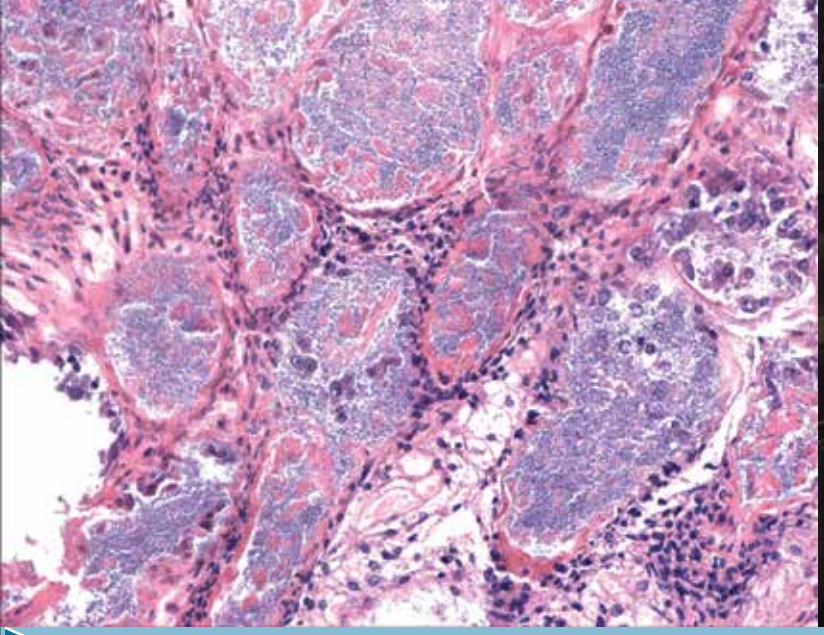

Early mortality syndrome of shrimp

FAN

51 June 2013

Seventh Session of COFI/SCA

FAO Aquaculture Newsletter

Fish IN Nutrition or Fish AND Nutrition?

A relatively young food production sector when compared to other sectors (e.g. terrestrial, crops), aquaculture development during the last few decades had been remarkable. While past development efforts mainly focused on production technologies and environmental issues, little attention was given to the value of aquaculture to human nutrition, even in major conferences on aquaculture.

Dr Albert Tacon, former FAO staff and fish nutrition expert, pointed to "food fish" not only as an excellent source of high quality animal protein and, equally important, as an extremely rich source of omega-3 polyunsaturated fatty acids, i.e. EPA (eicosapentaenoic acid) and DHA (docosahexaenoic acid) with health benefits both for the body and the mind.

A world renowned brain chemistry and human nutrition expert, Dr Michael A. Crawford, during a plenary talk at the 5th World Fisheries Congress 2008 held in Yokohama, Japan, said that solving the problem of mental ill health (predicted by the Global Forum of Health, www.globalforumhealth.org, to be the top three burdens of ill health world wide by 2020), "...will require a new paradigm in food with a focus on the nutritional requirements for the brain. This may well mean agriculturising the oceans and enhancing the development, use and consumption of sea food worldwide". According to Dr Crawford, it is essential that DHA is obtained for human nutrition especially during pregnancy and lactation when the new fetal and infant's brain is forming at high velocity. He reckoned that while the land food chain is a poor source of DHA, the richest source is the marine food web where the brain first evolved.

The significant role that aquaculture (and fisheries) could play in improving human nutrition will be discussed in two major upcoming events: the first one will be during the Seventh Session of the COFI Sub-Committee on Aquaculture (St Petersburg, October 2013); and secondly, during the Joint FAO/WHO International Conference on Nutrition (ICN2) in 2014.

The above initiatives are much awaited considering the increasing recognition that fish has superior nutrition qualities which can be beneficial for early life development (first 1000 days), for pregnant and lactating mothers. Eating fish is part of the cultural tradition of many people. About 1 billion people in 58 countries worldwide including many developing and low-income food-deficit countries depend on food fish as the primary source of animal protein. In some countries, fish is a major source of food and essential nutrients. There is clear evidence that eating fish can address health problems such as stunting and obesity; thus, a good alternative to less healthy diets.

There are also essential micronutrients found in significant amounts only in some freshwater fish species, particularly certain indigenous fish. The specific nutrients provided by these fish can be found from cultural and traditional knowledge, especially, of rural communities in developing countries. However, these indigenous species are slowly diminishing in many parts of the world, mainly due to the rather unplanned and unregulated human development activities. A shift in development objectives, that reduce such negative impacts, is important in order to harness the contribution of these aquatic species to the nutrition of many poor and vulnerable communities around the world. More attention should be given to promoting aquatic biodiversity conservation and active engagement in promoting, e.g. rice-fish farming in rural development programmes, where possible. Aquaculture stakeholders working together with a firm recognition of the role of fish in human nutrition will enable the sector to provide affordable, accessible and nutritious "food fish" to support the expected 9.2 billion people by 2050. To achieve this, it should be **Fish IN Nutrition rather than Fish AND Nutrition.**

Photos cover:
Top left: Histopathology of Early Mortality Syndrome, courtesy of Loc Tran
Top right: Trainees working in the ark shell hatchery in Qingdao, China, courtesy of G. Chunren
Bottom: Whiteleg shrimp *(Litopenaeus vannamei)* under a pond side health check, Surat Thani Province, Thailand, courtesy of K. Yamamoto

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7th Session of the COFI Sub-Committee on Aquaculture

St Petersburg, Russia, 7-11 October 2013

The 7th Session of the Committee on Fisheries COFI Sub-Committee on Aquaculture (COFI/SCA7) will be held at the Redisson Pribaltiyskaya Hotel, St. Petersburg, Russia from 7-11 October 2013. The Session is sponsored and hosted by the Russian Federation.

Since its establishment in 2001, the SCA has convened six sessions in P.R. China, Norway, India, Chile, Thailand and South Africa. The 7th Session will take place in an era where hunger and malnutrition continues to be the most devastating problems worldwide. They are inextricably linked with poverty and currently almost 870 million people are chronically undernourished. The challenges governments and international development communities need to address, given a global population that is projected to reach 9 billion in 2050, much of it in developing countries prone to hunger, is to ensure adequate food and nutritional security for all.

It is widely acknowledged that aquaculture has the capacity – if supported and developed in a regulated, environmentally, socially responsible and sensitive manner – to address the challenges and contribute positively towards eradication of hunger, food insecurity and malnutrition. However, the challenges of reducing poverty and the magnitude and diversity of the aquaculture sector issues around the world are simply too big for any single government or organization to tackle alone. Addressing the challenges thus requires making use of the world's best knowledge and capacities, and financial resources, which do not reside in any one institution. The international development community therefore attaches great importance to working together in partnership with all relevant governmental, non -governmental, private sector and other stakeholders at global, regional and national levels in support of shared development goals.

The 7th Session of COFI/SCA will address many issues relevant to the above goals and inspirations, both at policy and technical levels. Among others, the following are some of the interesting and relevant topics to be discussed in St. Petersburg.

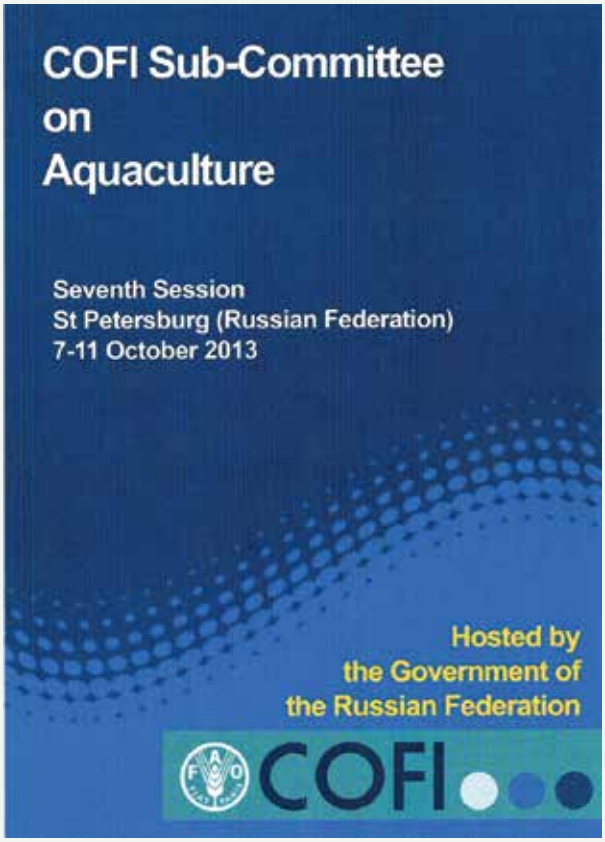
Evaluation framework to assess to conformity of aquaculture certification schemes with the FAO aquaculture certification guidelines: Driven by concerns that some forms of aquaculture are environmentally unsustainable, socially inequitable and that products are not safe for consumers, there have been attempts, over the years, to respond to the consequent public perceptions and market requirements. In this regard, food safety standards were elevated and international trade regulations tightened. Policy and regulations governing environmental sustainability were put in place in many countries, requiring aquaculture producers to comply with more stringent environmental mitigation and protection measures. In order to respond to these environmental and consumer concerns on aquaculture production and to secure better market access, there is increasing interest in the certification of aquaculture production systems, practices, processes and products from aquaculture. In 2011, COFI approved the Technical Guidelines on Aquaculture Certification as an international instrument to provide the uniform basis for aquaculture certification. FAO Members, whilst endorsing the Guidelines, also recommended that FAO develops an Evaluation Framework to assess the conformity of public and private certification schemes with the Guidelines. Under this agenda item, the draft conformity assessment framework developed by FAO will be discussed and debated.

Applying spatial planning for promoting future aquaculture growth: Around the globe, the availability of and access to aquaculture zones and sites with favourable characteristics, including those areas that minimize interactions and conflicts with other activities, represent constraints for the expansion of the sector. Meeting the future demand for food from aquaculture will, to a large degree, depend on the availability of space for aquaculture. In most countries where aquaculture is new, a comprehensive and coordinated spatial planning to secure an adequate allocation of space in waters and land for sustainable growth of aquaculture is being developed. In countries where aquaculture is already well established, the spatial distribution of the sector has not been well-planned. This agenda

item attempts to raise awareness on the need for spatial planning to allocate space for aquaculture and to illustrate the benefits that can be derived from it when promoting sectoral growth.

Role of aquaculture in improving nutrition: opportunities and challenges: Fish is an excellent source of protein, but what makes fish a really unique food is the additional nutrients that can be found in fish in significant amounts. Fish has a complete package of nutrients, and the unique nutritional composition of fish is derived also from fatty acids and micronutrients (vitamins, minerals). Wild and farmed fish are healthy and are better alternatives to almost any other meats. Farmed fish have a more constant nutrient composition compared to their wild counterpart, whose environment, food and access to food varies during the year. In addition to being a good source of essential nutrients, aquaculture products also play an important role in replacing less healthy diets. On the other hand, one should also make sure aquaculture products do not replace important foods such as small indigenous fish species with a long tradition as a source of many essential micronutrients. This agenda item will discuss the significant role that aquaculture and fisheries could play in combating malnutrition; a subject that will also be highlighted during the Second International Conference on Nutrition (ICN-2) to be held in November 2014.

Special event on strengthening international cooperation for accelerating sustainable aquaculture development: This special event will set the scene for the exchange of information and experience on international cooperation in aquaculture. It contends that improving international cooperation in the sector is crucial if the latter is to continue growing so as to enable the world to meet the increasing global demand for safe and quality fish as well as other aquatic foods. The paper outlines some of the recent progress achieved in international cooperation in aquaculture, discusses its potential benefits and reviews some of the main vehicles used whilst exploring ways for strengthening such cooperation. In addition to training and capacity building, international cooperation in aquaculture has enhanced technology transfer and diffusion, amongst countries. Such cooperation has also led to harmonized regional aquaculture development strategies in some places. As a result of this



improved cooperation, aquaculture productivity has increased, food security and nutrition have been enhanced and both employment creation and income generation have been promoted along the value chain. International cooperation could be further advocated through forging of strategic partnerships, expansion of bilateral and South-South cooperation arrangements, the increase of direct foreign investment in the sector, encouragement of joint ventures, the promotion of greater use of consortiums in aquaculture and ensuring sustainability of existing networks.

For further details, including the provisional agenda and technical documents, please visit: http://www.fao.org/fishery/about/cofi/aquaculture

8th Session of the General Fisheries Commission for the Mediterranean Committee on Aquaculture

The Eight Session of the Committee on Aquaculture (CAQ) of the General Commission for the Mediterranean (GFCM) was held in Paris, France from 13-15 March 2013 along with the Fourteenth Annual Meeting of the Information System for the Promotion of Mediterranean Aquaculture (SIPAM, www.faosipam.org) network.

The session held on a biannual basis, was attended by 17 GFCM Members and by observers from the International Union for the Conservation of Nature (IUCN), the International Organization for the Development of Fisheries in Eastern and Central Europe (EUROFISH), the European Union (EU) funded project AquaMed and representatives of FAO and the GFCM Secretariat.

The Secretariat presented the intersessional activities of the Committee focusing on the activities carried out by its three Working Groups (WGs): the *Working Group on Aquaculture Sustainability (WGSA)*; the *Working Group on Site Selection and Carrying Capacity (WGSC)*; and the *Working Group on Marketing in Aquaculture (WGMA)*. The outcomes of a recently established fourth working group called *Working Group on the Black Sea (WGBS)* and the *LaMed project* focussed on interactions between aquaculture and capture fisheries in Mediterranean coastal lagoons were also presented.

The CAQ working groups have produced useful outcomes during the years in terms of lessons learnt and the sound methodology applied. The WGs have among others elaborated guidelines to identify Allocated Zones for Aquaculture (AZA); undertaken a preliminary assessment of aquaculture farmers' organizations; developed indicators as a means to strengthen the public perception of aquaculture, market competitiveness, environmental sustainability and social acceptability.

Delegates acknowledged the good results achieved by GFCM in terms of organized meetings, outputs of the working groups and secretariat support to Member countries. They also recognized that the dissemination of the outcomes produced by the working groups to aquaculture producers should be strengthened and capacity-building should be implemented through pilot projects involving a wider range of stakeholders.

V. Crespi, FAO

Plenary discussion during the Eight Session of the GFCM Committee on Aquaculture

The most relevant planned activities included in the CAQ 2013–2014 work plan are the following:

- Project for the elaboration of a Regional Review on the current status of aquaculture in the GFCM competence area and organization of a final workshop for the dissemination of results.
- GFCM aquaculture statistical yearbook publication on a biannual frequency.
- Regional survey on aquatic animal health and biosecurity in aquaculture.
- Regional survey on the main aspects related to certification and traceability in aquaculture.

The full report of the Eight Session of CAQ is available in the web site of the GFCM www.gfcm.org/gfcm/en

Further information can be obtained by writing to: Mr Fabio Massa (Technical Secretary of the GFCM-CAQ) Fabio.Massa@fao.org

4th Annual Meeting of the Aquaculture Network for Africa

The Aquaculture Network for Africa (ANAF) is currently composed of twelve African countries: Cameroon, Ghana, Kenya, Mali, Mozambique, Namibia, Nigeria, Republic of South Africa, Senegal, Tanzania, Uganda and Zambia. These countries decided to develop, through the assistance of FAO, an informal, flexible and efficient network of regional experts to promote and accelerate the development of aquaculture in the region.

