

the implementation of DOF Plan of Action; (2) participants expressed concern particularly on who will cover the costs for quarantine and conduct of risk analysis; and (3) establishing control measures at farms and exporter premises. Participants identified a number of capacity building needs such as: farm-level biosecurity guidelines including aspects of quarantine, record keeping, farm to farm movement of fish, responsible use of chemicals, water quality management; practical guidelines on surveillance; information on fish nutrition for health enhancement; research on appropriate use of chemicals in fish farming; farmer awareness and education on aquatic animal health management; rapid response to disease epizootics (both DOF and farmers); contingency planning; guidelines for risk analysis; standard operating procedures for aquaculture operations; and inter-calibration and proficiency testing for laboratories.



Inception Workshop of TCP/CPR/3202 "Better management of freshwater aquaculture in Pingjiang County, Hunan Province"

3 April 2009, Beijing, China

Information: Melba.Reantaso@fao.org

Inception Workshop of TCP/CPR/3203 "Improvement of aquaculture food safety in Hubei Province"

30 July 2009, Songzi Province, China

Information: Iddya.Karunasagar@fao.org/Rohana.Subasinghe@fao.org

Latest developments in the establishment of a regional fisheries and aquaculture arrangement for Central Asia and the Caucasus

In FAN 41, the first steps in the process of establishing a regional inter-governmental collaboration arrangement in capture fisheries and aquaculture in Central Asia and the Caucasus were described. Since then, a Steering Committee was established, consisting of focal points from each of the countries in the region and the FAO Secretariat to the Steering Committee. This Steering Committee met for the first time in Ankara, Turkey on 24-26 March 2009 at the FAO Subregional Office for Central Asia. Its role was to prepare for the second regional inter-governmental meeting on the establishment of a Central Asian and Caucasus regional fisheries and aquaculture arrangement.

The Steering Committee meeting was funded under the FAO Technical Cooperation Programme through TCP/RER/3203 Component 2 "Support to the establishment of a regional fisheries and aquaculture organization for Central Asia and the Caucasus". It was attended by officially appointed focal points of nine countries (Armenia, Azerbaijan, People's Republic of China, Georgia, Kyrgyzstan, Russian Federation, Tajikistan, Turkey and Uzbekistan), as well as observers from the Interstate Coordination Water Commission (ICWC) based in Uzbekistan, the Turkish International Cooperation Agency (TICA) and the World Bank.

The meeting discussed the pros and cons of the remaining options for the establishment of a regional inter-governmental arrangement in fisheries and aquaculture in order to decide on the most suitable option in terms of a cooperative framework for fisheries and aquaculture in the region. The options presented and discussed were:

- 1) an independent Inter-Governmental Organization (IGO) following the example of the Network of Aquaculture Centers in Asia and the Pacific (NACA), and
- 2) an Article XIV body under the FAO constitution.

Legal and policy assistance towards the development of the outline agreement of a regional inter-governmental arrangement for fisheries and aquaculture was provided by the FAO Secretariat.

The meeting initiated the drafting work on the substantive issues of the agreement that would establish the preferred type of arrangement and govern its operations and work. It also agreed on the next steps including a timeline to confirm the commitment to a cooperative arrangement and the choice on the option for the regional cooperative arrangement.

In accordance with the schedule agreed at the first Steering Committee meeting, seven countries (Armenia, Georgia, Kyrgyzstan, Russian Federation, Tajikistan, Turkey, Uzbekistan) have informed FAO

of their preference. These countries stated that they would prefer a body that is established under Article XIV of the FAO Constitution rather than an independent network type inter-governmental organization for fisheries and aquaculture.

Preparations are being made for a second regional inter-governmental meeting on the establishment of a Central Asian and Caucasus regional fisheries arrangement. This meeting will be hosted by the Ministry of Agriculture and Rural Affairs of Turkey and is scheduled to take place in Trabzon, Turkey on 3-5 June 2009.

More information on the process for and matters relating to the establishment of the cooperative arrangement in fisheries and aquaculture for Central Asia and the Caucasus can be obtained from: Mr Raymon van Anrooy (FAOSEC) at Raymon.vanAnrooy@fao.org; Mr Ndiaga Gueye (FIEL) at Ndiaga.Gueye@fao.org; Mr Blaise Kuemlangan (LEGN) at Blaise.Kuemlangan@fao.org or Mr Thomas.MothPoulsen (SEU) at Thomas.Mothpoulsen@fao.org.



Participants of the First Steering Committee Meeting for the preparation of the Second Regional Inter-governmental Meeting

R. VANANROOY, FAO

Melamine in fish feed and implications for safety of aquaculture products

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A large outbreak of renal failure in cats and dogs in the United States of America (USA) in 2007 associated with pet food containing melamine and cyanuric acid and hospitalisation of over 50 000 children in China in 2008 linked to consumption of melamine-contaminated infant formula had focussed attention on the human health hazards due to exposure to melamine through food. Melamine is a nitrogen-rich compound that could mimic proteins in some tests; melamine was therefore added to protein supplements used in feeds such as wheat gluten, corn gluten and rice gluten to artificially inflate protein levels. Melamine has also been detected in fish feed in several countries and the human health implications of melamine in fish feed is discussed here.

CHEMICAL NATURE AND SOURCES OF MELAMINE

Melamine (2,4,6-triamino-1,3,5-triazine) is a chemical, which on reaction with formaldehyde, forms resins with many industrial uses such as the production of plastics, laminates, glues, adhesives, moulding compounds, coatings, paper, paperboard and flame retardants. It is the major component of pigment yellow 150 that is used as colourant in inks and plastics. Melamine is also used in some fertilisers. It is found as a metabolite of the pesticide cyromazine, that is used in plants¹ and in veterinary practice, as

an ectoparasiticide on some animals such as sheep, goat, and rabbits. Trichloromelamine is approved for use as a sanitising agent on food processing equipments and utensils except for milk containers and equipment². Trichloromelamine may decompose to melamine during this use.

Melamine is degraded by some soil associated bacteria in three successive deamination reactions to ammeline (4,6-diamino-2-hydroxy-1,3,5-triazine), ammelide (6-amino-2,4-dihydroxy-1,3,5-triazine) and cyanuric acid (s-triazine-2,4,6-triol) (Figure 1). Cyanuric acid may be found as an impurity in melamine. It is also found in swimming pool water as a dissociation product of dichloroisocyanurates used for water disinfection.

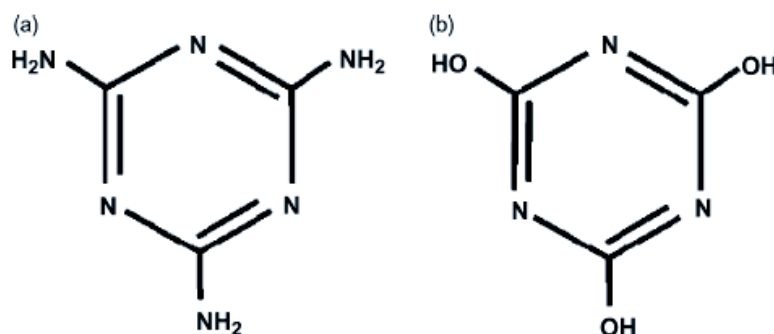


Figure 1. Structure of (a) melamine and (b) cyanuric acid

Due to its permitted usages, very low levels of melamine may be found in food. Some countries have legal limits regarding migration of melamine from food contact material to food. In the European Union (EU), the migration limit is 30mg/kg food (Commission Directive EC No. 2002/72). The level of melamine in food resulting from permitted usage on food contact surfaces has been estimated² to be less than 15 µg/kg (ppb). Under experimental conditions (hot, acidic conditions, 95°C for 30 min), levels of 0.54, 0.72, 1.42, 2.2 mg/kg were found in coffee, orange juice, fermented milk and lemon juice respectively as a result of migration from cup made of melamine-formaldehyde resin³.