ANAF aims to address the many common infrastructure, technological, policy, institutional, human capacity, research, and information gathering and dissemination problems of Member countries.

The fourth ANAF Annual Meeting, held at the Central Inn Hotel in Entebbe, Uganda, from 04 to 06 December 2012 achieved the following objectives: (i) described the steps for the establishment and management of national Aquaculture Advisory Group (AAG) and the national Aquaculture Farmer Orgnaizations (AFO) in the ANAF Member countries; (ii) adopted a strategy to turn ANAF into a functional inter-governmental organization (IGO) similar to the Network of Aquaculture Centres in Asia and the Pacific (NACA); and (iv) discussed and endorsed the ANAF work plan for 2013.

The meeting was attended by the ANAF National Focal Points from nine member countries, two international consultants, two representatives from NEPAD, one representative from the EU funded programme ACP FISH II (Eastern Africa), one consultant from the FAO Regional Office for Africa and one Aquaculture Officer from FAO, Rome.

Group Photo

The meeting conducted over three days, consisted of presentations by the international consultants, ANAF National Focal Points (NFP); halfday was dedicated to working group discussions of the three established task forces; and a final round-table discussion regarding the work plan and adoption of the report.

The first consultant's presentation focused on the findings of the consultancy report entitled "The role of AAG and AFO: lessons learnt from Zambia and Uganda's experiences and guidelines for the establishment of AFOs". The consultant elaborated simple guidelines for the ANAF countries wishing to facilitate the development and management of AFOs.

The second consultant's presentation "Towards an ANAF IGO: small steps for the final leap" provided conceptual and operational guidelines for the ANAF member countries to make decisions on how to proceed with the transformation of the network into a functional IGO.

Participants decided to create three task forces composed of ANAF members to work on the following subjects:

Task Force 1 on prospective host governments and a proposed schedule of government contributions;

Task Force 2 three-year Work Programme for ANAF; and

Task Force 3 ANAF Agreement and the other legal instruments with specific expert assistance from FAO's Aquaculture Branch and Legal Service.

The three task forces elaborated their terms of references and agreed to prepare three distinct reports defining the next steps that will lead ANAF member countries towards the establishment of the ANAF IGO.

The three reports will be presented and finalized at the fifth ANAF Annual Meeting to be held at the end of July 2013 in Dakar, Senegal.

More information can be obtained by writing to: Valerio.Crespi@fao.org

Bangladesh develops a National Aquaculture Development Strategy and Action Plan

Mohammad R. Hasan[1], Jiansan Jia[1] and Pedro Bueno[2]

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Bangladesh has hauled up its aquaculture sector to the ranks of the top aquaculture producers in the world; it was fifth in 2011 with an output of 1.52 million tonnes. Much of this production is from very small farms: the country has 4.23 million fishfarmers and 4.5 million farms with a combined area of 670 thousand hectares. Aquaculture has been rapidly growing but needs to grow even more to meet the protein requirements of a young and growing population. Fish now provides 60 percent of the protein in the people's diet. This growth and expansion has been guided by a National Fishery Policy formulated in 2006. The government felt that the widely anticipated rapid growth needed an updated guideline, which prompted the Ministry of Fisheries & Livestock (MoFL) to call for its review and update and requested FAO's assistance for this undertaking during the 29th Session of Committee on Fisheries (COFI) in 2011. Along with this request was one that was met through the FAO TCPF project TCP/BGD/3301: Identification and understanding of key technical, economic and social constraints to seed and feed production and management in Bangladesh that was implemented in 2012. This project became the platform for the review and formulation of an aquaculture strategy and action plan, which was informed by the country investment plan, national fishery policy, the plans for the fisheries and livestock sectors, and the results of the TCPF project on seed and feed.

Process

In collaboration with the MoFL, the FAO Representation in Bangladesh and the Aquaculture Branch (FIRA) organized the consultation workshop, designed to be widely participatory to reflect priorities of the major stakeholders of the aquaculture sector. Thirty-six participants representing government agencies, academic and R&D institutions, private industry

N. Ahmed, FAO

Harvest of Indian major and Chinese carps from a semi-intensive ploycultureculture farm in Mymensingh, Bangladesh

including farmers, civil society organizations, the WorldFish Centre, the Bangladesh Shrimp and Fish Foundation (BSFF) took part in the workshop. The process will lead to a final result that shall embody the aspirations of the people and the commitment to pursue those aspirations by the Government and the other stakeholders. That commitment shall be expressed in concrete and doable goals, strategic actions and specific activities, and the resources needed to execute the activities.

Strategy and Action Plan

The workshop strongly recommended, among others, a crop insurance programme, filling up at least 30 percent of the technical positions in the fisheries departments and institutions with women, a national selective breeding programme for important aquaculture species, implementation of the aquafeed act, a survey and characterization of the fisheries and aquaculture potential of all public water bodies, increase in the lease period of water bodies to 25 years, and other measures to assure that expansion is orderly and development is sustainable and equitable. A set of technical implementing guidelines for the Fish and Animal Feed Act shall be developed and a pilot feed quality analytical laboratory was proposed to be established. A communication support system for planning, management, enforcement and public information will be developed harnessing the power of the new information technology.

To jumpstart the implementation of the Action Plan, priority projects are proposed for development and initiation in the immediate term. These include, among others, stock improvement of commercially important fish species through a selective breeding programme; capacity building for training institutions and development of training and extension materials; and organization of fish farmers, traders and hatchery operators associations at the local and national levels.

M. Hasan, FAO

A pangas (striped catfish) farm in Trishal, Bangladesh. Aquaculture has been one of the fastest growing economic subsectors of the Bangladesh economy. More than four million fishfarmers mostly small-scale and over 8.5 million people derive livelihood from it directly and indirectly. It provides 60 percent of the animal protein in the people's diet. Its share of the GDP is 4.4 percent. Export revenue in 2012 was estimated at US$ 450 million

The Strategy and draft Action Plan and comprises four interlinked objectives – social, economic, ecological and institutional, 14 outputs and more than 50 activities.

The Government of Bangladesh was represented by Mr Syed Arif Azad, Director General of the Department of Fisheries and Mr Shamsul Kibria, Joint Secretary of MoFL. Keynote speaker Mr. Ujjawal Bikash Dutta, Secretary of MoFL stressed the need to review and update the guiding policy documents along with updating the Strategy and Action Plan to cope with the demands of the country and keep up with new scientific knowledge and experiences. FAO participants were Ms Rosanne Marchesich (FAO Representative a.i in Bangladesh), Ms Nurun Naher Begum (FAO Bangladesh), Mr Jiansan Jia and Mr Mohammad R. Hasan (FIRA, Rome, Italy) and Mr Pedro Bueno, International Consultant to FAO.

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Development of a Sub-regional Strategy for Improving Biosecurity (aquatic animal health) in the Sub-regional Countries of the Mozambique Channel

Background

White spot syndrome virus (WSSV), the most serious pathogen of cultured shrimp had affected almost all shrimp producing countries in Asia since the 1990s; as of 1999, at least 9 countries in the Americas were affected. Most recent outbreaks were reported in Brazil (2005), the Kingdom of Saudi Arabia (2010-2011), Mozambique (2011), Brunei (2012), and Madagascar (2012). In Asia alone, losses from WSSV outbreaks were estimated at USD 6 billion during 1992-1993 outbreaks; in the Americas, about USD 1-2 billion during 1999 outbreaks.

P.P. Blanc, APCM - PRCC project, Mozambique

WSSV was reported first in Mozambique (September 2011) and a few months later, in Madagascar (April 2012). The direct impacts of the disease were destruction of more than 600 tonnes of production in the two affected countries and cessation of farming operations for more than 1 year for the concerned shrimp farms.

Madagascar has about 5 603 km of coastline and 2 744 ha used for aquaculture. Mozambique has a coastline of 2 470 km and about 77 000 ha suitable for aquaculture. Tanzania has a coastline of 1 300 km and 3 000 ha of land available for aquaculture. The sub-region of "Canal de Mozambique" has an outstanding potential for shrimp aquaculture. This potential can be easily threatened by disease.

The World Bank requested FAO to facilitate the preparation of a sub-regional strategy on aquatic biosecurity (aquatic animal health). In order to achieve this, two main activities were carried out: (i) conduct of an aquatic animal health performance and capacity assessment of the three countries (Madagascar, Mozambique and Tanzania) using an FAO survey questionnaire carried out in February and March 2013; and (2) a 3-day sub-regional meeting participated by representatives from each of the three countries (Maputo Workshop)[1] to discuss the results of the survey and use these as basis for developing a sub-regional strategy. The latter was hosted by the Instituto Nacional de Desenvolvimento da Aquaculture (INAQUA) from 2-4 April 2013 in Maputo, Mozambique. The draft sub-regional strategy was presented by INAQUA during a regional stakeholder consultation (which involved a consortium of organizations and institutions interested in providing solutions and interventions to this current shrimp disease situation in the sub-region) that was held in May 2013 in Madagascar and organized by the World Bank.

Shrimp aquaculture in the Mozambique Channel and impacts of WSSV[2]

Shrimp aquaculture, representing the main source of aquaculture production for Madagascar and Mozambique, with 58.1 percent and 79 percent production, respectively, is an important contributor to socio-economic growth. Madagascar exports crustacean products to the European Union and in 2012, exported 9 829 tonnes of which 8 548 tonnes were shrimp with 4 952 tonnes derived from aquaculture. In Tanzania, frozen shrimp valued as USD 6.4 M and live shrimp valued at USD 708 168 were exported between 2005-2012 to several destination countries.

The incursion of WSSV resulted not only to production, employment and financial losses; the disease also impacted the inhabitants of areas concerned. The impact on employment was felt severely due to the absence of any economic activity or other livelihood alternative in those areas; the direct result was migration of people or small temporary activities which disorganized the main area activities. The medium- and long-term WSSV impact can be the limitation of the growth of the shrimp aquaculture sector, recognized as one of the main activities that can offer important employment with high socio-economic impact in remote areas of the sub-regional countries.

Strategy for Improving Aquatic Biosecurity (Aquatic Animal Health) for the Mozambique Channel Sub-regional Countries (Madagascar, Mozambique and Tanzania)

The Strategy **(Box 1)**outlines a long-term, agreed-upon programme to improve aquatic animal health capacity in the sub-regional countries of the Mozambique Channel, i.e. Madagascar, Mozambique and Tanzania. The programme identifies the activities of sub-regional and national interests and importance that can be addressed jointly by the sub-regional countries and the national aquatic animal health activities that must be accomplished by individual countries in order to implement the Strategy. This Strategy can be used to approach international organizations such as the FAO (through its Technical Cooperation Department), the World Organisation for Animal Health (OIE) and other regional and bilateral mechanisms, as well as the participating governments for possible internal and external funding and/or organizational support.

This Strategy is part of joint concerted efforts to address transboundary issues related to aquatic animal health management of the aforementioned countries. The Strategy recognizes the importance of human capacity building, and this is addressed primarily in the form of targetted training programmes including post-graduate training, workshops and research capacity building on various aspects of aquatic animal health management. The preparation of the full implementation plan of the Strategy will be an ongoing process. Each Programme Component may be accomplished by completion of a number of activities. These include actions to be taken by individual countries in support of their national aquatic animal health strategies and typically supported by the government and essential to successful completion of the regional activities. Sub-regional activities will be undertaken jointly by countries. A coordinating mechanism need to be established, e.g. a Regional Aquatic Animal Health Advisory Group consisting of regional and international experts or other mechanism/s that may be appropriate for the region.

Further information can be obtained by writing to Melba.Reantaso@fao.org or Rohana.Subasinghe@fao.org

Box 1: The Strategy includes a Vision and set of Guiding Principles for aquatic animal health in the Mozambique Channel and consists of eight Programme Components, within which are 12 Programme Elements containing a total of 41 Programme Activities. The eight Programme Components address the broad themes of:

1. Biosecurity Governance
2. Sub-regional Preparedness/Response and Contingency Plan for Shrimp Disease Emergencies
3. Diagnostics, Surveillance and Reporting
4. Prevention and Management of Risks from Exotic, Emerging and/or Unknown Aquatic Pathogens
5. Promotion of Sustainable Aquaculture Development and Responsible Investment in Shrimp Aquaculture
6. Assessment of socio economic benefits/potential and risks, technical feasibility and environmental impacts of further shrimp aquaculture development in the Indian Ocean sub-region
7. Institutional Strengthening and Targetted Capacity Building on Aquatic Biosecurity
8. Regional Collaboration Communication and Networking on Information and Shared Resources.

[1]The Maputo Workshop which developed the Sub-regional Strategy was participated by Dr Ralaimarindaza Luc Josué (Madagascar); Dr Ana Paula Baloi, Ms Isabel Omar and Mr Philip-Pierre Blanc (Madagascar); Dr Hamisi L. Nikuli (Tanzania); and Dr Melba B. Reantaso (FAO).
[2]Information were taken from Draft Strategy for Improving Biosecurity (Aquatic Animal Health) in the Sub-regional Countries of the Mozambique Channel (Madagascar, Mozambique and Tanzania), Workshop Report (in preparation).

Spatial Planning Development Programme for Marine Capture Fisheries and Aquaculture

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A strategy on spatial planning is considered one of the essential requirements for ensuring sustainable marine capture fisheries and aquaculture development in the RECOFI region.

Spatial planning is an instrument that promotes and facilitates integrated management of land, water and living resources for the development and expansion of fisheries and aquaculture in a sustainable and equitable way. Spatial planning is a great tool which can be used in analyzing any issue or problem that has a spatial perspective, such as the identification, analysis and possible allocation of specific geographical areas to be used for marine capture fisheries and aquaculture or for other purposes.

The May 2011 session of RECOFI held in Rome, agreed to adopt a regional spatial planning approach to marine capture fisheries and aquaculture for the region and, within available resources, to provide the necessary support for follow-up action for the implementation of a "Regional Strategy".[1] As a follow-up, a regional technical workshop was held in Cairo, the Arab Republic of Egypt (25–27 November 2012), that finalized a detailed "Spatial Planning Development Programme" to support the "Regional Strategy" including preliminary budget estimates for capacity development.

The significant outputs of this workshop were:

- **Awareness and capacity building on spatial planning for marine capture fisheries and aquaculture** — FAO provided participants with the required knowledge on key concepts such as the ecosystem approach to aquaculture and fisheries (EAA/EAF), marine spatial planning, aquaculture zoning, carrying capacity, and also provided insight on spatial analysis skills available among RECOFI countries. Each RECOFI Member provided feedback on recent and relevant spatial planning projects for its country.
- **Survey Questionnaire on RECOFI Spatial Planning Development Programme for Marine Capture Fisheries and Aquaculture** — countries fully cooperated in the completion of a questionnaire, the summary and analysis which were presented and further discussed during the workshop. This served as basis for the development of a regional programme.
- **Proposal for a Spatial Planning Development Programme for Marine Capture Fisheries and Aquaculture** — this proposal, presented and further developed during the workshop, outlined the components of a "Regional Strategy" to implement such a programme.
- **Concept notes on pilot projects on marine fisheries and aquaculture** — workshop participants identified potential pilot projects which were elaborated in detail by international consultants after the workshop and in consultation with workshop participants.