Melamine has been in industrial production for many years and its environmental distribution has been evaluated by several agencies. In factories involved in its production, 80-90 percent in waste water is eliminated by the waste water treatment plants (WWTPs)⁴. It has been reported that microorganisms in WWTPs can adapt to melamine, when continuously exposed. Water is the preferred environmental

compartment for melamine and the environmental distribution has been estimated⁴ as follows: air <0.0001 percent, water 99.99 percent, soil 0.006 percent, sediment 0.0001 percent. The Predicted Environmental Concentration (PEC) is 0.003 mg/l in site-specific water (based on estimates of a plant producing 300 t/yr) and 0.0042 mg/l in regional water based on European Union System for Evaluation of Substances (EUSES) model. Data of monitoring melamine in river water in Japan indicates levels ranging from below detection limit of 0.0001 to 0.0076 mg/kg in water, below detection limit of 0.01 to 0.40 mg/kg in sediment and below detection limit of 0.02-0.55 mg/kg in fish (OECD, 1998). The EUSES estimates for fish in local waters (near production facility) is 0.36-10.9 mg/kg. In common carp *Cyprinus carpio*, the bioconcentration factor (BCF) has been estimated⁴ to be <0.38. Melamine is metabolically inert and all studied animals excrete melamine or its analogues as such. Fish are reported to excrete melamine more slowly than rodents².

TOXICITY OF MELAMINE

Toxicity test has been performed in some aquatic animals. The no-observable-effect-concentration (NOEC) in chronic toxicity estimations for the aquatic invertebrate *Daphnia magna* was 500 mg/l based on macroscopic observation and <125 mg/l based on microscopic observation⁴. The EC_{50,48h} for this organism in acute/prolonged toxicity estimation was >2000 mg/l. For fish, the LC₅₀ was as follows: *Leuciscus idus melanota*, LC_{50,48h} >500 mg/l; *Oryzias latipes*, LC_{50,48h} 1000 mg/l; *Poecilia reticulata* LC_{50,96h} >3000 mg/l; *Poecilia reticulata* LC_{50,48h} >2000 mg/l (OECD, 1998). Data for chronic toxicity are available in two fish *Jordanella floridae* (NOEC 500 mg/l) and *Salmo gairdneri* (NOEC >1000 mg/l)⁴.

A 13-week rat study established a no-observed-adverse-effect level (NOAEL) of 63 mg/kg and based on this data and adopting a 100-fold safety factor, FDA⁵ designated 0.63mg/kg as the tolerable daily intake (TDI). Considering the increased toxicity of melamine and cyanuric acid, FDA² applied an additional 10-fold safety factor and revised the TDI to 0.063mg/kg. This would mean, for a 60 kg person, a 3.78 mg melamine and its analogues/day. Using a worst case exposure scenario, in which 50 percent of diet (estimated 3 kg, typically composed of 1.5 kg liquid and 1.5 kg solid food) is contaminated with melamine, it was estimated that if the level in the contaminated food is 2.5 mg/kg (ppm), the daily intake would be 0.063 mg/kg bw/d. Based on these calculations, FDA² concluded that levels of melamine and its analogues below 2.5 ppm in foods other than infant formula is not of public health concern.

The European Food Safety Authority (EFSA)⁶ recommended a TDI of 0.5 mg/kg bw/day for the total of melamine and its analogues ammeline, ammelide, cyanuric acid (EFSA, 2008).

A recent Expert Meeting of the World Health Organization (WHO) used dose-response modelling and benchmark dose approach for deriving TDI⁷. The benchmark dose for 10 percent response rate (BMDL₁₀) was calculated to be 35 mg/kg body weight per day. Applying a safety factor of 200 to this value, the Expert Meeting determined TDI to be 35/200=0.175, rounded to 0.2mg/kg body weight per day.

MELAMINE IN AQUACULTURED FISH

Since the price of fish meal depends on the protein content, there is a possibility of adulterating this ingredient of fish feed with melamine to artificially inflate protein levels. Recently, there have been reports of detection of melamine (up to 150 ppm) in fish meal and fish feed in different countries. Method for determination of melamine in catfish tissue up to 10 ng/g (ppb) using Triple quadrupole LC-MS-MS has been reported⁵. This method was further improved⁸ to achieve a limit of detection (LOD) of 3.2 µg/kg (ppb) and melamine could be detected in edible portion of fish fed with melamine alone or with cyanuric acid at 400 mg/kg. In catfish (*Ictalurus punctatus*), the levels ranged from 81-210 mg/kg; tilapia, (*Oreochromis* sp.), 0.02-177 mg/kg; trout (*Oncorhynchus mykiss*) 34-80 mg/kg; salmon (*Salmo salar*) 58-94 mg/kg. Melamine was not detected in muscle tissue of non-dosed catfish or tilapia, but levels ranging from 0.04-0.12 mg/kg were found in non-dosed trout and salmon. This was attributed to the presence of melamine at 0.5 mg/kg and 6.7 mg/kg commercial trout and salmon feed, respectively. Two salmon that were dosed 380 mg/kg for longer withdrawal study died at 7 and 11 days. Fish dosed with combination of melamine and cyanuric acid had lower cyanuric acid residues in tissue compared to fish dosed with cyanuric acid alone. Melamine-cyanurate crystals were observed in kidney and intestinal tissue but not in edible tissue⁸. Maximum cyanuric acid residue level detected was 5.8 mg/kg in trout, 11.2 mg/kg in catfish, 27.7 mg/kg in tilapia. In the case of salmon, after 1 day withdrawal, 1200 mg/kg was found in tissue, but levels were 1.7 and 0.43 mg/kg after 6 and 10 days withdrawal⁹. Two salmon that received lower

dose of 200 mg/kg melamine and cyanuric acid had residue levels of 0.57 and 0.78 mg/kg after 14 days withdrawal and kidneys of these fish had crystals⁹.

Shrimp fed for 14 days with feed containing 50 or 100 mg/kg melamine had 217 and 51 µg/kg in muscle, while shrimp fed with non-dosed feed had 41 µg/kg. Shrimp feed had background level of 170 µg/kg. Shrimp given feed with 100 mg/kg were found to feed poorly⁸. Cyanuric acid could not be detected in edible tissues of shrimp fed with melamine and cyanuric acid, though melamine residues could be detected⁹.

In a survey⁸ of market-ready shrimp, catfish, tilapia, salmon, eel and other types of fish in the USA, 31.4 percent had melamine at concentrations above LOD. 10/105 samples (9.5 percent) had melamine at levels ranging from 51-237 µg/kg.