The Regional Strategy

The vision of the "Regional Strategy" is "*To illustrate how spatial planning tools are one essential element to achieving sustainable clean, healthy, safe, productive and biologically diverse marine seas in the RECOFI region, and how they allow for mariculture and marine fishery production activities to be maximized while at the same time taking into account the other users of the marine space.*" The guiding principles that underlie the outlined components of the strategy are founded broadly on the ecosystem approach to aquaculture (EAA) and the ecosystem approach to fisheries (EAF), allied to the need to ensure that all legitimate uses of the marine space can continue on the basis of sustainability. The strategy is more specifically guided by the principles of Marine Spatial Planning.

Group photograph of workshop participants[2]

Spatial Planning Development Programme

The Regional Strategy completed in Qatar in 2010 and endorsed by the Commission in May 2011 sets out four programme components, 12 elements and 30 activities. The purpose of this current Spatial Planning Development Programme is to address some of the key elements of the Regional Strategy, essentially based on all programme components, eight of the 12 elements and 14 of the 30 activities from the 2010 Regional Strategy.

Conclusions and follow-up actions

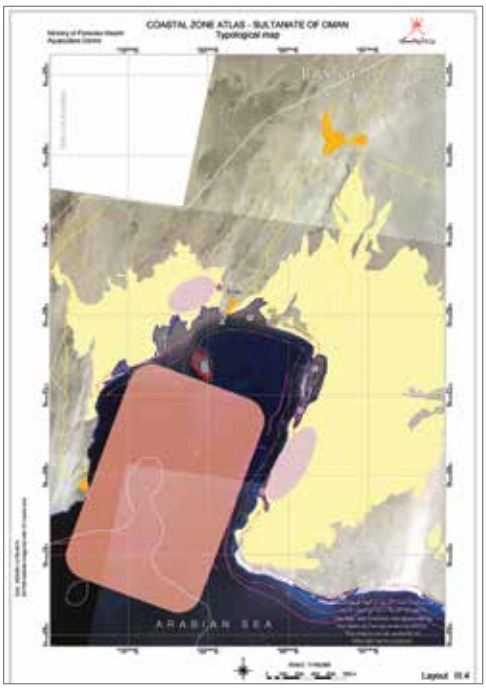
A "Regional Strategy" and a Spatial Planning Development Programme were formulated to address management needs of the RECOFI marine area concerning spatially-based issues for marine capture fisheries and aquaculture development. This Development Programme contains a series of logical and attainable measures for sustainable development of the sector, with the longer-term goal of the various users of the marine space working in harmony for the benefit of all, and for the natural ecosystems to be functionally in balance and moving towards a situation where maximum marine productivity is attained and maintained.

The Regional Strategy's primary strength is that it will allow for the delivery of spatial planning tools to enable a wide spectrum of analyses to address spatial problems for fishery and aquaculture planning and management. Spatial planning tools will not solve every marine management problem but they will provide the spatial framework within which RECOFI member countries will have more options to solve problems through sound decision-making.

A key regional activity and a core component of the "Regional Strategy" will be to identify RECOFI countries and appropriate government agencies who are willing to cooperate in developing national and regional plans (Marine Spatial Plans) to improve the environmental, social and economic conditions of the RECOFI region and to agree on cooperative working environments including the need to share data. It will be up to the RECOFI Members to address issues concerned with governance-related recommendations contained in the "Regional Strategy" at government level, including, most importantly, acceptance by RECOFI countries on current approaches to marine spatial planning, fishery zoning, and the adoption of EAA and EAF.

RECOFI will also be responsible for allocating resources to fund the Development Programme components, and likewise, it will be the responsibility of each Member country to implement their pilot projects and/or to seek synergies for collaborative work with neighbouring countries and/or countries with similar needs and priorities.

Potential areas for shrimp farming (two large pink circles) and for Sea Cucumber restocking (light orange rectangle). Bay of Jazirat. Muhut Area.



Source: Ministry of Fisheries Wealth. 2010. Sultanate of Oman. Aquaculture centre. Atlas of suitable sites for aquaculture projects in the Sultanate of Oman. pp 233. www.mofw.gov.om/AquaOman/public/images/ATLAS%20final%206%20August%202010.pdf

A draft workshop report[3] was distributed at the seventh session of RECOFI, held in Tehran, Islamic Republic of Iran from 14 to 16 May 2013. The Commission requested feedback on the draft report to allow for its completion and distribution in July 2013, and agreed that efforts should be made to obtain funds to proceed with an "operational phase" so to start with its implementation.

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[1]FAO/Regional Commission for Fisheries. 2011. Report of the Regional Technical Workshop on Spatial Planning for Marine Capture Fisheries and Aquaculture. Doha, the State of Qatar, 24–28 October 2010. FAO Fisheries and Aquaculture Report. No. 961. Rome, FAO. 118 pp. (also available at www.fao.org/docrep/014/i2054e/i2054e00.pdf).
[2]Participants included two international consultants on marine capture fisheries (Dr Geoff Meaden) and aquaculture (Mr Patrick White) respectively, and one national consultant (Dr Peter Longdill) on GIS from the State of Qatar.
[3]FAO/Regional Commission for Fisheries. (forthcoming). Report of the Regional Technical Workshop on Spatial Planning Development Programme for Marine Capture Fisheries and Aquaculture. Cairo, the Arab Republic of Egypt, 25–27 November 2012. FAO Fisheries and Aquaculture Report. No. 1039. Rome, FAO.

Biosecurity governance in Indonesian's shrimp aquaculture kicks off through TCP/INS/3402

Indonesia is the world's 4th most populous country with >239 billion people as of 2010. About 70 percent of the population depend on agriculture activities (including aquatic food production). The sector contributed around 15.34 percent of the gross domestic product (GDP); average GDP growth during the fourth quater 2011 was 1.50 percent. Since most of Indonesian people are farmers, therefore food self-sufficiency especially rice is a priority for the Agricultural Ministry's main programmes.

As an archipelagic country with more than 14 700 islands, capture fisheries and aquaculture are the main sources of income of the coastal communities. The Ministry of Marine Affairs and Fisheries (MMAF) Strategic Plan (2010-2014) has a fish production target of 22.39 million tonnes in 2014; twice higher than that achieved in 2009. With capture fisheries leveling off, it is expected that aquaculture production will increase. The sector provides employment to about 13.8 million people. The share of shrimp in total aquaculture production in 2009 was 348 000 tonnes and it is the government's aspiration to attain a 100 percent increase by 2014. Thus, aquaculture, particularly shrimp, is of great importance to Indonesia.

During the 1990s, Indonesia was the second largest black tiger shrimp (*Penaeus monodon*) producer in the world. Recurring problems such as environmental deterioration and diseases forced the closure of more than 50 percent of intensive shrimp industries and production stayed below 100 000 metric tonnes. In 2003, because of the important role that shrimp played in Indonesian export earnings, the government embarked on a programme to intensify shrimp culture. As part of efforts to increase shrimp production, the white-legged shrimp (*Penaeus vannamei*) from Brazil was introduced to the country. The period 2001 to 2002 became a transition period from *P. monodon* to *P. vannamei;* the latter has become the major cultured shrimp species in Indonesia. Production from 159 997 metric tonnes in 2002 further increased by 20.5 percent and achieved a production of 192 912 metric tonnes.

Then problems with diseases with this species became apparent. Taura syndrome virus (TSV) and White spot syndrome virus (WSSV) were detected in the early 2003. In 2006, infection with Infectious myonecrosis virus (IMNV) was reported in Situbondo, East Java based on an active surveillance of mortalities in the small-scale shrimp clusters. Following the 2006 major outbreak of IMNV, the government through the Fish Quarantine Board acted rapidly by adding IMNV to the List of Quarantine Fish Disease under Ministerial Decree No. 17/2006 issued by MMAF. In response to such outbreaks, simple network communication and reporting system had been established, especially among experts, private sectors, and government. As a result, Ministrial Decree No. 32/2006 was released. Active surveillance was carried out by research institutions and the private sectors. The disease appeared to have been contained (through improved farm level biosecurity and good aquaculture practices) during the period from the serious outbreaks in 2006 until 2008. Nonetheless, further outbreaks of IMNV occured in Lampung in 2009, and hit quite a number of big shrimp producers. But due to the lack of a systematic emergency response system and capacity, the outbreaks continued since 2009 until present. Although a national aquatic animal health (NAAH) strategy has been prepared during the outbreak of another viral disease, koi herpesvirus which affected the important food fish common carp and the high value ornamental fish koi carp, in 2002, the strategy has not been reviewed and there is now a need for it to be reactivated.

Past experience revealed that such efforts are not sufficient and addressing the issue of diseases in aquaculture require a more systematic and vigilant approach to anticipate further outbreaks and reduce losses. The TCP/INS/3402 "Development of preventive aquatic animal health protection plan and enhancing emergency response capacities

to shrimp disease outbreaks in Indonesia" has the overall development goal of supporting sustainable aquaculture development for food security and economic empowerment through effective biosecurity governance. The TCP project officially signed in April 2013, has a duration of 18 months (NTE of September 2014) and being implemented by the Division of Fish Health and Environment (DFHE), Directorate General of Aquaculture (DGA) of MMAF.

Managing for resilience: effective biosecurity governance produces healthy shrimp

Through improved and effective biosecurity, countries can grow food more efficiently, increase their income and thus improve their resilience, reduce their vulnerability and enhance their ability to respond to the impacts of higher food prices and other threats to food security such as diseases.

A Project Inception Workshop held on 14 May 2013 laid down the detailed project implementation work plan for achieving the 4 expected outputs, i.e. (1) surveillance systems for aquatic animal pathogens/diseases established and functional and an aquatic animal health information system improved, (ii) aquatic animal disease emergency preparedness guidelines improved and simulation exercise initiated, (iii) trainers and shrimp farmers trained on shrimp biosecurity and best management practices, and (iv) a National Aquatic Animal Health (NAAH) strategy updated and implementation plan approved.

A NAAH Strategy workshop, held on 15-16 May 2013, made a strong headway and achieved the following:

(i) an **Aquatic Animal Health Task Force** (AAH Task Force) was formed chaired by Ir Maskur (Director of DFHE and TCP National Project Coordinator), supported by two Vice-chairs (Dr Sukenda and Ir Mukti) and 9 members with multi-disciplinary background on aquaculture, epidemiology, molecular biology, bacteriology, parasitology, pathology and socio-economics.

(ii) **elements of the NAAH strategy** was finalized from 16 to 9 [i.e. legislation, policy and institutional framework; surveillance, monitoring and reporting for diseases; aquaculture drugs and residue; risk analysis, quarantine and health certification; disease control (prevention, treatment and eradication); emergency preparedness and contingency planning; aquatic animal health services and diagnostic laboratories; research and technological developments including outreach; national and international networking (communication and information system); human resource development and capacity building; and resource mobilization].

(iii) the **National List of Aquatic Pathogens** was examined in great detail and harmonized the listing criteria based on the current quarantine list criteria, the OIE criteria and additional criteria provided by the quarantine officers. As a result, the list has been revised to contain the following:

- **Crustacean diseases:** 16 diseases (11 from quarantine list and 5 new);
- **Finfish diseases**: 10 diseases from quarantine list and 4 to 5 diseases for national control purposes;
- **Molluscan diseases:** 12 from quarantine list consisted of 5, 1 and 6 diseases of abalone, green mussel and oysters, respectively.
- **Aquatic plant diseases:** 2 diseases

Progress report on TCP implementation will be made through future issues of FAN.

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Support to the South-South Cooperation between Namibia and Viet Nam (GCP/NAM/014/SPA)

This article describes the progress made on the project GCP/NAM/014/SPA "Support to the South-South Cooperation (SSC) Technical Assistance Programme between Namibia and Viet Nam" which aims at providing technical assistance in support of the development of aquaculture in Namibia through the deployment of SSC experts and technicians from Viet Nam, during the period of 2010–2015, under the leadership of the Ministry of Fisheries and Marine Resources (MFMR) of Namibia.

This project is managed through a tripartite agreement between the Government of Namibia, the Government of Viet Nam, and FAO, and funded by the Government of Spain. FAO's role is to facilitate the implementation of the non-operational aspects of the SSC programme and to provide regular backstopping, while the Department of Aquaculture (DoA) of MFMR concentrates on the technical and operational aspects.

A 10-day backstopping mission composed of Mohammad R. Hasan, Valerio Crespi (Aquaculture Officers) and Madhy M. Bamba (Food Security Officer) was undertaken in November 2012. This mission reviewed the progress of project implementation in relation to the work plan, provided the necessary technical advice and recommendations for the smooth implementation of these activities; and participated in the annual review of SSC Programme.

A Project Team composed by 12 Vietnamese experts (including one Team Leader and nine technicians) and officers from the Directorate of Aquaculture (DoA), carried out tangible achievements in relation to the 2012 work plan. These include in particular, (1) substantial progress made on seed production of North African catfish (*Clarias gariepinus*) and three-spotted tilapia (*Oreochromis andersonii*); (2) six study proposals were prepared including the collection of two tilapia strains (Onavivi and Okavango strains) for selective breeding programme; and (3) completion of a the study tour to Viet Nam.

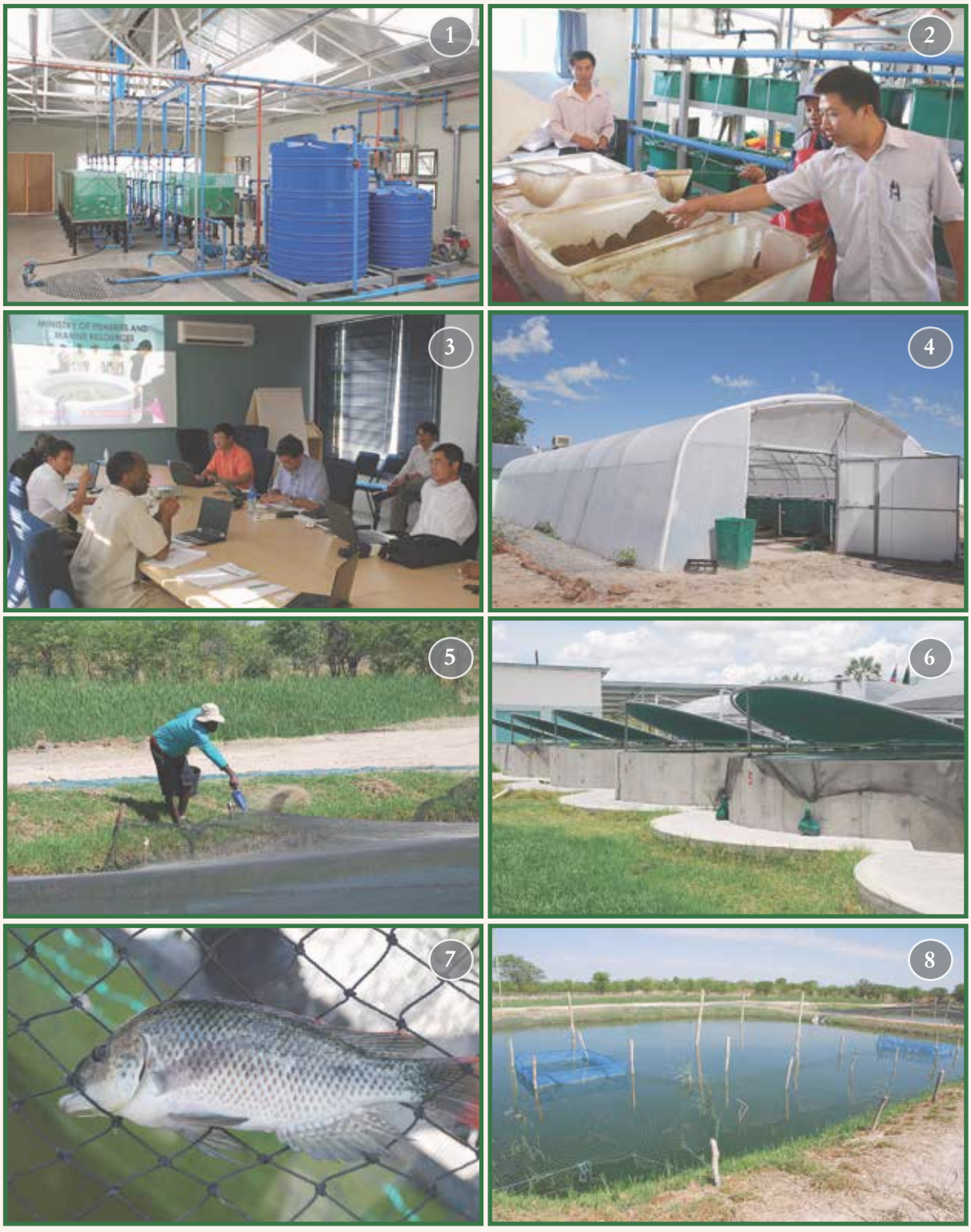
The six study proposals, related to project output onenhanced national capacities of the DOA to identify and promote improved aquaculture practices and technologies were prepared by the Project Team in cooperation with FAO and will be carried out at the Inland Aquaculture Centre (IAC) located in Onavivi and Ongwediva, in Kamatjonga Inland Fisheries Institute (KIFI), and at the Swakopmund National Marine Information and Research Centre. The subjects of the study are the following:

1) comparative assessment of the growth performance of three-spotted tilapia (*O. andersonii*) fed on locally produced sinking and imported floating pellets;
2) production of all male three-spotted tilapia and Mozambique tilapia (*O. mosambicus*) through hormonal sex reversal techniques by application of 17 α-methyl testosterone;
3) domestication of largemouth bass (*Microlepterus salmoides*) as a potential candidate species for aquaculture in Namibia;
4) establishment of a fish museum at KIFI;
5) acclimatization of African river prawn (*Macrobrachium vollenhovenii*), a potential freshwater prawn species for aquaculture practices in Namibia; and
6) development of a national aquaculture extension strategy and aquaculture extension material.

Within the framework of the SSC programme, three small-scale community-based aquaculture projects have been proposed for FAO technical clearance and subsequent funding. These projects mainly focus on fish farming integrated with agriculture and animal production which can have demonstration impact on the communities promoting aquaculture and its direct benefits to the stakeholders. Project activities will also be used for hands-on training purposes for different stakeholders living in the community.

A coordination meeting, organized with a Spanish Cooperation mission to Namibia identified possible synergies between the Namibia/Viet Nam and FAO and other Spanish-funded projects in Namibia. The meeting discussed ways of strengthening aquaculture skills through support of tertiary institutions and management and production capacity of existing research and production aquaculture centers in Namibia; and construction of a new tilapia hatchery at the Caprivi Inland Aquaculture Center. An updated status of the Spanish-funded aquafeed plant (in Onavivi IAC) based on a feasibility study which determined whether the existing feed plant can be modified to install a steam boiler and a new floating pellet extruder.

Through the execution of this 5-yr programme, Namibia will acquire enough experience and technical capacities to implement the planned activities leading to the development of a sustainable national aquaculture sector.



1. The room for fish museum and aquaria in Kamatjonga Inland Fisheries Institute (KIFI)
2. Feed grading in the Inland Aquaculture Centre of Ongwediva
3. Meeting with SSC team and FAO team in KIFI
4. Nursery in a green house in the Inland Aquaculture Centre of Ongwediva
5. Feeding fingerlings in an earthen pond
6. Circular concrete tanks in the Inland Aquaculture Centre of Onavivi
7. Three spotted tilapia *(Oreochromis andersonii)*
8. Hapas in an earthen pond

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W. Miao, FAO

Participants of project terminal workshop of TCP/THA/3304

Aquaculture information management system in Thailand (TCP/THA/3304)

Background

Aquaculture development in Thailand has grown consistently during the past 25 years. Development policies were directed towards intensification and expansion of the sector. However, with this growth, emerging problems related to environmental degradation and losses due to diseases have affected production. Decentralization of authority for planning at the provincial and district levels was another development and required more effective guidance to local planners. The Department of Fisheries (DoF) has the mandate to implement appropriate aquaculture planning and zoning so that local government can protect the environment and ensure that aquaculture development does not end up creating problems for itself, which can lead to economic losses and hardship for producers. The information necessary for decision-making has to be scaled-up and tailored to meet the needs of the government and relevant stakeholders. In parallel, there is recognition that modelling tools of varying complexity, with a particular focus on site selection and carrying capacity, may provide information of importance in addressing sustainability for various types of aquaculture.

In response to a request to FAO for technical assistance by the Thai DOF to upgrade and strengthen informed aquaculture sectoral policy-making, planning and effective management, the TCP project "Aquaculture information management system (AIMS) in Thailand" (TCP/THA/3304) was approved in early 2011 and implementation was completed in April 2013.

The expected outcome of this project is improved operational decision-making on aquaculture management and development and enhanced aquaculture planning and policy capabilities. This was to be achieved through an issues-driven, timely, geographically comprehensive and objective AIMS operated mainly, but not exclusively by personnel from provincial and district DoF offices and research centres, and also by personnel at all levels of the DoF and with participation by other departments, ministries and non-governmental organizations. The project also supported the development of tools to improve management of information on the aquaculture sector in Thailand.

Project outputs

The five major outputs achieved by this TCP included the following:

i) System and mechanisms which conveyed management information and decision-making needs from stakeholders to the responsible DOF divisions and research centres and a feedback system which expedited solutions back to stakeholders.
ii) AIMS with a basic geo-framework and attributes implemented in Songkhla and Chiang Rai provinces.
iii) Aquaculture site selection modelling tools in Songkhla and Chiang Rai provinces.
iv) Ecological carrying capacity models for bivalve and finfish culture in Petchaburi, Songkhla and Chiang Rai provinces.
v) Capacities improved for informed decision-making for aquaculture planning and management through training on AIMS at different levels.

An important component of this TCP was to provide capacity building to empower the central and local DoF officers with the required knowledge and to ensure a continuity to this project. To this end, training was first conducted in Songkhla and Chiang Rai provinces from 27 April to 2 May 2012 and was attended by 20 provincial officers from the DoF. The training consisted of lectures on GIS/Spatial and ecological carrying capacity modelling for aquaculture site selection and zoning, followed by hands-on exercises.

A second training workshop took place at the DOF headquarters in Bangkok from 10–12 January 2013 and

was attended by 30 staff from the DoF and provincial fisheries offices. The workshop enhanced knowledge of participants on: (1) principles, methodologies and applications of GIS/Spatial and ecological carrying capacity modelling for aquaculture site selection and zoning; (2) features and functions of AIMS, GIS/Spatial and ecological carrying capacity modelling tools; (3) policy and planning objectives of AIMS and its corresponding services; and (4) practical use of AIMS. Collected feedback from participants will improve AIMs features and functions.

Structure and features of AIMS

The AIMS *per se* consists of:

i) a database using free Open Source GIS software consisting of farm locations in Songkhla and Chiang Rai provinces including attribute information (i.e. cultured species, technology used, culture systems, environments, farm characteristics, production, etc.);
ii) a new mobile application for use with iPad and/or smartphones to facilitate real-time location, multimedia and attribute data collection;
iii) GIS/Spatial and ecological carrying capacity modelling tools for aquaculture site selection and zoning, and
iv) a new web site (forthcoming) to convey management information derived from the database, and models results to responsible DOF divisions.

Schematic diagram illustrating the different applications, tools and models developed for AIMS

Field data for AIMS is collected with an iPad in real time and can immediately be analyzed, shared and published in the Web for use by DOF in Bangkok and staff in different provinces in Thailand. AIMS makes accurate, timely information available to DOF and stakeholders faster and easier than ever before.

Project terminal workshop

Convened from 14–15 January 2013, the Project Terminal Workshop (PTW) was attended by 45 participants including the Deputy Director and staff of the DoF and provincial fisheries offices, officials from different government departments, and representatives from the academe, private sector as well as regulatory sectors of the industry, thus giving a wide perspective of views. The workshop presented and discussed the structure and features of the new AIMS and project outputs. Two working group sessions defined the functional attributes of AIMS according to user groups' needs and identified follow-up actions for the construction of AIMS and its expansion including an agreed time-frame, priorities and agencies with primary responsibilities. A final wrap-up meeting held right after the PTW reviewed the outcomes of the workshop and drew the plans for the completion of the remaining project activities.

Conclusions and way forward

The TCP achieved its main objectives; the results of this TCP should enable the DoF to be in a better position to recommend appropriate aquaculture planning and zoning.

The DoF is committed to securing and sustaining the use and further development of AIMS at all administrative levels. The geo-informatics group at the DoF and the Songkla Provincial Fisheries office are well-equipped with skilled personnel and data.

While the models for GIS/Spatial and ecological carrying capacity developed by international consultants are coherent with existing needs of the DoF, success will depend on timely and continued support of the DoF and on the work of the national team.

To help ensure the sustainability of the AIMS, there are plans to link and/or integrate AIMS to a recently launched national agriculture zoning programme that includes aquaculture and to a new fishery monitoring and operation centre for natural disaster monitoring and response action that includes coastal aquaculture.

The main outputs and experiences gained through this project should eventually serve as a "prototype" for the application of AIMS in other provinces in Thailand. FIRA/RAPI and the Network of Aquaculture Centres in Asia-Pacific (NACA) could play a catalytic role in establishing similar projects in other countries in Asia with similar needs and capacities.

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Capacity strengthening of International Agriculture Training Centres for improved South-South Cooperation in China (TCP/CPR/3303)

FFRC, Wuxi, China

Workshop developing sample SSC aquaculture training program and teaching modules

Since the 1980s, the Chinese government has supported national research and educational institutions and more recently, corporations in conducting international training and other South-South Cooperation (SSC) activities in agriculture and other areas where China has comparative advantage. Recent advances in technological and economic developments in China provide enormous opportunity and potential for collaboration with FAO on capacity development in support of food security and poverty eradication in developing country partners through international training and other technical cooperation activities. Chinese national institutions have been conducting international training for decades and has thus established considerable human and physical capacity development. However, these institutions were established and operated mainly for research purposes and/or domestic education/training. Professionals engaged in managing and conducting international training programmes do not always the necessary educational background related to international teaching, thus this weak capacity in standard management and operation of institutions engaged in international training, proper identification of training needs and designing of appropriate international training programmes and effective implementing of such programmes have prevented Chinese SSC training programmes to produce greater impacts to recipient countries in terms of promoting their economic and social development goals through successfully adoption of advanced and practical Chinese technologies and managerial models and experiences imparted through the international training activities.

The TCP project "Capacity strengthening of International Agriculture Training Centres (ATCs) for improved South-South Cooperation in China" (TCP/CPR/3303) developed to strengthen capacity of the Foreign Economic Cooperation Centre (FECC) of China's Ministry of Agriculture and six ATCs in the effective conduct of international training under the framework of SSC with FAO, has two main objectives: (a) assist the ATCs in developing an effective institutional management framework and human resource capacities geared towards establishing reputable and recognized international ATCs in China, and (b) through a focused human resources capacity building, to create a pool of qualified ATC management and training staff for effective implementation of training programmes and activities. The Freshwater Fisheries Research Centre (FFRC) of Chinese Academy of Fishery Sciences was selected as one of the two priority ATCs to be strengthened through this TCP project.

Project accomplishments

Most project activities have been carried since project implementation commenced in September 2011. These include the following: (i) a project inception workshop which focused on a baseline survey of the ATCs; (ii) national training workshops on developing, managing, implementing and evaluating the impacts of need-based, SSC-oriented training programmes and management of international training centres; (iii) design, development and facilitation of teaching modules for SSC-oriented training programmes; (iv) overseas study visit of ATC Directors to renowned training & educational institutions in Asia and Europe; (v) upgrading of training equipment at selected ATCs and information exchange and networking among ATCs. Efforts were also made to improve the foreign language proficiency of training staff at the ATCs through the project support.

The FFRC successfully developed a model training programme on Sustainable Aquaculture Technology and a sample course module for fish seed production through application of principles and methodologies introduced in the national training workshop on Best Practices in the Design and Delivery of International Training Programmes conducted in early December. During the implementation of the TCP project, the FFRC successfully conducted two aquaculture-related training courses for African and Central Asian countries through the China-FAO SSC trust fund support.

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Improving national carp seed production system in Nepal (TCP/NEP/3303)

Nepal is a landlocked country with inland fish production as an important source of animal food for the people. Inland capture fish production has been stagnant at 21500 tonnes harvested in recent years. Aquaculture, on the other hand, started to develop in the 1980s, but production had not grown fast enough until recently. Aquaculture is now recognized not only as an important source of animal food for the Nepalese people, but also as a profitable business for rural population. The government-reported total aquaculture production reached some 36000 tonnes in 2012. However, the domestic fish supply for the people was only 2.07 kg per capita in 2012, which was far below the regional average of over 20 kg per capita. The government of Nepal has set the domestic fish supply target at 5 kg per capita for 2032, which implies that the national aquaculture production has to reach 160 000 tonnes by 2032, a huge leap from the current production level. There are several challenges facing the Nepalese aquaculture sector which need to be addressed in order to reach the planned aquaculture growth target. These include the issue of poor fish seed quality resulting from genetic degradation of broodstock quality and lack of regulation of the fish seed production sector and poor management practices at hatcheries. Responding to the request of Nepalese government for FAO assistance to improve fish seed quality, TCP/NEP/3303 Improving national carp seed production system in Nepal was implemented from February 2011 to March 2013.

Project accomplishments

The TCP project effectively addressed a number of key technical issues related to the production of quality seed of carp species, the dominant cultured species in the country. The project strengthened the capacity of technical personnel at government breeding centres and private hatcheries through overseas and local training on carp genetic improvement technology, broodstock management and hatchery operation practices. The project assisted the Pokhara Fisheries Research Centre of National Agriculture Research Centre in starting a pilot common carp selective breeding program. The project supported the successful reintroduction of original stocks of grass carp, bighead, silver carp and common carp from China, an essential requirement for long-term carp genetic improvement in the country. The project also improved the facilities of nuclear breeding centres and equipped a molecular-genetic laboratory at the National Agriculture Research Centre. A National Fish Seed Act and Standard Manual for Carp Hatchery Operation was drafted. A National Carp Seed Production and Distribution System and National Carp Genetic Improvement Programme have been designed.