Methods for analysis of melamine in food and feed were reviewed by the WHO Expert Meeting. Enzyme-linked immunosorbant analysis (ELISA) kits are available and these tests can be performed without sophisticated laboratory. These are useful for screening with detection limits ranging from 0.1 to 25 mg/kg⁷ depending upon the matrix being analysed and sample extraction method employed, but positive results should be confirmed using methods like High Performance Liquid Chromatography-ultraviolet/diode array detection (HPLC-UV/DAD) which has a detection limit of 0.05-65 mg/kg.

The levels found in market survey and in non-dosed fish/shrimp in experimental studies were lower than 2.5 ppm concern level suggested by FDA. At these levels, there is no health hazard for fish/shrimp consumers. However, studies with experimental

feeding show that if the feed is contaminated with high levels (reports indicate up to 150 ppm), some fish species may have levels that are of concern. Therefore, it would be important to ensure that fish feed is not adulterated with melamine and its analogues.

WHO/FAO. 2006. Pesticide Residues in foods. Report of Joint FAO/WHO Meeting on Pesticide Residues. 400pp.

²FDA. 2008. Interim Safety and Risk Assessment of Melamine and Analogues in food for humans. accessed October 3, 2008. (<http://www.cfsan.fda.gov/~dms/meamra3.html>).

³Ishiwata, H., Inoue, T., Yamazaki, T., & Yoshihira, K. 1987. Liquid chromatographic determination of melamine in beverages. *J. Assoc. Off. Anal. Chem.* 70: 457-460.

⁴OECD. 1998. Screening Information Data Set for Melamine. CAS No. #108-78-1. Available at <http://www.chem.unep.ch/irptc/sids/OECD/SIDS/108781.pdf>, 17 Sept, 2008.

⁵FDA. 2007. Interim Melamine and Analogues Safety/Risk Assessment, May 25, 2007. (<http://www.cfsan.fda.gov/~dms/meamra.html>).

⁶European Food Safety Authority (EFSA). 2008. Statement of EFSA on risks for public health due to the presence of melamine in infant milk and other milk products in China. *The EFSA Journal* 807: 1-10.

⁷WHO. 2009. Toxicological and Health aspects of melamine and cyanuric acid. Report of a WHO Expert Meeting in collaboration with FAO supported by Health Canada. http://www.who.int/foodsafety/fs_management/infosan_events/en/index.html.

⁸Andersen, W.C., Turnispeed, S.B., Karbiwnyk, C.M., Clark, S.B. Madson, M.R., Giesecker, C.M., Miller, R.A., Rummel, N.G., & Reimschuessel, R. 2008. Determination and confirmation of melamine residues in catfish, trout, tilapia, salmon and shrimp by liquid chromatography with tandem mass spectrometry. *J. Agric. Food Chem.* 56: 4340-4347.

⁹Karbiwnyk, C.M., Andersen, W.C., Turnispeed, S.B., Storey, J.M., Madson, M.R., Miller, K.E., Giesecker, C.M., Miller, R.A., Rummel, N.G., & Reimschuessel, R. 2008. Determination of cyanuric acid residues in catfish, trout, tilapia, salmon and shrimp by liquid chromatography-tandem mass spectrometry. *Anal. Chim. Acta* doi:10.1016/j.aca.2008.08.037.



Use of environmental friendly feed additives and probiotics in Chinese aquaculture

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The production of fish feed additives for the aquaculture industry is a thriving sector in China. These natural substances are being used for several purposes including the enhancement of the immune systems of farmed fish, promoting growth, attaining the desired flesh and skin pigmentation, as well as improving the organoleptic properties of the farmed product. At the same time, the use of such additives has no negative impacts to the farming environment.

A few decades ago, fish farms made use of large volumes of antibiotics, chlorides, and other substances that negatively impacted the environment as a whole. With the expansion of the industry at the global level and the increased knowledge gained on the impacts resulting from poor farming practices, policy makers urged and supported the industry to research on and increasingly make use of environmentally-friendly feed additives. In view of the above and also due to growing consumer conscientious for safe and healthy products, the Chinese aquaculture industry is actively pursuing the improvement of its products from a qualitative point of view and not simply focusing on increasing outputs.

The type of feed additives and probiotics currently produced in China used by the aquaculture industry are listed in the table below.

Probiotics and PSB. As early as 76 A.D., the Roman historian, Plinius, found that yogurt can be used to treat human enteritis and in 1907, a Russian biologist revealed that consuming fermented milk was good for the health. The above “discoveries” were reconfirmed in the twentieth century and, in 1996, scientists from around the globe got together to renew discussions on the values and benefits of probiotics. A Joint Food and Agriculture Organization/World Health Organization Working Group on drafting “Guidelines for the evaluation of probiotics in food” has recommended that probiotics be defined as “live micro-organisms which, when administered in adequate amounts, confer a health benefit on the host”¹. Results from numerous applied aquaculture research trials have effectively confirmed that the use of some bacteria species such as the rod-shaped *Bacillus* (e.g. *B. licheniformis*, *B. natto*, *B. subtilis*)

Table 1. List of feed additives and probiotics currently used in Chinese aquaculture

Item	Products	Use
Probiotics	<i>Bacillus</i> spp. – <i>B. licheniformis</i> , <i>B. natto</i> , <i>B. subtilis</i> and other species	Water treatment and feed additive
Photosynthetic bacteria (PSB)	<i>Rhodospseudomonas</i> – <i>R. palustris</i> , <i>R. capsulatus</i> and other species	Water treatment and feed additive
Poly-unsaturated fatty acids (PUFA)	Meal and DHA oil isolated from the marine fungus, <i>Schizochytrium</i> , or from the heterotrophic microalga, <i>Cryptocodinium cohnii</i>	Fatty acid supplement
Pigments	Astaxanthin pigment isolated from the <i>Phaffia</i> yeast, the green algae, <i>Haematococcus pluvialis</i> , or extracted from crustacean exoskeleton, or chemically produced	Pigmentation of fish flesh and skin, and enhancement of the immune system
Vaccines	Live viral vaccines, inactivated viral vaccine, inactivated bacteria vaccine, subunit vaccine, and inactivated trivalent bacteria vaccine	Anti-viral
Herbal medicines	<i>Rheum palmatum</i> (Chinese rhubarb) (and other species in same genus), <i>Isatis indigotica</i> (woad), <i>Houttuynia cordata</i> (lizard tail), <i>Stemona japonica</i> (stemona), <i>Pulsatilla chinensis</i> (bai tou weng) and others	Anti-bacterial and anti-fungal
	<i>Isatis indigotica</i> (Chinese woad), <i>Polygonum cuspidatum</i> (Japanese knotweed), <i>Belamcanda chinensis</i> (blackberry lily), <i>Chrysanthemum indicum</i> (mums), and <i>Corydalis bungeana</i> (yan hu so, a native Chinese herb)	Anti-viral
	<i>Amomum tsao-ko</i> (type of ginger), <i>Dichroa febrifuga</i> (blue evergreen hydrangea), <i>Areca catechu</i> (betel nut palm)	Insecticide
	<i>Allium sativum</i> (garlic), <i>Rosa lavigata</i> (Cherokee rose), <i>Cyanotis arachnoidea</i> (a perennial herb), and <i>Gentiana flavomaculata</i> (a perennial herb)	Stimulates growth and regulation of the ecdysis rhythm in crustaceans

and photosynthetic bacteria can improve the farming environment and help increase the survival rate of a wide range of different farmed aquatic organisms including crustaceans, finfish, bivalve molluscs and echinoderms. To date, there are over 10 Chinese companies producing and distributing these products throughout the country clearly indicating that the use of probiotics is widely accepted by fish farmers.