Project Terminal Workshop

The Project Terminal Workshop was convened on 22 March 2013 in Kathmandu. The Joint Secretary of the Ministry of Agricultural Development, the Director General of the Department of Agriculture, the Principal Fisheries Scientist of the National Agriculture Research Council, the Director of the Directorate of Fisheries Development and other senior government officials and major stakeholders participated in the workshop. While reviewing the project progress, there was wide discussion on the technical and legal documents developed by project consultants. The high level government officials expressed their appreciation to FAO for supporting the implementation of the TCP project and requested continuing support by FAO to carry forward the project results and outcomes through developing and implementing a full trust fund project for comprehensive advancement of the aquaculture industry in the country. The TCP project has effectively addressed the technical problems associated with fish seed production in the country. Greater efforts and input are needed to improve the national systems and mechanism supporting the aquaculture sectoral development and public infrastructure and services.

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Joint Secretary addressing the Project Terminal Workshop of TCP/NEP/3303

Seed production and rearing of ark shell and sea urchin species in DPR Korea (TCP/DRK/3304)

Traditionally, marine capture fisheries is a major source of animal food for the people of the Democratic People's Republic of Korea. The country has suffered a drastic decline in stock and catch of high valued species in recent years which led not only to deterioration of the food and nutritional security in the country, but also threatened the livelihood from fishing and foraging activities of some estimated half million coastal dwelling Koreans. As a countermeasure, the DPR Korean Government has been trying hard to promote mariculture in the coastal areas. Marine shellfish species such as ark shell, sea urchin and scallop were identified by the government as priority species of great aquaculture potential due to high market value and adaptability to culture in large water areas along the coast. The government requested FAO for assistance in developing technical capacity and the needed infrastructure for seed production and rearing of ark shell and sea urchin, to support development of culture of these species and enhance the aquatic animal protein source for the country. Responding to such request, TCP/DRK/3304 project "Capacity building in seed production and juvenile rearing of ark shell and sea urchin species" was implemented from February 2011 to December 2012.

The TCP project, which focused largely on capacity building, supported a 6-week hands-on training of four professional staff from a selected Fishing and Mariculture Cooperative, University and Ministry of Fisheries, on ark shell and sea urchin hatchery and culture technology jointly conducted by the Yellow Sea Fisheries Research Institute and the Yellow Sea Fishery Culture Co. in China. The training covered both theoretical aspects of ark shell and sea urchin hatchery operation and grow-out culture techniques and engaged the trainees in practical broodstock and larval hatchery operation and management. Under the supervision of project consultants, trained personnel successfully induced spawning of ark shell and sea urchin and rearing of the larvae. The training provided valuable practical experiences which enhanced the capacity to operate the shellfish hatchery for seed production of ark shell and sea urchin.

G. Chunren, YSFRI, Qingdao

Trainees working in the ark shell hatchery in Qingdao, China

The project also upgraded the shellfish hatchery facility through improvement water storage, treatment and distribution pipe systems and provision of heating facility, equipments and instruments for larvae rearing and natural feed cultivation. The grow-out equipment (incl. longlines, floats) for both ark shell and sea urchin was also provided. The Phycology Laboratory of Wonsan Fisheries University was upgraded and better equipped to enhance technical support for the fishing and mariculture cooperatives throughout the country.

Under the project, a draft strategy for promoting shellfish culture was developed; this will serve as the foundation for further government policy decisions. A technical manual on sea urchin seed production and culture was also developed and currently being finalized for wider dissemination.

This TCP project achieved its major objectives, particularly the needed capacity building for the successful introduction, pilot testing and local adoption of the technologies for the target Fishing and Mariculture Cooperative. Significant constraints, e.g. inconsistent supply of broodstock of desired shellfish species from the wild, unreliable supply of key production inputs and low production of natural food needed in the hatchery, still remain to be resolved to support commercial seed production of ark shell, sea urchin and other shellfish species. For shellfish culture to effectively contribute to the food and nutritional security and livelihood of coastal population, the government will need to make real efforts in addressing these constraints.

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Development of community-based milkfish farming in Nomuka Island and Tongatapu in Tonga (TCP/TON/3402)

During a regional review of aquaculture development in selected countries in the Pacific region conducted by FAO in 2010, the revival of milkfish resources in a lake at Nomuka Island was identified as a potential community-based aquaculture activity. In response to a formal request for technical assistance from the Government of Tonga, FAO carried out a feasibility study on milkfish farming in Tonga in October 2011 which also served as the basis for the preparation of a national TCP project.

Based on positive results and recommendations of the study, this national TCP project addresses two main issues, namely: a) lack of reef fish for local consumption in Tonga'tapu and 2) depleted milkfish stock in the lake of Nomuka, Ha'apai group of islands.

Approved in March 2013, TCP/TON/3402 project "Development of Community-based Milkfish Farming in Nomuka Island and Tongatapu in Tonga" will initiate and support the establishment of milkfish farming systems in two islands in Tonga.

The project document was officially signed by the Minister for Agriculture & Food, Forests and Fisheries, the Honourable Sangster Saulala, in Tonga and the FAO Sub-regional Coordinator for the Pacific Islands, Mr Gavin Wall, during one of the side events of the 10th Meeting of FAO South West Pacific Ministers for Agriculture held in Apia, Samoa, 11-13 April 2013 (see photo).

The project, to be executed by the Fisheries Department, Ministry of Agriculture & Food, Forests and Fisheries in Tonga, has the primary objective of developing commercially viable and environment-friendly milkfish farming systems in Nomuka Island and Tonga'tapu as sustainable source of food and income for island communities in Tonga. in cooperation with FAO.

The viability of community-based milkfish farming systems will be demonstrated by establishing and operating two pilot aquaculture systems (pond and pen culture). The Communities will be involved in each step of the process (i.e. site identification, environmental impact assessment, pond and pen construction, local feed production, post-harvest handlng of fish and marketing) and will receive extensive training in the operation of the farm as well as in business management. Successful implementation of the project will enhance food security in the communities in the two islands through milkfish farming. The project also adds to government efforts towards viable income sources for local communities and local production of nutritious food.

Detailed workplan was finalized during the Project Inception Workshop held in May 2013 in Nuku'alofa and Nomuka Island conducted by FAO and in cooperation with the Fisheries Department.

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Use of renewable energy in aquaculture

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Introduction

It is evident from the past trends that growth rate of aquaculture is gradually declining, although the sector is still growing. If aquaculture production follows the current growth trend, the expected annual aquaculture growth rate by 2030 would be around 4.0 percent. If this trend continues, there will be an inevitable global supply and demand gap for aquatic products (fish), perhaps amounting to nearly 50 million tonnes. This means, there is a need to increase the aquaculture growth rate to ensure that there will be enough fish to feed the growing and wealthier population by the year 2030, such a daunting task.

Despite having achieved good progress in terms of expansion, intensification and diversification, the aquaculture sector is confronted with key issues and challenges that need to be proactively addressed in order to achieve its goal of sustainable and equitable development. In doing so, the sector needs to pay particular attention to most countries in the sub-Saharan Africa, Asia and the Pacific, Central and Eastern Europe and North Africa; these regions are relatively under-developed in terms of human and technical resources. Some of the challenges that we consider important in future sustainable aquaculture development are: land and water; cost and energy efficient productivity; ecosystem impacts; feeds: fishmeal and fish Oil; biosecurity and health; conducive policy; technology and knowledge; and finance and investment.

The importance of renewable energy

Access to modern energy is crucial to improve living standards through sustainable farming. The International Energy Agency 2010 report on energy poverty stated that "Lack of access to modern energy services is a serious hindrance to economic and social development and must be overcome if the UN Millennium Development goals (MDGs) are to be achieved."

Worldwide, 1.4 billion people lack access to electricity, 85 percent in rural areas, and 2.7 billion still rely on traditional biomass fuels for cooking and heating. The greatest challenge is sub-Saharan Africa and parts of South East Asia, where only a small percentage of the population has access to electricity, the lowest level in the world. There is close correlation between income levels and access to modern energy. Countries with a large proportion of the population living on an income of less than USD2/ day tend to have low electrification rates and a high proportion of the population relying on traditional biomass. Small agro-ecological farms are ideally served by new renewable energies that can be generated and used on site, and in off-grid situations most often encountered in developing countries. The renewable energies generated can also serve local businesses, stimulate local economies and create plenty of employment opportunities.

Use of solar energy in aquaculture

Production cost is an important factor in any sectoral development and expansion, including that of aquaculture. Every effort is taken to reduce the cost of production, without sacrificing the quality of the final product. Since energy is one of the key cost factors in aquaculture, particularly semi-intensive and intensive systems, it is timely to explore alternate economical sources of energy other than non-renewable sources.

Captive power generation uses coal, diesel and gas to generate electricity. This could be a good alternative for meeting the need of aquaculture farmers who suffer from inadequate power supply and high tariff rates.

Coal-based captive power is less expensive but with advancement in solar technology, the use of coal will become less and less. Coal mines are facing stiff opposition from environmentalists. Coal-based power plants are highly-polluting and international agreements on environment will result to more levy cost for such power plants. These factors could only escalate the cost of power for the end consumer.

Estimates show that use of diesel-based power plants for energy was highest in textiles (32.4%), automobiles (19.7%), cement (19.5%), food products & livestock (18.9%), chemicals (15.8%) & engineering industries (15.5%). When compared to diesel, solar power is cheaper on a life cycle-cost basis. Diesel pumps are typically characterized by a lower first cost but a very high operation and maintenance cost. Solar

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Solar Power Plant in Gajner, Rajasthan, India: The National Solar Mission in India will one day provide energy to the country's aquaculture sector

photovoltaic (PV), a system using the sun as power source, is the opposite, with a higher first cost but very low ongoing operation and maintenance costs. In addition, unlike diesel, solar prices will continue to decrease. In general, solar power requires a high one-time capital investment, with relatively small operating costs for a solar plant life of 25 years.

One drawback of solar PV that can be minimized over a period of time pertains to the cost of solar panels which is expected to drop. Solar PV-based captive power production is likely to provide significant benefits when compared to diesel-based power, especially for back-up power.

The future of captive power generation through solar PV is bright as industrial demand will continue to increase, and activities like trading through private exchanges will make it easier for captive power generators to sell the surplus for cash benefits.

Solar power vs. diesel generators

Table 1 below shows a comparison of the pros and cons of using Solar PV and diesel generators in terms of cost, pollution, efficiency and reliability.

Cumulative installed capacity of solar PV reached roughly 65 GW at the end of 2011, up from only 1.5 GW in 2000. Solar power can provide low carbon, renewable energy resources in countries or regions with strong direct normal irradiance (DNI), i.e. strong sunshine and clear skies. Renewable energy is a quick-fix for aquaculture operations. It will reduce the energy costs and supply all the electricity one needs without a great deal of planning, patience and time. Most renewable energy technologies are installed by individuals or companies with a passion for striving to help the environment in the long-term. Renewable energy development is here to stay given the government's commitment to the Kyoto Protocol on Climate Change which commits its Parties by setting internationally binding emission reduction targets and Madrid Declaration on Biosphere Reserves and Effective Global Partnerships which promotes the greater use of renewable energy.

Table 1. Pros and cons of using Solar PV generator or Diesel generator

	Solar PV generator	Diesel generator
Cost	high one-time capital investment relatively small operating costs cost of solar panel expected to decrease	lower initial cost of installation need constant supply of fuel
Pollution	no noise conserves power reduces pollution	produces continuous noise
Efficiency	dependent on amount of sunlight	
Reliability	very reliable on warm/hot countries life span of 25 years	high weather-related risks (storms, natural disasters)

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Gender mainstreaming in fisheries and aquaculture: building capacity and strong cases to drive the gender agenda forward

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Much awareness raised in recent years

In recent years a number of publications and meetings have highlighted the interest of the fisheries and aquaculture sector in mainstreaming and applying gender development. In India, on July 2010, a "Women in Fisheries Workshop – Recasting the Net: Defining a Gender Agenda for Sustaining Life and Livelihoods in Fishing Communities" was convened by the International Collective in Support of Fishworkers (ICSF). The workshop analyzed the impact of current developments in fisheries on the livelihood of fishing communities with a focus on women's experiences, shared local agendas and strategies of women's organizations in fisheries; it defined an agenda as well as strategies for sustaining life and livelihood in fisheries in the future.[1]

The Global Conference on Aquaculture 2010 (Thailand) included a thematic review addressing human capital development and gender issues in aquaculture as one of the 20 important issues in aquaculture development. At FAO, the International Women's Day (8 March 2011), was marked by a gender focus making the case to close the gender gap by addressing gender issues. On April 2011, the Third Global Symposium on Gender in Aquaculture and Fisheries (GAF3) was followed by the FAO Workshop on Future Directions for Gender in Aquaculture and Fisheries Action, Research and Development, held in Shanghai. A Shanghai statement was drafted as a starting point to guide actions on the path to understand the implications of roles, experiences and contributions of women and men in aquaculture and fisheries.[2]

Make strong cases to drive the gender agenda forward

The sector needs to convince policy makers and donors. Most needed in this respect, is to document those strong cases where improved impact (economic, social and material outcomes) and sustainability can be directly related to the integration of a gender approach.

In many countries, fisheries and aquaculture sector comprehensive gender-disaggregated data are not consistently available and lack of these data make it a real challenge to account for women's roles thus contributing to low visibility in planning and decision-making processes. Lack of disaggregated data also leads to the under-estimation of the economic contributions of the sector (specifically of women's contributions, mostly in post-harvest and marketing) as well as the food and nutrition security contribution of the sector.

Data are the starting point but gender analysis is needed to build evidence-based baseline for strategic and practical gender needs assessment and to identify societal relations and power structures which need to be addressed.

These strategic, practical and social relations information translated from data analysis into identification of developmental issues will require a real buy-in from staff and partners so that at multi levels they can be integrated in the planning process and actions. Within the organization, setting gender indicators and including these indicators in staff performance and accountabilities will be part of the mainstreaming process.

Salted fish vendors, Congo

Gender gap in education is well-known by most staff, but in planning processes and activities, this knowledge is not always translated into addressing the gender issue.

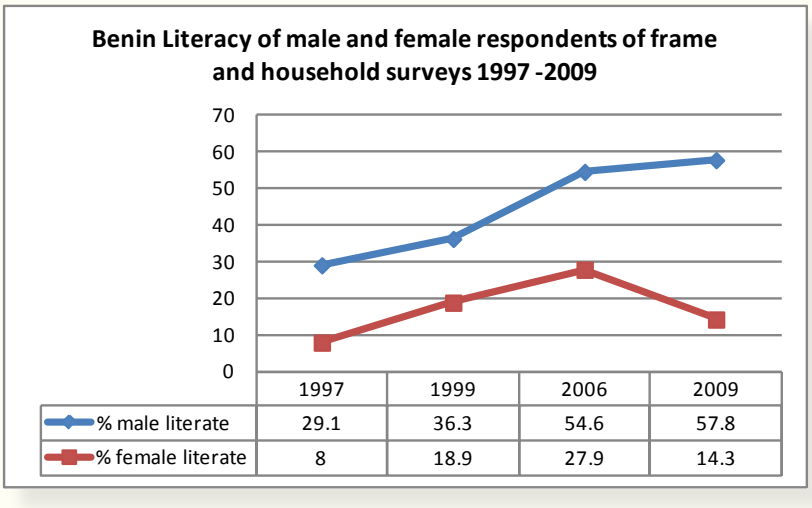
If a fisheries and aquaculture department is planning for improved governance of the resources, male and female community organizations will be invited to take part in the process. In order to be equitable, strategic processes and practical gender concerns such as literacy, time use, socio-cultural norms for participation in meetings and power relations concerning access rights, tenure and traditional institutions regulating fishing activities will need to be considered and addressed.

If livelihoods diversification support, as a means of improving food and nutrition security of resource poor households, does not take into account the different motivations of male and female actors in their livelihoods decisions and no analysis of the power relations governing the use of financial capital at the level of the household, the risk of having limited impact and sustainable results is all too real.

If time use of women's or poorer households limited mobility is not taken into account in interventions on, for example, crop production (without processing or marketing assistance and assistance to overcome barriers to value addition), beneficiaries will have very limited negotiation capacity and power within the value chain.

A global gender gap index has been documenting macro-level trends in gender inequality. It documented ratios between men and women in economic participation (wage ratios), in education (see Figure 1), in health status (life expectancy) and in political empowerment. It is recognized that policy changes and the integration of developing countries within the global economy could worsen or improve the living standards of man and women and contribute to narrowing or widening gender gaps in incomes, health, education, nutrition, etc. If we could assist fisheries departments to document the gender gap among actors in the fisheries and aquaculture sector and compare it to national or regional gender gap indexes, this would give a strong case to lobby for more investment and support to a sector gender agenda.

Figure 1. Literacy rates for male and female respondents in the marine fisheries sector



Power and societal relationships are at the root of gendered decision-making patterns and this will not appear in gender gaps statistics. Monitoring should include information on power and societal relationships. For example in value chain upgrading strategies, the motivation at the governance end of the chain and at the producers or processors end as well as the social relationships between producers and processors should be analyzed and integrated in a Participatory Planning Process and Gender Change Dialogue.

Capacity building: a research/topic specific checklists and gender indicator briefs?

The CGIAR workshop on gender transformative research and development mentioned the need for a "vision" and the availability of gender transformative research questions. Capacity building of

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Literacy training component in Niger

staff should aim at transferring the skills so as to be able to move from the checklist and research questions to visualizing gender asset gaps and gaps in social relations from the angle of household-, community- and vulnerability context levels as well as within the institutional linkages and networks in order to translate the visualized situation into drivers of change and actions. As important as establishing the baseline situation are the dialogue and the iterative process that are needed to translate the drivers of change into actions and analyze the underlying motivations that will make opinion leaders and actors accept the agenda for change.

Way forward

Gender analysis the key to gender mainstreaming

Staff could identify and support organizations that might best serve the gender agenda and vision and function as advocates on specific gender issues at all levels. There should as well be attention to promote more gender-responsive information delivery.

In aquaculture specifically, the collaboration should result in the context of globalization and increasing importance of aquaculture and processing factories, to protection of the gender specific interests of women working in processing factories.

Staff interventions should promote the codes of conduct and socio-economic role models for women including enforcement of equal opportunity legislation, enhanced access to assets and services such as formal education, training, asset titles and credit, enhanced social organization and leadership.

Judy Lawrence states the following in an OECD lecture:

... success in gender mainstreaming is largely about strategic positioning, some serendipity and opportunism, and above all good analysis that link the significance of gender analysis to the wider economic debate.

Mainstreaming gender analysis has been extremely difficult to implement where there has been no requirement for it to be undertaken as part of the policy analysis process. Small steps have been taken, but hardly mainstreaming in a complete sense. The presence of a department whose main task is gender analysis is not mainstreaming. That will only occur when everyone does gender analysis as an essential part of policy analysis and the capacity to do it exists across government. (Lawrence, 2000[3]).

[1]Kumar, H. and Prakash, S. 2010. Gender Agenda: Report: Women In Fisheries (WIF) Workshop. (available at http://wif.icsf.net/en/samudra/detail/EN/3481-Gender-Agenda.html)

[2]FAO. 2012. Report of the Workshop on Future Directions for Gender in Aquaculture and Fisheries Action, Research and Development. FAO Fisheries and Aquaculture Report No. 998. FAO, Rome. 28 pp. (available at http://www.fao.org/docrep/015/i2762e/i2762e00.pdf)

[3]Lawrence J. 2000. "Nordic Council of Ministers/OECD Gender Mainstreaming Competitiveness and Growth, 23-24 November 2000, OECD Paris.

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Aquaculture initiatives on prudent and responsible use of veterinary medicines

Why is prudent use of antimicrobials important in aquaculture?

The expansion of commercial aquaculture has driven the routine use of veterinary medicines (antimicrobial agents including chemotherapeutants, disinfectants, antibiotics and vaccines) to prevent and treat diseases caused by pathogens, assure healthy stocks, and maximize production.

However, there are a number of issues related to:

(i) **disease diagnosis** (i.e. rapid and accurate diagnosis of pathogens prior to initiating treatment; susceptibility testing to ensure treatment efficacy against the strain of the causative pathogen);
(ii) **human and animal** health (i.e. antimicrobial resistance and antimicrobial residues in aquaculture products);
(iii) **environmental/ecological impacts** (e.g. leaching from unconsumed feeds, intentional/unintentional release of effluent waters from aquaculture facilities, presence of residues in faecal materials, accumulation of residues in sediments and impacts of drugs and chemicals on natural biota, antimicrobial resistance in aquatic bacteria); and
(iv) **legislation and enforcement** (i.e. procedures for drug registration, licensing of aquatic animal health professionals, prudent use, etc.).

Residues in aquaculture products are important to trade as they could lead to negative impacts such as product rejections. Enforcing a maximum residue limit (MRL) is a risk management measure to antimicrobial residues. However, only a few antimicrobials with MRLs have been established by international agencies. In addition, antimicrobial resistance in aquaculture is complicated by possible multiple origins of resistant traits found in aquatic bacteria (Karunasagar, 2012a). There are also challenges with respect to compliance, especially by developing countries, to international standards, such as that of WTO's SPS Agreement and the FAO/WHO Codex Alimentarius as well as trading requirements of importing countries.

Aquaculture initiatives on prudent and responsible use of veterinary medicines

FAO had a number of initiatives pertaining to the responsible and prudent use of veterinary medicines including (i) expert workshops (Arthur, Lavilla-Pitogo and Arthur, 2001[1], WHO, 2006[2], Bondad-Reantaso, Arthur and Subasinghe, 2012[3]), (ii) a survey on the use of veterinary medicines in aquaculture (Alday-Sanz *et al.*, 2012), (iii) *ad-hoc* training courses on aquatic animal health management, and (iv) a project funded by the Standard Trade Development Facility (STDF) in Bangladesh being implemented in 2013.

Survey highlights

Alday-Sanz *et al.* (2012) used two approaches in the conduct of the survey, i.e. via internet and through direct interviews in selected major aquaculture-producing countries. Internet-based surveys may not be the most suitable way; the sensitivity on the use of veterinary medicine may have contributed to the low response as information collected might reflect a negative image of the country as well as the respondents. Direct interviews generated better response rate but costly in terms of required resources. The survey revealed some useful findings and recommendations:

- External treatment and use of antibiotics (i.e. oxytetracycline, florfenicol and trimethoprim-sulfadiazine) are the most commonly used therapy for most aquaculture species groups (e.g. carp, catfish, marine fish, *Pangasius*, shrimp, tilapia, trout). The wide use of oxytetracycline for both treatment and prevention for most species and species group can mean that this product is effective and its regular use for many years may also mean low resistance developed against this drug.
- For parasites, the antihelminthic praziquantel has the widest species group use while emamectin benzoate and hydrogen peroxide were commonly used for sealice control.
- Treatments were done throughout all stages of production, i.e. more commonly during: (1) grow-out operations for marine fish, carp, pangasius and tilapia; (2) hatchery operations in shrimp and trout; and (3) grow-out and hatchery phases for salmon.

- Vaccination was reported primarily for tilapia, marine fish, pangasius, trout and salmon for the prevention of aeromonids and vibrios. Vaccines against *Streptococcus*, *Yersinia*, *Edwardsiella* and *Pasteurella* were also common.
- As to the perceived negative impacts of antibiotics - building up of resistance, presence of residues of food safety concerns and toxicity to the environment - were most frequently reported among the six choices given. As to the perceived positive impacts - reduction in mortality during disease events and overall better survival - were most frequently reported among the seven choices. As to failure of treatment - poor diagnosis and the pathogen not being the primary cause of the disease - were the most common response among nine choices given.
- Different regions and between countries showed differences in terms of availability of veterinary medicines.
- There were more emphasis on treatment rather than prevention.
- Minimizing the need for the use of veterinary drugs could be achieved through training of both farmers and aquaculture advisors on health management and biosecurity, disease diagnosis and proper use of veterinary drugs.
- Competent authorities (CA) should make available effective aquatic disease diagnostic support services as a priority.

Country experiences

The country papers presented during the FAO/AAHRI Expert Workshop on Improving Biosecurity through Prudent and Responsible Use of Veterinary Medicines in Aquatic Food Production provided important lessons, e.g.:

- Chile: prevention and implementation of good aquaculture practices (GAqPs) based on biosecurity (Bravo, 2012).
- Norway: aquatic animal health legislation as cornerstone of disease prevention, vaccination as a key to disease prevention and industry cooperation and public communication (Gudding, 2012).
- Thailand: clearly identified CA with clear responsibilities and regulations (Baoprasertkul, Somsiri, and Boonyawiwat, 2012).
- Viet Nam: less antibiotic use and more use of probiotics, vitamins and locally mixed herbs for improving health and promotion of best management practices and GAqPs (Mai Van Tai, 2012).

R. Wardle, Intervet/Sharing plough

Vaccination of tilpaia against bacterial disease

Examples of ongoing initiatives to ensure responsibility in the use of veterinary medicines in aquaculture, include:

- China: licensure programme for fish vets and drug stores, fish health clinics with good diagnostic service, promotion of ecological aquaculture models, e.g. integrated multi-tropic aquaculture or IMTA, active information network with disease prevention and management databases disseminated through text messaging and other communication media (Yuan and Chen, 2012);
- Viet Nam: more use of registered products and environmentally friendly chemicals for enhancing water quality (Mai Van Tai, 2012);
- United States of America: regulatory approach to the registration and use of aquaculture drugs and addressing the need for prudent and responsible use through a risk-based drug approval process, surveillance and research on antimicrobial resistance mechanisms, and outreach programme (Matysczak and Prater, 2012).

From a manufacturer's point of view, the emphasis was on closely working with regulatory bodies and relevant organizations on quality assurance programmes and best practice schemes towards a holistic approach that ensures product efficacy and safety for consumers, producers, the fish and the environment (Wardle and Boetner, 2012).

Issues and actions

The expert workshop also identified other important issues, e.g. the complexities and difficulties of determination of antimicrobial resistance (Smith, 2012), the lack of MRLs for aquaculture drugs (Karunasagar, 2012a), the low number of veterinary drugs approved for use in aquaculture (Zarza, 2012), the lack of residue testing methods, the lack of drug prescription standards, the lack of susceptibility testing for bacteria as targets of antimicrobial treatments (thus the need for protocols and criteria), and the need to address illegal use of antimicrobials.

A clear national framework and legal instruments (national regulations and standards) for authorization of aquaculture drugs and their prudent use are needed and where possible, should be in line with international standards to ensure safety and effectiveness and harmonized regulatory environments. The consultation also recommended that the use of aquaculture drugs should be based on correct diagnosis and administered and/or supervised by aquatic animal health practicioners[4]. Both authorities and industry must be well-organized, local partnerships built and there should be right competence at all levels. Recognizing the difficulty in implementing international standards, building capacity of both public and private sectors at all levels on various aspects of both aquaculture and aquatic animal health management are deemed essential.

Information, research and knowledge should be improved and enhanced, for example, on: disease epidemiology, pathogen pathways, transmission and sources; risk assessment of antimicrobial resistance and drug approval process; sources of entry of antimicrobials into the environment (e.g. industrial, aquaculture, human use, etc.); and efficacy of antimicrobial treatments under different environmental regimes.

Last but not least, the need for the following actions was highlighted:

- risk-based official programmes for testing and monitoring residues in aquaculture,
- inspection and surveillance system for the entire supply chain of aquaculture drugs,
- innovations and research on alternatives to antibiotic treatment [e.g., probiotics, phage therapy (Karunasagar, 2012b); vaccines (Gudding, 2012)], and
- effective communication strategies, good extension and outreach programmes to empower farmers, especially small-scale producers, on, e.g. improving host conditions and the environment, disease prevention, responsible use of veterinary medicines, impacts of antimicrobial residues, managing disease risks through BMPs/GAqPs (Bravo, 2012, Karunasagar, 2012b, Koonse, 2012).

Conclusions

As a food producing sector, aquaculture is extremely important but it is also complex because of the difficulty in restricting contact with the natural environment. Managing aquatic animal health and good biosecurity governance are key features which need to be given priority attention. Prudent use of aquaculture drugs offers many opportunities to improve the sustainability of the aquaculture sector in terms of better biosecurity policy, enhancement of diagnostic services, active promotion of responsible production practices, more attention to human and animal health and protection of the environment. For aquaculture producers, responsible use of veterinary medicines could be a good incentive to: (1) improve fish health, food safety and subsequent public health, and (2) reduce environmental impacts and increase their income and profit. It helps produce resilient stocks and make them resilient producers.

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[1]Arthur, J.R., Lavilla-Pitogo, C.R. & Subasinghe, R.P. (2001). - Use of Chemicals in Aquaculture in Asia. Proceedings of the Meeting on the Use of Chemicals in Aquaculture in Asia. 20-22 May 1996. Tigbauan, Iloilo, Philippines. SEAFDEC, Philippines. 235 pp.

[2]WHO. (2006). Antimicrobial use in aquaculture and antimicrobial resistance. Report of a Joint FAO/OIE/WHO expert consultation on antimicrobial use in aquaculture and antimicrobial resistance : Seoul, Republic of Korea, 13-16 June 2006, Geneva, WHO 97 pp.

[3]Bondad-Reantaso, M.G., Arthur, J.R. & Subasinghe, R.P. (eds). (2012). Improving biosecurity through prudent and responsible use of veterinary medicines in aquatic food production. FAO Fisheries and Aquaculture Technical Paper. No. 547. Rome, FAO. 207 pp. Note: All references cited in this article can be found in this document.

[4]Aquatic animal health practicioners are defined as veterinarians working in the field of aquatic animal health and non-veterinary aquatic animal health experts trained and authorized to prescribe and/or supervise the use of veterinary medicines in aquaculture production facilities (Bondad-Reantaso, Arthur and Subasinghe, 2012).