Pigments. Astaxanthin is the major carotenoid responsible for the pink-red pigmentation of many fish and shrimp species. As aquatic animals are unable of producing this pigment, farmed animals must be supplied with this natural nutritional component in the diet in order to obtain the natural colouration of wild fish. This pigment has been long used by feed producers catering for the salmon and trout industry. In China, the production of this natural pigment has been neglected mainly because of the small contribution of salmonids to the national aquaculture industry. However, only recently, the astaxanthin has been shown to have other biological and nutritional functions, linked to its ability to act as a powerful antioxidant.

In China, the astaxanthin pigment is currently being produced using the *Phaffia* yeast (*Xanthophyllomyces dendrorhous*, formerly *Phaffia rhodozyma*), the unique freshwater microalga (*Haematococcus pluvialis*)², extracted from crustacean carapace or synthetically produced. Among these, the yeast and the microscopic green-algae are considered as the most promising resources for the extraction of this natural dye due to the high level of accumulated astaxanthin. Furthermore, studies have demonstrated that the astaxanthin derived from *Phaffia* yeast results in the highest deposition levels in farmed fish and shrimp. One Chinese company located in Xiamen (Amoy), Fujian Province, has become a leader in the production of this carotenoid (Figure 1).

As mentioned the freshwater microalga, *Haematococcus pluvialis*, is another important source of astaxanthin. There are currently a handful of facilities producing algal astaxanthin in China with the largest one located in Jingzhou, Hubei Province. The cost of producing the pigment from this algal species is higher than if using the yeast as it requires some expertise among the personnel (Figures 2 and 3). From this point of view, the producers of microalgal astaxanthin are facing strong competition in both domestic and international market.

In China, the production of astaxanthin from crustacean shell or through chemical synthesis is only carried out at a small scale mainly due to problems related to the availability and supply of large quantities



Figure 1. View of a workshop producing *Phaffia* Astaxanthin and probiotics in Xiamen, China

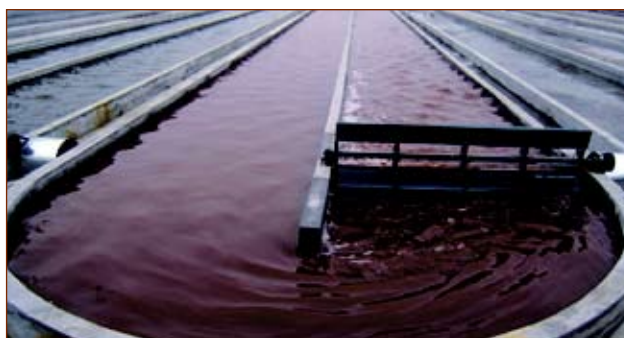


Figure 2. An outdoor tank for the production of the astaxanthin microalgae in China



Figure 3. Astaxanthin powder

of the raw material (crustacean exoskeleton) and technical issues. A further source of the pigment is from the aerobic Gram-negative astaxanthin-producing bacterium (*Paracoccus carotinifaciens*) which is, however, only produced in Japan.

The free-floating filamentous cyanobacteria *Spirulina*³ is also an important pigment source and food supplement. This blue-green algae is cultivated around the world, and is used as a human and farmed fish dietary supplement. Studies have shown that *Spirulina* significantly enhances the pigmentation in *Penaeus monodon* and other farmed shrimp. Besides its pigmentation properties, *Spirulina* as a feed supplement has shown to have other benefits such

as increasing feed efficiency. This cyanobacteria is cultured on a commercial scale and is widely utilized in Chinese aquaculture⁴.

PUFAs as nutrient supplements. Poly-unsaturated fatty acids (PUFAs) such as the arachidonic (ARA), eicosapentaenoic (EPA) and the docosahexaenoic (DHA) acids are all considered essential fatty acids. Among the three listed, the DHA is the more important one as it can be broken down to EPA or ARA, while the carbon chain of the EPA and ARA cannot be prolonged to form DHA. During the early stage of marine fish, the larvae are able to complete metamorphosis and develop the nervous system when the EFA in the yolk is exhausted. Marine fish are not capable of bioconverting C18 PUFA to their C20 and C22 homologues. Consequently, marine fish invariably obtain EPA and DHA from their natural diet which is rich in these particular fatty acids. It is therefore indispensable to supply farmed fish with diets enriched with fish oil. These oils can also be produced from sources such as marine fungus, *Schizochytrium* spp., or salt water microalgae such as *Nannochloropsis* spp. Due to various technical issues, the production of the marine fungus through fermentation is cheaper than the microalgae. Dried *Schizochytrium* meal has been widely used in Chinese marine fish seed production particularly in species such as the turbot and flounder. At present, selected strains with a high DHA level (>25% in dried cells) are available from the Xiamen Biotech Company. Besides the marine fungus, the microalga *Cryptocodinium cohnii* is also rich in PUFA. The current production of this species is at small scale and the products are mainly used as an additive for infant foods. To date, it is not used by the aquaculture sector.

Fish oil is a traditional source of PUFAs which has been used as a feed additive particularly in eel farming. The price of fish oil is considerably lower than other sources of PUFA, however, fish farmers tend to prefer the use of *Schizochytrium* products as they contain high level of DHA and are of suitable size for enriching rotifer and *Artemia*, while avoiding the emulsification process. Hence, *Schizochytrium* DHA meal is widely accepted by the aquaculture sector for raising marine fish and crustacean broodstock and seed material.

Vaccines. Dr Zhibing Huang, an immunologist based at the Pearl River Fisheries Research Institute in China, mentioned that the “incidence of diseases in aquaculture in 2004 was as high as 50 percent with an estimated production loss of up to 1.5 million tonnes equivalent to a financial loss of about RMB 151”. He further reported that since the 1970s, the grass carp hemorrhagic virus has caused havoc with losses of

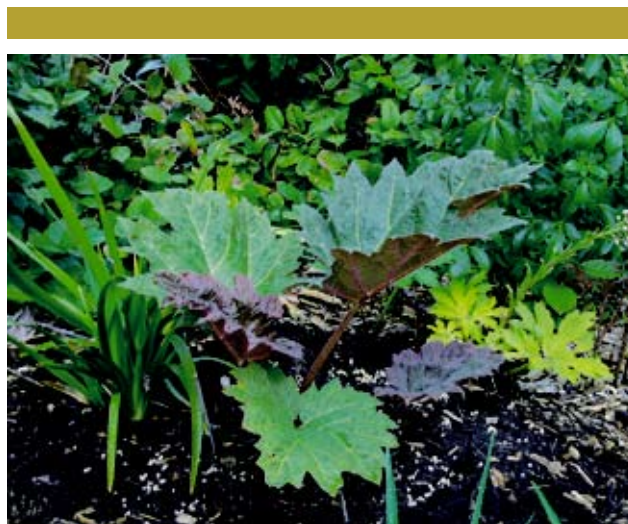


Figure 4. A plant of *Rheum palmatum* (Chinese rhubarb)



Figure 5. A plant of *Pulsatilla chinensis* (bai tou weng)

up to 90 percent for some years.” This problem has since been dealt with as a result of the development of an effective vaccine. Dr Zhibing Huang also indicated that in China “numerous vaccine products have been studied and among them, eight have been tested in the field; 23 vaccines are still being tested in the laboratories while an additional 23 vaccines are still at the research stage”. Four new vaccine production lines have recently been put into place in Guangzhou, Guangdong Province, producing live viral vaccines, inactivated viral vaccine, inactivated bacteria vaccine, subunit vaccine and inactivated trivalent bacteria vaccine. It is expected that the use of vaccines as an effective therapy and treatment for fish diseases will expand countrywide.

Herbs as medical feed additives in aquaculture. Chinese fish farmers have long used herbal plants for the prevention and treatment of fish diseases. Due to the global discussions on the use of antibiotics and other chemical substances such as malachite green, Chinese farmers and scientists are once again paying



Figure 6. A plant of *Areca catechu* (betel nut palm)

All photos J. Chen, FAO

attention on the use of these herbal products. These traditional medicines have been used to enhance the immune system of the farmed fish; as anti-viral, bacterial and fungal agents; as insecticides and pesticides; and for stimulating growth and regulation of the ecdysis rhythm in crustacean. Some of the herbal plants commonly used in Chinese aquaculture are listed in Table 1 above (see Figures 4, 5 and 6).

In summary, feed additives and water treatment reagents being used by the aquaculture industry are important and growing areas of applied research, dealing with animal health and welfare, environmental protection and food safety.

- ¹ Joint FAO/WHO Working Group Report on Drafting Guidelines for the Evaluation of Probiotics in Food, London, Ontario, Canada, April 30 and May 1, 2002. Available at: <ftp://ftp.fao.org/es/esn/food/wgreport2.pdf>.
- ² *Haematococcus pluvialis* is a freshwater species of Chlorophyta from the Haematococcaceae family. This species is well known for its high content of the strong antioxidant astaxanthin used in aquaculture and various pharmaceutical and cosmetic products. The high amount of astaxanthin is present in the resting cells, which are rapidly produced and accumulated when the environmental conditions becomes unfavorable for normal cell growth (e.g. strong light, high salinity levels).
- ³ *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*.
- ⁴ See also: Habib, M.A.B., Parvin, M., Huntington, T.C., & Hasan, M.R. 2008. 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. 33p.



**GFCM/CAQ Working Group on Marketing on Aquaculture -
“Development of a Strategy for Marketing and Promotion of
Mediterranean Aquaculture”**

26-27 October 2009, Tangier Morocco

Information: Fabio.Massa@fao.org/frad@mersin.edu.tr

GFCM/CAQ Eleventh Meeting of the SIPAM Aquaculture Network
9-10 Istanbul, Turkey

Information: Fabio.Massa@fao.org

Training course on the “use of GIS in fisheries and aquaculture” at the Federal University of Rio Grande Do Sul (FURG) in Brazil

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BACKGROUND AND OBJECTIVES

The need to carry out training activities on Geographic Information Systems (GIS) has been highlighted and discussed on several occasions and during meetings organised by the project GCP/INT/920/JPN “Capacity building for an ecosystem approach, including interactions with marine mammals”. The Project identified, through its Working Groups and workshops, that a general need exists for basic level training in the application of GIS methods. To respond to this need, a GIS training course on the “Use GIS in Fisheries and Aquaculture” was jointly designed by FAO’s Fisheries and Aquaculture Management Division (FIMF and FIMA). The overall objective of this course was to provide basic knowledge of GIS within the context of spatial issues of fisheries and aquaculture management using the most recent software available in the market.

The delivery of the course was linked to one of the GCP/INT/920/JPN project case studies in Brazil, where the goal has been to develop local capacity to implement an ecosystem approach to the management of small-scale and coastal fisheries in southern Brazil. Because of the many potential applications of GIS to management issues under discussion in the case study (e.g.

protected areas, effort control and enforcement, etc.) and the interest of a wider audience in Brazil on the theme, e.g. the Special Secretariat for Aquaculture and Fisheries of the Presidency of the Republic (SEAP/PR) and Institute for the Conservation of Biodiversity (ICMbio), the course was considered part of the efforts to build local capacity on tools in support of the Ecosystem Approach to Fisheries.

PROGRAMME AND PARTICIPATION

The training course was organized by Marcelo Vasconcellos (previously a staff member at FIMF) and conducted by FIMF/FIMA during a ten-day period at the Federal University of Rio Grande (FURG) in Rio Grande do Sul, Brazil (www.furg.br) from 27 January to 6 February 2009.

FIMF/FIMA conducted eight of the ten days of training; for the other two days, training was led by Dr. Phil Scott from the Universidade Santa Úrsula in Rio de Janeiro and Mr. Luiz Fernando Vianna from EPAGRI/CIRAM in Santa Catarina in Brazil. Their training focused on lectures and complementary exercises and case studies for aquaculture site selection in Brazil.

The course programme was designed to provide lectures followed by hands-on exercises,

case studies, and a field exercise using a Global Positioning Systems (GPS). The agenda was flexible and allowed for ample discussions amongst participants whenever necessary to better understand the concepts, tools and methodologies being learnt. The course was attended by 18 fishery and aquaculture biologists and fishery managers representing Brazilian research institutions and federal organizations. Most participants work mainly on marine fisheries except two working primarily on aquaculture. The computer literacy of the participants was considered to be high (10 or more years of computer experience), so everyone was able to complete the course with minimal assistance. Most of the participants had little or no experience on GIS, except for two having had advanced training.

TRAINING MANUAL, DATA AND LECTURES

FIMF/FIMA wrote a technical manual for use with ArcView 3.3 software that was tested and improved during a GIS training course in Split, Croatia in July 2007. Such training manual contained material which was further improved, updated and translated to the newest GIS software available on the market (ArcGIS 9.3) to benefit from its new features and functions and upon request by FURG.

Each participant received a hard copy of this new training manual along with data prepared by FIMF/FIMA for the practical exercises and case studies (Figure 1). Course lectures were also prepared for this course based on the training in Split in 2007, and these were also updated and improved. Messrs. Scott and Vianna prepared their lectures and exercises and they are also included in the manual (Figure2).

IMPLICATIONS FOR PROJECT GCP/INT/920/JPN

Although the present course has received very positive feedback from participants in terms of achieved knowledge of GIS techniques and understanding of principles, the course is a starting point, and there is still a need to enforce GIS capacity to better support the implementation of the Ecosystem Approach to Fisheries (EAF) and Aquaculture (EAA) in Brazil. FIMF/FIMA believes that course participants can now begin to explore the possibilities offered by GIS to better understand the interaction between fishery and the ecosystem in order to define operational objectives and strategies for improved management. Therefore, a follow-on recommendation to the project is to conduct a pilot project to demonstrate a practical application of GIS to support the implementation of EAF and EAA.