FAO participates in the EU's Seventh Framework Programme (FP7) project "Sustaining Ethical Aquaculture Trade"

Within EU's Seventh Framework Programme (FP7), the project "Sustaining Ethical Aquaculture Trade" (SEAT) was funded in 2009. The background for this project was the growing importance of seafood in international trade, the increasing contribution of aquaculture to seafood supply and the emergence of EU as a major importer of seafood, while Asia remains the largest exporter of aquaculture products. However, access to international markets is based on meeting very stringent requirements. While the regulatory European Union requirements focus on food safety, quality and animal health, market-based requirements like certifications covering environmental and social aspects are emerging and large importers like retailers and restaurant chains have different certification requirements. The proliferation of market-based standards is leading to confusion among consumers in the EU as well as consolidation of supply chains, exclusion of small- and medium-scale producers raising questions about environmental sustainability and distribution of benefits from increased growth. Against this background, the objectives of the SEAT project are to: (a) gain and disseminate an in-depth understanding of emergent Asian aquatic food production/market chains from a holistic systems perspective through an interdisciplinary effort, (b) develop improved and transparent measures of sustainability for target aquatic food production systems, (c) enhance the sustainability and ethical 'values' (i.e. consumption of environmental services, economic efficiency, social justice, food quality and safety, animal welfare) of four major aquatic food commodities – shrimp, tilapia, *Pangasius* and *Macrobrachium* and (d) enhance farmed aquatic food, scientific, business and policy linkages between Asia and Europe.

Collaborating partners

The project is coordinated by the University of Stirling, UK and has six European partners (University of Copenhagen and Danish Institute of International Studies, Denmark; Weymoth Laboratory, UK; Wageningen University and Leiden University, The Netherlands; University of Bergen, Norway), four Asian partners (Shanghai Ocean University, China; Can Tho University, Viet Nam; Kasetsart University, Thailand and Bangladesh Agricultural University, Bangladesh) and two international organizations (the Worldfish Center and FAO). More information about the coordinating and partner institutions, key personnel involved, and work packages can be accessed at www.seatglobal.eu.

Work package

FAO leads Work Package 10: Improving transparency and utility of trade-related information, whose objectives are: (a) evaluation of information asymmetries regarding trade-related values and implications for market access (e.g. food safety, certifications, labelling and trade agreements) and (b) training and capacity building targeted at relevant supply chain actors with a view to improving market access. To understand the information asymmetries, FAO conducted a questionnaire- based survey of major supply chain actors such as operators of hatcheries, farms, feed companies, processors as well as fish inspection and certification agencies in the four Asian countries. This survey was done in association with partner institutions in Asia and the FAO network in the region. Analysis of the causes of import alerts through the EU Rapid Alert System for Foods and Feeds (RASFF) and reports of EU Food and Veterinary Office (FVO) missions to target countries provided some insight into market access problems faced by Asian countries involved in the project. Large number of alerts due to residues of banned antimicrobials indicated inadequate understanding of the international market requirements. For residues of banned antibiotics, border testing laboratories use methods with a designated Minimum Required Performance Limit (MRPL) that are highly sensitive and can reliably detect 0.3 ppb chloramphenicol and 1.0 ppb metabolites of nitrofurans. In some of the aquaculture producing countries, MRPL is confused with Maximum Residue Limits (MRLs). The survey also indicated that for antimicrobials permitted for use in aquaculture, different MRLs exist in different markets. For example, for florfenicol, the MRL in EU is 1.0 ppm, but in Japan, the MRL is 0.2 ppm in finfish and 0.1ppm in crustaceans. There are new requirements in some

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Participants to the workshop for catfish and shrimp producers and processors in Can Tho (Viet Nam)

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Participants to the workshop for tilapia producers and processors in Maoming (China)

markets, for example ethoxyquin, an antioxidant permitted in feeds is causing rejection of shrimp in Japan. This is because, currently, Japan has MRL for ethoxyquin in finfish (1.0ppm) but not in crustaceans. Hence shrimp testing even for 0.01ppm is rejected.

Another issue highlighted by the survey pertains to "testing beyond regulation" in some border inspection laboratories. For example, there were a few alerts for *Listeria monocytogenes* in frozen *Pangasius* fillets. The EU microbiological criteria for foods (EC 2073/2005) specifies *L. monocytigenes* only in ready-to-eat products, while *Pangasius* fillets are not in this category. Even in the Codex Alimentarius system, *L. monocytogenes* criterion is only for ready-to-eat products. Due to the environmental distribution of this microorganism, it is extremely difficult to eliminate it in raw products and the processing of cooking would inactivate the pathogen.

FAO participation

One of the activities conducted by FAO under Work Package 10 is capacity building of aquaculture producers and processors and helping them to understand the complex requirements of international markets. Two workshops were held, i.e, for catfish and shrimp producers in Viet Nam (Can Tho, 15-16 April 2013) and for tilapia producers and processors in China (Maoming, 18-19 April 2013). Workshop presentations delivered included regulatory and non-regulatory (market-based) requirements in international markets, lessons from trade standard compliance failures, case studies of good aquaculture practices to minimize use of antimicrobials in aquaculture and value-added products of fish/shrimp produced by aquaculture. A visual database (http://vdb.eurofish.dk) of value-added products of shrimp, prawn, *Pangasius* and tilapia in selected EU countries was prepared and the information communicated to processors in Asian partner countries. This database provides information on the product contents, type package, additives used, certifications and other information as required by the EU food labelling regulations. The workshops in Bangladesh and Thailand are scheduled to be held in July 2013.

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World Aquaculture Performance Indicators (WAPI): a user friendly tool

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Background

Aquaculture is a young and fast growing sector with complex environmental, social and economic impacts. Quantitative assessment and monitoring of the aquaculture sector performance is essential to evidence-based policy making and sector management.

There is a general lack of quantitative information on aquaculture sector performance. When available, such information tends to be scattered in the literature, leading to underutilization and sometimes misuse of available information. Misusing data from different sources (or even the same source) to create incorrect or misleading indicators is not an uncommon phenomenon.

In light of this situation, FAO has initiated the development of a user-friendly tool that compiles, generates and provides easy access to quantitative indicators on aquaculture sector performance at the national, regional and global levels. The tool is called World Aquaculture Performance Indicators (WAPI) tool.

The WAPI tool is intended to become a user-friendly instrument that helps experts utilize data and information from various sources to assess and monitor aquaculture sector performance in social, economic, environmental and governance terms and detect important trends of parameters of interest in the sector.

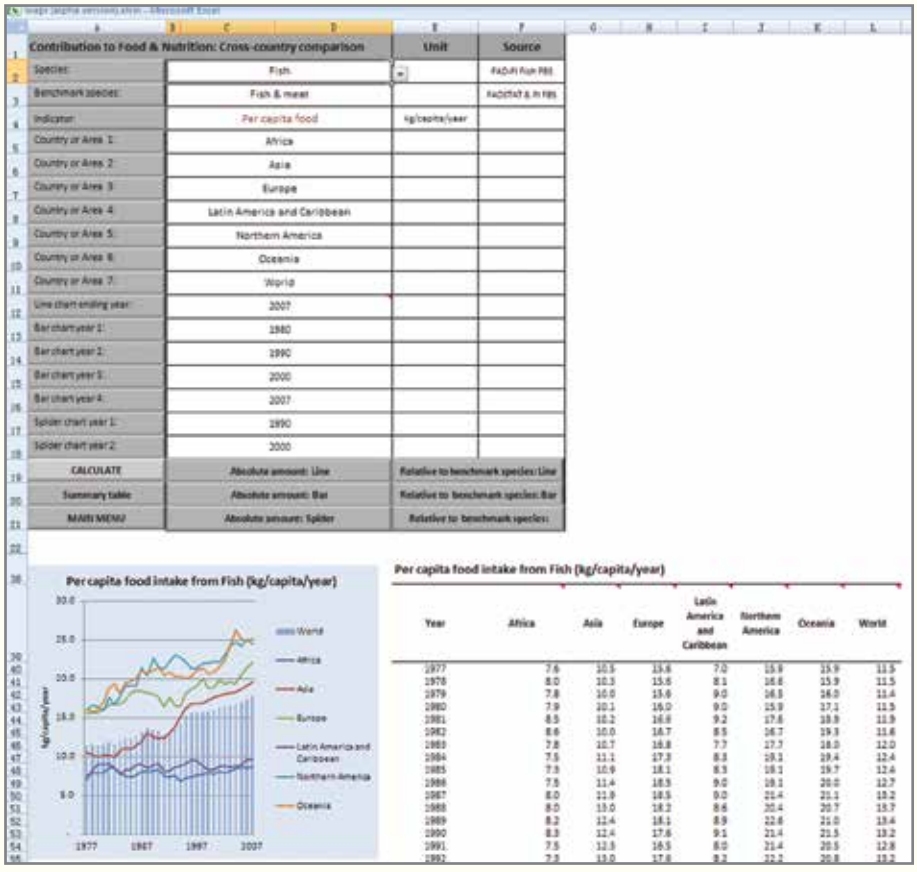
The primary users of the WAPI tool would be professionals in the aquaculture and fisheries sector, including policymakers, planners, managers, advisors, analysts, researchers, students, etc.

Experts often produce their own favorite tables and graphs and sometimes wish to use tables and graphs produced by others. The WAPI tool can become a shareware that provides a way for professionals to capitalize their sporadic efforts into standardized templates for convenient use not only by themselves but also by others. The WAPI tool can also provide a venue for detail analysis and information that are unable to be accommodated by technical reports or journal articles.

A prototype WAPI tool

A prototype WAPI tool has been developed by FAO based on various official and/or publically available data sources[1]. The draft WAPI tool covers 233 countries (or territories), 42 country groups (regions, sub-regions, etc.) and major fish species groups (freshwater finfish, diadromous finfish, marine finfish, crustacean, molluscs, cephalopod, etc.).

Figure 1: An example of cross-country comparison



The draft WAPI tool includes 72 templates in two sections. Section I includes templates on aquaculture's social, economic and environmental performance[2], while section II contains templates on the status and trend of aquaculture development[3].

The draft WAPI tool uses these templates to analyze the data and statistics included and present the resulting quantitative indicators in well-structured tables and graphs. Simple analyses such as comparisons across time, countries, species and products have been standardized for many indicators in the draft tool **(Figure 1)**.

The draft tool also includes some advanced analysis such as measuring correlations between variables **(Figure 2)** and projection of fish demand and supply in the future **(Figure 3)**.

The draft tool in its current status can be used to help generate policy briefs, factsheets or other thematic reports for policymaking or sector management. But there is still plenty of room for improvement and expansion. Tables and graphs in the tool can be linked to corresponding sources of information and data for users to obtain more contextual information. The tool can also be used to gain broader information and deeper understanding of specific aspects of aquaculture sector performance for a given country, region or the entire world. As the tool consolidates enough information, templates can be developed to address specific policy or management issues. It is also feasible to develop or incorporate weighting schemes, performance index or other processes to measure the net impact (i.e., overall performance) of aquaculture sector.

The draft WAPI tool was designed to facilitate easy modification and update: Replacing or appending new data in the data templates would automatically update all the tables and graphs in the related indicator templates and hence lead to new inferences, policy and management advice on the sector.

Figure 2: An example of illustrating correlation between indicators

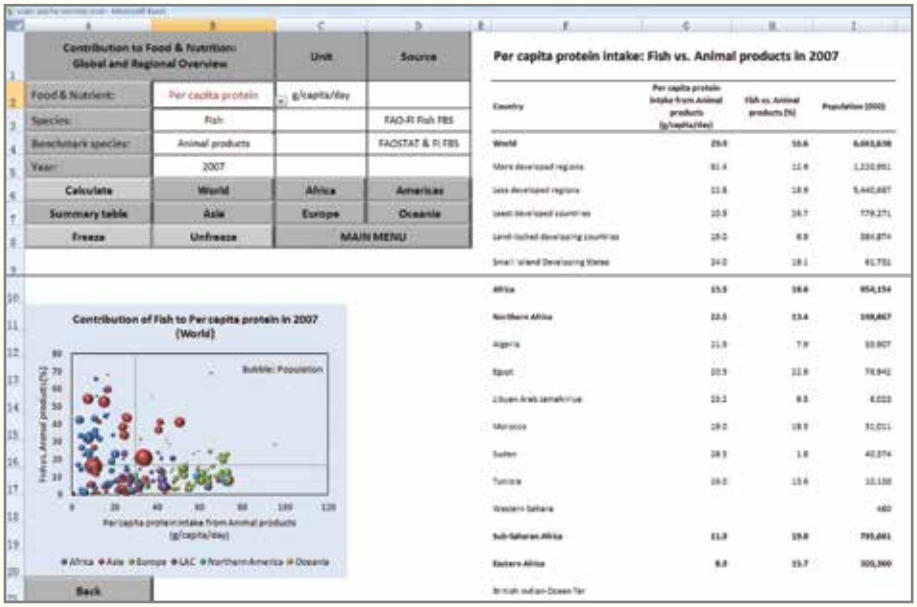
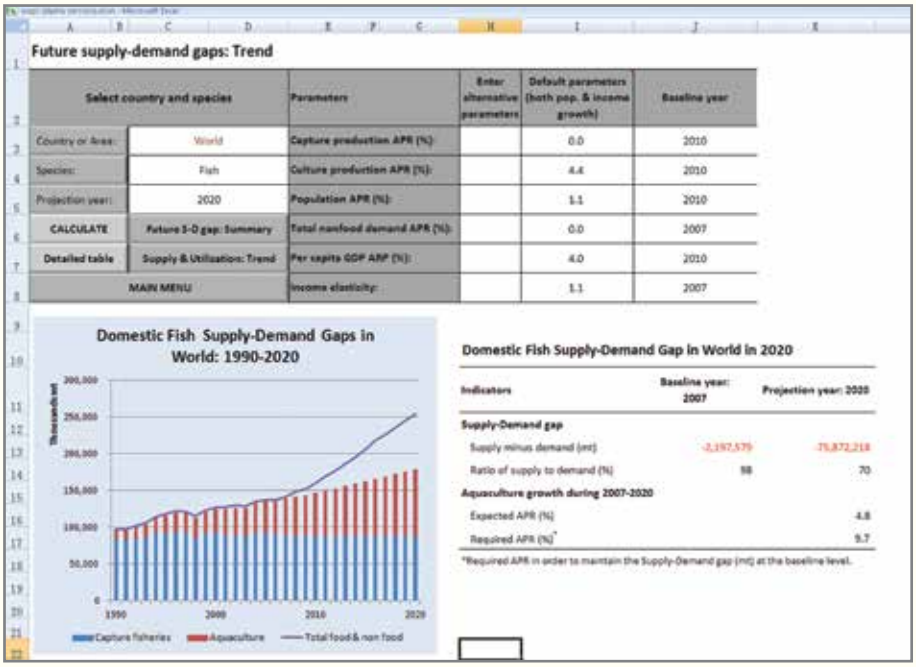


Figure 3: An example of scenario analysis



Feedbacks

During the FAO Expert Workshop on Assessment and Monitoring of the Aquaculture Sector Performance (November 2013, Gaeta, Italy)[4], the prototype WAPI tool was presented to experts from different disciplines for comments, suggestions and collaborations.