Given that the FURG has an important role on GIS activities in the region and has a good capacity on GIS, the University has the potential to become a regional resource on GIS in fisheries and aquaculture, with particular emphasis on the EAF.

In terms of future activities in the region, one potential target would be the UTF/URU/025/URU "Gestión pesquera en Uruguay". Given the relevance of the course to the objectives of the UTF, it would be good for the UTF to consider this type of training in the future.

CIHEAM SEMINAR – ZARAGOZA, SPAIN JUNE 2009

A seminar on the Use of Geographic Information Systems for Fisheries and Aquaculture Planning and Management will be held at Zaragoza, Spain from 8 to 19 June 2009. This seminar is organized, under the sponsorship of the Spanish Agency for International Development Cooperation (AECID), through the NAUTA Programme, by the International Centre for Advanced Mediterranean Studies (CIHEAM), through the Mediterranean Agronomic Institute of Zaragoza (IAMZ), with the collaboration of FAO through the Fisheries and Aquaculture Department.

The seminar is designed for a maximum of 25 participants with a university degree, from public bodies or private entities, with responsibilities in



Figure 1. Course exercise on analysis the likely distribution of fishing fleet in the southern coast of the Mediterranean Sea

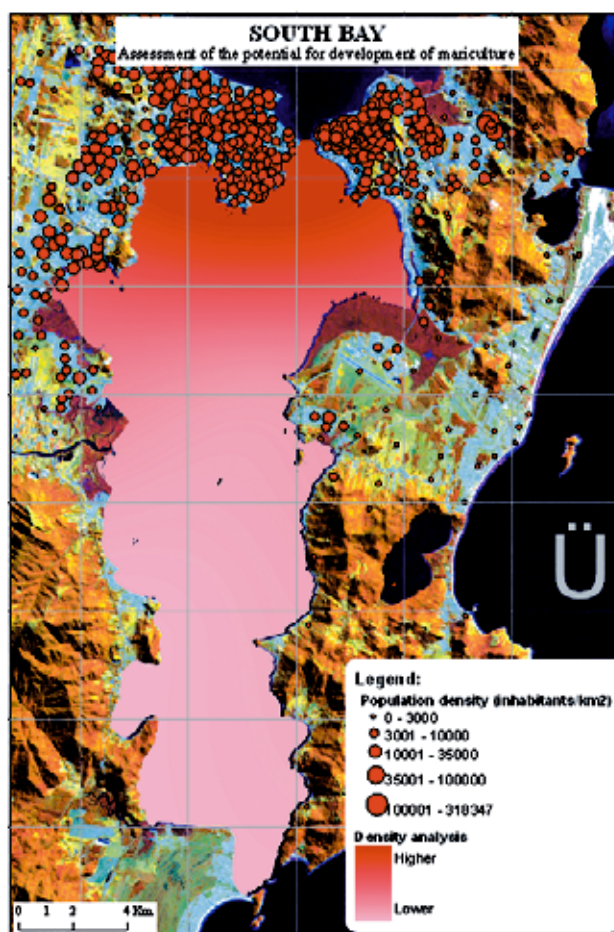


Figure 2. Course exercise on Building scenarios and decision-making methods for coastal aquaculture site selection in Brazil. A case study of South Bay in Florianópolis, Santa Catarina, Brazil – Map showing Population density (inhabitant km²) as one of they key factors for analysis



F. CAROCCI, FAO

Participants of the training course



P. SCOTT, THE UNI OF SANTA ÚRSULA, R. DE JANIÉRO

Fabio Carocci (FIMF) and José Aguilar-Manjarrez (FIMA) facilitating discussions at the course

aquaculture sectors in their respective countries, or professionals working in the management of aquaculture farms or fishing activities.

Details of the seminar are available at: www.iamz.ciheam.org/en/pages/paginas/pag_formacion6.htm

The programme of the seminar is similar but by no means identical to the course conducted in Rio Grande do Sul, Brazil above because this seminar is specifically designed for Mediterranean countries; thus, it includes case studies that are most relevant to this region. Also a total of eight lecturers from Mediterranean countries will participate. Despite the differences, parts of the technical manual prepared by FIMF/FIMA will be used, so it will be an opportunity to conduct a final test to key parts of the manual and a few new case studies written by some of the lecturers at the CIHEAM seminar will be incorporated in the manual.

ANNOUNCEMENT OF NEW TECHNICAL MANUAL

The new technical manual that was tested and fine-tuned during the course in Brazil and then in Zaragoza will be published as an FAO Fisheries and Aquaculture Technical Paper in 2009. The new manual is a follow-up to a highly requested hands-on self-training manual written by de Graaf *et al.* (2003)¹. Parts of the manual by de Graaf were included, translated and/or improved for this new manual.

The role of GIS to support the implementation of the EAF and EAA *per se* is currently being reviewed by FIMA and FIMF, so their precise role is yet to be defined. However, the exercises and case studies presented in this new manual, in addition to introducing basic concepts of GIS, illustrate how GIS is used to address key issues in fisheries and aquaculture management. Thus, this manual already represents combined effort by FIMA and FIMF to provide a more holistic approach to training on GIS in fisheries and aquaculture.

¹de Graaf, G., Marttin, F.J.B., Aguilar-Manjarrez, J. & Jenness, J. 2003. Geographic Information Systems in fisheries management and planning. Technical manual, FAO Fisheries Technical Paper. 449. Rome. 162p. (available at: www.fao.org/docrep/006/y4816e/y4816e00.htm).





Special Achievement in GIS Award

The ESRI (Environmental Systems Research Institute) International User Conference, held in San Diego, California on 15 July 2009, ESRI - the world leader in GIS - awarded the FAO Fisheries and Aquaculture Department with a 'Special Achievement in GIS' in recognition of its vision, leadership and innovation in GIS technology applied to fisheries and aquaculture. The award consists of a plaque together with a certificate.

The Department was selected from among 300 000 organizations worldwide and this constituted a significant recognition of its extraordinary contribution to global society. FI's GISFish Web site was singled out as one of the 150 key sites selected from among more than 100 000 ESRI user sites worldwide, constituting yet another significant distinction.

This is the first time that the award is given to FI or even FAO, so it is an important acknowledgement of the work done so far. Team members that contributed to this award are Messrs. J. Aguilar-Manjarrez, James McDaid Kapetsky, Fabio Carocci, Jeff Jenness, Geoff Meaden, Carlo Travaglia, Gertjan DeGraaf, Felix Marttin, Marc Taconet, Francesco Cardia, Valerio Crespi and the KCTU programmers; Marcella Pesce, Ennio Lepri, Cosimo Togna, Yi Shuai and Sabina Ramazzotto.

Excerpts from the press release award documentation

Using GIS...

GIS and remote sensing provide the technology for mapping the distribution of aquatic resources, their environment, fishery management units, production systems, etc. which can support decision-making. FAO plays a unique role in providing such information. The Department's strategic approach for the use of GIS and Remote sensing is to set out the issues in Fisheries and Aquaculture and demonstrate the benefits of using GIS, remote sensing and mapping to resolve them. In overview, the GIS outputs at FIM from 1985 to date can be classified under four main categories: training, projects, field projects and missions, and oral presentations and publications.

Improving service to customers...

GIS, remote sensing and mapping are tools that support informed decisions concerning sustainability of fisheries and aquaculture. GIS is currently being used to support strategic plans for aquaculture and/or inland fisheries development. Spatial issues addressed most frequently include suitability of site and zoning, habitat quality and quantity linked to plant and animal abundance and distribution.

Providing benefits to local communities...

FAO field projects, missions and training courses have provided an opportunity for FIM to interact directly with experts and students from different countries around the world. Examples include use GIS to assist in the development of masters plans for aquaculture and/or inland fisheries development in the Republic of Cameroon and the Islamic Republic of Mauritania.

History at the Department...

The work was initiated and led by Dr James McDaid Kapetsky (FAO Senior Fishery Resources Officer retired) from 1985 to 1999. Dr Carlo Travaglia (FAO Remote sensing Officer retired) supported Dr Kapetsky's work and also played a key role in the promotion and development of GIS/RS at FIM during this time period. From 2001 to date Dr José Aguilar-Manjarrez has continued the same line of work as in the past with the continued support of Dr. Kapetsky as an external consultant.

Future plans...

Expanded GISFish will include marine fisheries in 2009. Two publications on the role of GIS, Remote Sensing and Mapping to support the Ecosystem Approach to Fisheries and Aquaculture respectively; one FAO Technical manual on GIS and Remote Sensing in Fisheries and Aquaculture; and one self-training manual on GIS for Fisheries and Aquaculture. Maps to inventory aquaculture. FAO field missions include: GIS to support an Aquaculture Information Management and Traceability System in Thailand; use of GIS as part of an Improved Aquaculture Information Systems in Africa. Efforts on the Ecosystem Approach and climate change at FAO are likely to shape the direction of future work on GIS at FI.

Photos from left to right: José Aguilar-Manjarrez, Fabio Carocci, Marc Taconet, Jim Kapetsky



reprinted from FAO NEWS RELEASE 09/67en

Zambezi hit by killer fish disease risks spreading to other parts of Africa

21 July 2009, Rome – A killer disease is decimating fish stocks in the Zambezi River Valley, threatening the food security and livelihoods of rural populations in an area shared by seven countries, FAO warned today.

An alert issued by FAO's **Global Information and Early Warning System** (GIEWS) said the disease, known as Epizootic Ulcerative Syndrome, or EUS, is caused by the fungus *Aphanomyces invadans*, which forms ugly lesions on fish and has a high rate of mortality. It is one of the most serious aquatic diseases affecting finfish.

"If not properly contained there is the risk of the disease spreading to other countries surrounding the Zambezi River as well as river systems in the region," said Rohana Subasinghe, Senior Fishery Resources Officer. The 1,390,000 km² Zambezi River Basin is home to some 32 million people, of whom 80 percent are dependent on agriculture or fishing and fish farming.

Up and downstream

Indications are that EUS, which was first confirmed in Africa in 2007, is spreading both upstream and downstream of the Zambezi and risks taking hold in other parts of Africa. The GIEWS alert serves notice on the international donor community that a food security crisis is developing and that assistance and funding will likely be required.

The most affected country is Zambia, where two thirds of the Zambezi River Basin lies. Over 2000 villages and some 700,000 people are at risk of food insecurity because fish is not only a source of revenue in many rural districts but is also the cheapest available source of protein.

Fish infected with EUS do not normally pose health hazards to humans, although the deep ulcerations and tissue decay characteristic of the disease could harbour secondary, more threatening pathogens. It is therefore recommended not to eat EUS-contaminated fish unless it is thoroughly cooked.

Irreversible damage

EUS-affected fish is un-marketable, causing severe economic loss to fishers and fish farmers. Some 50 species of finfish are susceptible to the disease, with outbreaks often affecting younger fish in particular so that irreversible damage to fish populations and severe loss of biodiversity often occurs.

EUS first appeared in Japan in the early 1970s then spread to Australia and much of Asia, while the United States was hit in 1984. It is now present in at least 24 countries in the world.

FAO has since 2007 been helping build capacities for coping with the disease in the seven Zambezi River Basin countries – Angola, Botswana, Malawi, Mozambique, Namibia, Zambia and Zimbabwe. This includes basic EUS diagnosis, targeted EUS surveillance and basic aquatic animal health management.

Urgent requests

In response to urgent requests from a number of countries FAO, in close cooperation with the Paris-based World Organisation for Animal Health (OIE), is helping develop and implement an aquatic biosecurity framework for Southern Africa and build capacity for the management of Zambezi River resources.

The programme will strengthen institutional and human capacity for managing aquatic animal health in the wild in the affected countries through appropriate policies and regulations.

Control of EUS in natural waters such as rivers is impossible but is relatively simpler in fish farming operations where a number of simple biosecurity measures can minimize or prevent its spread. They include preventing possible carriers or vectors getting into water bodies or fish ponds, removing dead fish and improving water quality.

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FAO/Regional Commission for Fisheries. Report of the fourth meeting of the Working Group on Aquaculture. Muscat, Sultanate of Oman, 27–28 January 2009. FAO Fisheries and Aquaculture Report. No. 895. Rome, FAO. 2009. 44p.

The fourth meeting of the Working Group on Aquaculture (WGA) of the Regional Commission for Fisheries (RECOFI) was held in Muscat, Oman, from 27 to 28 January 2009. The WGA reviewed the recommendations and decisions of the Commission made at its fourth session (Jeddah, Kingdom of Saudi Arabia, 7–9 May 2007) and noted that all planned and endorsed WGA activities had been duly implemented. The meeting extensively discussed the final activities and inputs to the Regional Aquaculture Information System (RAIS) in view of its imminent and official launching in March 2009. The participants discussed and agreed on: i) the RAIS User Manual, ii) the promotional flyer, iii) the press release, and iv) the overall communication strategy to launch and to further strengthen the information system. The WGA noted with regret that the start of the “Aquaculture legal and policy framework project” during the intersessional period was not possible as the agreed financial input from all the contributing Commission members had not

been received. The WGA finalized its proposed programme of work for the new intersessional period based on the needs and recommendations resulting from the implementation of activities in the last biennium and emerging issues of importance for the region. The six main activities proposed in order of priority for the new work plan include: 1) application of risk analysis to aquaculture, 2) environmental monitoring in cage aquaculture, 3) impacts of red tides to aquaculture, 4) development of national strategies on aquatic animal health, 5) spatial tools and aquaculture zoning, and 6) aquaculture recirculation strategies. The WGA recommended that the Commission should also encourage and support more training and on-the-job cooperation in the field of aquaculture development among its members as well as in countries outside the region.

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



FAO/Regional Commission for Fisheries. Report of the Regional Technical Workshop on Sustainable Marine Cage Aquaculture Development. Muscat, Sultanate of Oman, 25–26 January 2009. FAO Fisheries and Aquaculture Report. No. 892. Rome, FAO. 2009. 135p.

The Regional Commission for Fisheries (RECOFI) Regional Technical Workshop on Sustainable Marine Cage Aquaculture Development was held from 25 to 26 January 2009 in Muscat, Sultanate of Oman. The workshop focus was on environmental impact assessment and monitoring, and aquaculture licensing for marine aquaculture cage systems. It also aimed at identifying constraints and shortcomings that needed to be dealt with to support the development of the cage industry. The document contains a set of suggestions and recommendations made by the experts with regard to technical and policy requirements needed to support the growth of the aquaculture sector as a whole and more specifically cage fish farming. The major constraints identified in the establishment of fish cages, particularly along the northwestern shores of the Gulf, have been the limited availability of suitable farming sites characterized by shallow waters,

highly fluctuating salinity and temperature levels and inadequate sea currents. Other limitations included price competition from wild-caught fish, inadequate farming technologies for the region and the limited availability of endemic candidate species of commercial importance suitable for cage aquaculture. The report also contains three review documents on marine cage aquaculture in the region, regulation of Norwegian net-cage fish farming, and a review on cage aquaculture licensing procedures prepared as background discussion papers for the workshop. With specific regard to environmental impact assessment (EIA) there is a need for the region and individual Commission members to develop an ad hoc EIA format based on the conditions of the local marine environment as this would determine the level of detail and elements needed to complete a meaningful and useful EIA study. The experts also agreed on the importance to establish regional Environmental Quality Standards (EQS) for fish farm sites in order to set the limits for maximum permissible impact on the area exploited by the cage farming industry and assist in establishing monitoring programmes. With regard to cage aquaculture licensing, the experts acknowledged that a clear licence system is required for exercising legal and administrative control over aquaculture operations as it confers different rights and obligations, and allows public control with regard to environmental protection and the economic sustainability of the farming practices. Furthermore, it was noted that the legislation involved and process in aquaculture licensing should be transparent, readily available and include information on processing time, payable fees, etc. A proposed

cage aquaculture licence procedure was discussed and proposed at the workshop based on the format developed and adopted by the Sultanate of Oman. Other matters discussed at the workshop included the occurrence of hazardous algal blooms in the Gulf and its effects on fish farming and the possibility of establishing a regional fish cage farm for demonstration, research and training purposes.

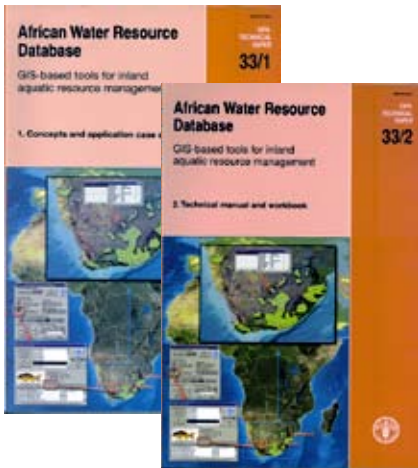
Further details can be obtained by writing to Mr Alessandro Lovatelli at FAO/HQ (E-mail: Alessandro.Lovatelli@fao.org).

Report of the Expert Consultation on Improving Planning and Policy Development in Aquaculture. Rome, 26–29 February 2008. FAO Fisheries Report. No. 858. Rome, FAO. 2008. 18p.

The Expert Consultation was convened by FAO in order to elaborate guidelines on how to improve the process of aquaculture policy formulation and policy implementation. The twenty-seventh session of the FAO Committee on Fisheries (COFI), held in Rome, Italy, in March 2007 and the third session of the FAO COFI Sub-Committee on Aquaculture, held in New Delhi, India, in September 2006, had both indicated that guidance was required on planning and policy formulation and implementation monitoring in the aquaculture sector. The Expert Consultation had before it a comprehensive background document on the subject matter and recommended that two outputs be produced by FAO: (i) an FAO Fisheries Technical Paper on planning and policy formulation in aquaculture development that would include a full review of background information and the outcomes of the discussions held



by the Consultation; and (ii) an FAO Technical Guidelines for Responsible Fisheries booklet on planning and policy development in aquaculture that would be a more concise document highlighting steps towards good planning, policy formulation and implementation for the sustainable development of the aquaculture sector. The Consultation produced a detailed outline of the technical guidelines. It agreed on the definitions of policy, strategy and action plan and on the main phases of policy development processes. It highlighted the importance of considerations such as legitimacy, participation in such processes, but in specific circumstances, the inevitability of trade-offs and the possible resort to hard choices. In determining the link between policy formulation and policy implementation and the characteristics of strategies as a means for implementing policies, the Consultation emphasized that coordination was one of the most important component of the policy implementation discourse. The Consultation also made recommendations regarding future FAO work in supporting aquaculture policy development worldwide.



The African Water Resource Database (AWRD) -- a set of data and custom-designed tools, combined in a geographic information system (GIS) analytical framework aimed at facilitating responsible inland aquatic resource management with a specific focus on inland fisheries and aquaculture -- is now available on the internet at <http://www.fao.org/fishery/gisfish/id/2389> or upon request to FAO/FIMA in a set of two DVD's or ten CD-ROMs. Please consult the link below or contact us at FI-inquiries@fao.org for copies and further information. Related documents: <http://www.fao.org/fishery/gisfish/id/1038>



FAO. Report of the International Emergency Disease Investigation Task Force on a Serious Finfish Disease in Southern Africa, 18-26 May 2007. Rome, FAO. 2009. 70p.

This document is the final report of the work carried out by the International Emergency Disease Investigation Task Force on a Serious Finfish Disease in Southern Africa, a joint undertaking by the Food and Agriculture Organization of the United Nations (FAO), Botswana's Department of Wildlife and National Parks (DWNP) and Department of Animal Health and Production (DAPH), the Aquatic Animal Health Research Institute (AAHRI) of Thailand's Department of Fisheries and the Network of Aquaculture Centres in Asia and the Pacific (NACA), as a result of a technical mission to Botswana undertaken from 18 to 26 May 2007 and the subsequent outcomes of laboratory analysis of field samples conducted by AAHRI. This report provides comprehensive information on the outcomes of the 2007 Task Force investigation, building on earlier reports, and including further updates on epizootic ulcerative syndrome (EUS) occurrence in southern Africa based on an active surveillance programme that was implemented by FAO and partners in late 2007 until 2008. It also includes other ongoing activities and development aimed at further enhancing aquatic biosecurity in southern Africa.



RAIS – Regional Aquaculture Information System user manual (version 1.0) prepared by Valerio Crespi and Alessandro Lovatelli. 52 p. Rome, FAO. 2009.

The Regional Aquaculture Information System (RAIS) user manual has been just published by the Aquaculture Management and Conservation Service of FAO.

This simple user manual produced both in English and Arabic is addressed to all RAIS authorized users who wish to gain a better understanding on how the new established information system works and to exploit all its functionalities.

The new Web site has been developed by the Food and Agriculture Organization (FAO) under the aegis of the Regional Commission for Fisheries (RECOFI) to facilitate the exchange of aquaculture information in the Gulf area among regional experts and stakeholders, and to promote and develop a sustainable aquaculture industry.

For further information, please contact: Valerio.Crespi@fao.org



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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 1 300 copies.

It is also available on the FAO Web page:
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