The expert participants were generally impressed by the draft WAPI tool and recognized its value as not only a tool for sector assessment and monitoring but also a mechanism to facilitate demand-driven data collection and compilation.

However, it was noted during the workshop that accurate and reliable data are essential to functionalize the many templates included in the draft WAPI tool; without which the templates would be like "castles in the air".

One concern was that the tool in its current format may be too complicated, even for professionals, and may be difficult to maintain considering the enormous amount of data needed to substantiate the templates included in the tool.

A suggestion was to break the gigantic prototype WAPI tool into various components. It was believed that simpler, more tailor-made WAPI components equipped with substantial data would be easier to develop and maintain, more user-friendly, and more attractive to potential users. Another related suggestion was to develop WAPI components through a bottom-up process that starts with specific countries or regions. As such, the tool could become a vehicle to facilitate data dissemination from national to regional to global.

Way forward

The WAPI tool would be a long-term, continuing, and improving-by-using process to consolidate and promote efforts in assessment and monitoring of the aquaculture sector performance.

"Contribute and share" – this is the motto of the WAPI tool. But it entails persistent and coordinated effort to turn the idea into reality. With its unique comparative advantage in data collection and dissemination, FAO can play a major role in this endeavour. However, partnership with other stakeholders and experts is essential to its success.

The draft WAPI tool is being modified and refined according to the feedbacks received from the workshop and elsewhere. In order to make sure that the tool serves the needs of its targeted users, we welcome your comments, suggestions and collaboration on the WAPI tool.

Should you wish to learn more about the WAPI tool and/or receive a copy of the draft WAPI tool for testing, please send a request to WAPI@fao.org.

More information can be obtained by writing to:
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[1]Data sources used by the draft WAPI tool include (1) FAO Food Balance Sheet, (2) FishSTAT, (3) FAO-INFOOD data on nutrition, (4) FAO Statistics Division's data on food security, (5) UN COMTRADE, (6) UN Population, (7) ILO's data on employment, (8) International Monetary Fund's World Economic Outlook (WEO) database, (9) World Bank's World Development Indicators (WDI), (10) Global Aquaculture Performance Index (GAPI), (11) China Fishery Statistics Yearbook, among others.

[2]Section I of the draft WAPI tool includes templates on (1) basic socio-economic conditions (population & demographics, food & nutrition security status, health, gross domestic product, etc.), (2) the socioeconomic contributions of aquaculture (food and nutrition, GDP, foreign exchange, employment, labor income, gender, etc.), (3) the environmental impacts of aquaculture (land, water, wild species, feed & feed ingredients, energy, etc.), and (4) performance indicators measuring the tradeoffs between the benefits and costs of aquaculture (labor productivity, land productivity, feed efficiency, energy efficiency, etc.).

[3]Section II of the draft WAPI tool includes templates on (1) consumption & demand, (2) production & supply, (3) commodities & trade (including bilateral trade), (4) Food Balance Sheet, (5) resources used in aquaculture (labor, land, water, feed, seed, financial resources, etc.), (6) prices (farm-gate, wholesale, retail, trade, etc.), (7) productivity & efficiency, and (8) projections.

[4]This article is based on the contents of the forthcoming FAO Report on the Gaeta workshop.

What happens when hepatopancreas - shrimp's main organ for food absorption, digestion and storage - becomes infected by a pathogen?

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In 2011, FAO provided technical assistance to Viet Nam to address an 'unknown' disease of shrimp that has devastated the shrimp farming communities of the Mekong Delta. A Rapid Deployment fielded by FAO through the Crisis Management Centre – Animal Health (CMC-AH), in July made a quick assessment of the disease situation and confirmed that a disease outbreak was occurring with increasing mortality over consecutive days, with >10 dead shrimp/day on the pond sides exceeding what was considered normal. The pattern of spread of the unknown disease was typical of a propagating infectious disease agent, i.e. starting in one pond in one location and subsequently spreading to several ponds within the farm, followed by spread in neighbouring farms. Both *Penaeus monodon* and *P. vannamei* were affected. This was not similar to any shrimp disease outbreak observed in the country before 2010. A short epidemiological survey conducted during the CMC-AH mission observed a number of risk factors which may play a role with this unknown disease:

- strong association between seedstock source and outbreaks;
- high salinity at stocking associated with outbreaks;
- temperature fluctuations (important as in other shrimp diseases).
- wide spread of the pathogen through water;
- pond-pond and farm-farm transmission through movement of people/domestic animals or birds;
- use of chemicals [insecticides, chlorine] and antibiotics;
- change in husbandry practices [from extensive to intensive; frequent use of probiotics]; and
- seed transportation stress.

Based on the recommendations of the CMC-AH mission, an emergency Technical Cooperation Programme project TCP/VIE/3304 was developed and subsequently implemented from July 2012 to present by Vietnam's Ministry of Agriculture and Rural Development (MARD). This unknown disease was given the name of Early Mortality Syndrome or more technically Acute Hepatopancreatic Necrosis Syndrome (EMS/AHPNS) by Professor Don Lightner of the Aquaculture Pathology Laboratory, Department of Veterinary Science and Microbiology, the University of Arizona (UAZ).

In April 2013, Professor Don Lightner and his team (with support from several organizations, including FAO, and the private sector) discovered[2] the causative agent of EMS/AHPNS pointed to a bacterial pathogen, a strain of *Vibrio parahaemolyticus*.

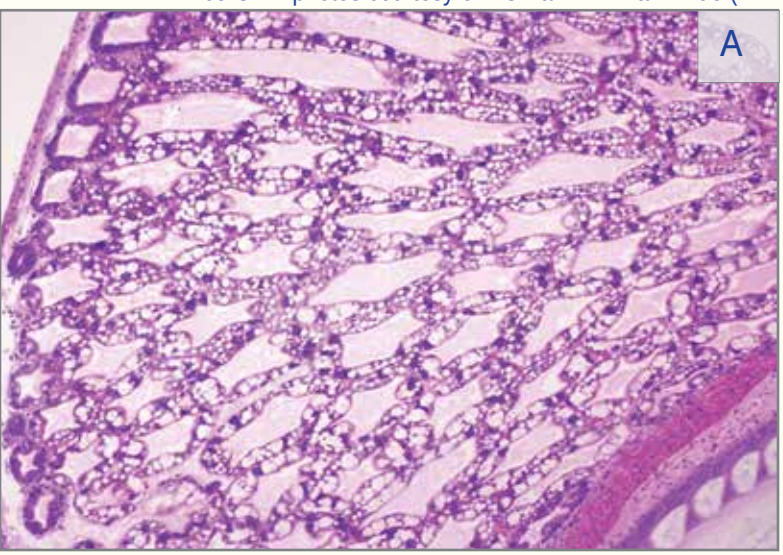
Vibrio parahaemolyticus is a marine micro-organism native in estuarine waters throughout the world. The organism was first identified as a foodborne pathogen in Japan in the 1950s (Fujino *et al.*, 1953). By the late 1960s and early 1970s, *V. parahaemolyticus* was recognized as a cause of diarrheal disease worldwide, although most common in Asia and the United States of America. Strains producing thermostable direct haemolysis (TDH) and TDH-related haemolysin (TRH) – are considered pathogenic to man.

Source: FAO/WHO.2011. Risk assessment of *Vibrio parahaemolyticus* in seafood: Interpretative summary and Technical report. Microbiological Risk Assessment Series No. 16. Rome 193 pp.

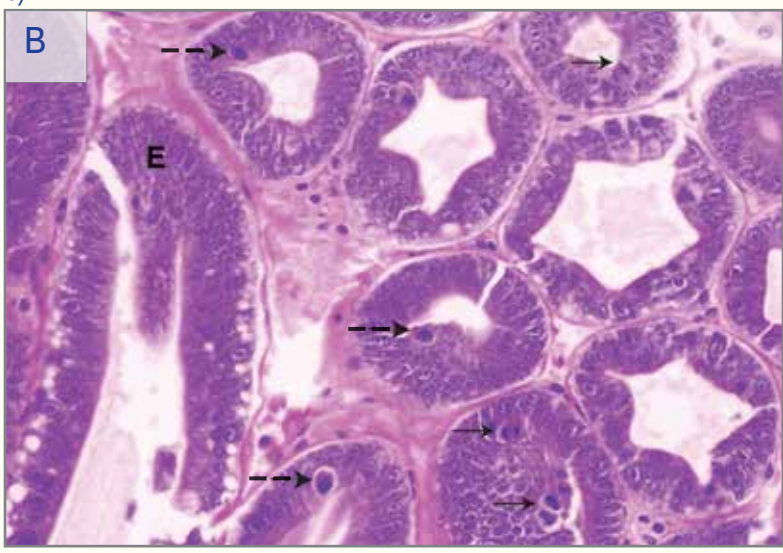
Role of hepatopancreas

The hepatopancreas (HP) or digestive gland of shrimp (and other arthropods, mollusks and fish) has the same function as that of the liver and pancreas in mammals. It is the main organ for food absorption, transport, secretion of digestive enzymes and storage of lipids, glycogen and a number of minerals[3] (Gibson and Barker, 1979; Diaz *et al.* 2010). The HP is enclosed by a thin membrane of connective tissue and contains several blindly ending tubules held together loosely by basophilic connective tissue strands which provide an increased surface area for digestion and absorption. Each HP tubule has a lumen in the centre that is lined by an epithelium. There are five cell types identified in the HP tubule epithelium that are involved in the digestion process. Four of them are described[4] (Felgenhauer, 1992; Bell and Lightner, 1998) below (**see Figure 1**).

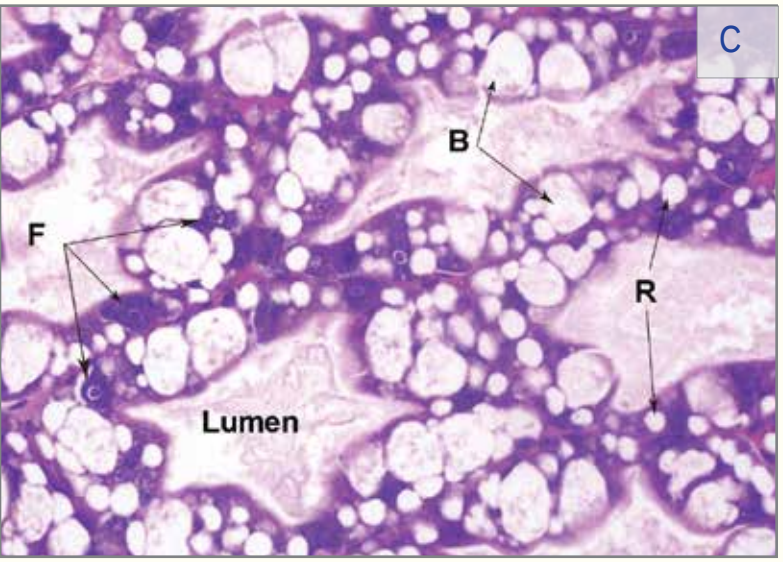
Figure 1. Histology sections of normal hepatopancreas of *Penaeus monodon* shrimp showing E-, R-, B- and F-cells. All photos courtesy of Ms Dan Thi Thanh Hue (RAHO 6).



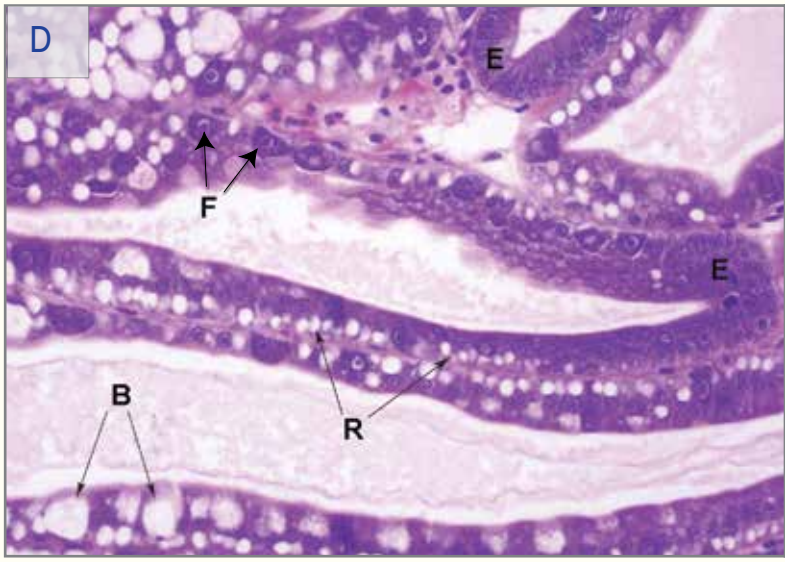
A: Normal hepatopancreas, *P. vannamei*, Ben Tre Province, Viet Nam, 20X magnification, H&E stain



B: Normal hepatopancreas, *P. vannamei* (Ben Tre Province, Viet Nam) showing normal E-cells: E-cell division (arrow); metaphase (broken arrows), 20X magnification, H&E stain



C: Normal hepatopancreas, *P. vannamei* (Ben Tre Province, Viet Nam) showing lumen, normal developing B-, R-, and F-cells, higher magnification at 40X magnification, H&E stain



D: Normal hepatopancreas, *P. vannamei* (Ben Tre Province, Viet Nam) showing normal developing B-, R-, and F-cells, lower magnification at 20X, H&E stain

E-cells (embryonic or Embryozellen) found at the distal tips of each tubule with proximal nuclei and conspicuous nuclear bodies give rise to the other three cell types of the digestive gland.

R-cells (resorptive/absorptive or Restzellen), multi-vacuolated cells, occur throughout the HP and have absorptive and lipid and glycogen storage functions. They also commonly sequester mineral deposits such as calcium, magnesium, phosphorus, sulfur, and others.

B-cells (blister-like or Blastozellen), large, primary secretory cells, are the primary producers of digestive enzymes in the HP and are responsible for nutrient accumulation, intracellular digestion, transport of digested material.

F-cells (fibrillar) are responsible for protein synthesis and storage of minerals.

What happens when the hepatopancreas of shrimp becomes infected by a pathogen?

A particular strain of *V. parahaemolyticus*, colonizes the shrimp gastrointestinal tract and produces potential toxin(s) that cause the dysfunction of HP cells in the early stage of the EMS/AHPNS.

According to Prof. Lightner, there are two distinct phases of EMS/AHPNS: (i) an **acute phase** where HP tubule cells (R,B, F and later E-cells) show acute loss of function with significant acute sloughing of HP tubule epithelial cells; at this stage, bacteria are not readily visible even with in-situ hybridization with a 16S RNA universal probe; and (ii) a **terminal phase** which shows total destruction of HP by bacterial colonization.

The main pathological features of EMS/AHPNS, identical in both natural infection and experimentally-induced EMS/AHPNS shrimps, are shown in **Figure 2,** include: massive sloughing where HP epithelial cells are discarded or cast-off following an infection; these dead cells can serve as good substrate for bacterial growth; intertubular haemocytic infiltrations among HP tubules; sloughing of tubular epithelial cells; intratubular haemocytic infiltration; and intratubular bacterial colonization.

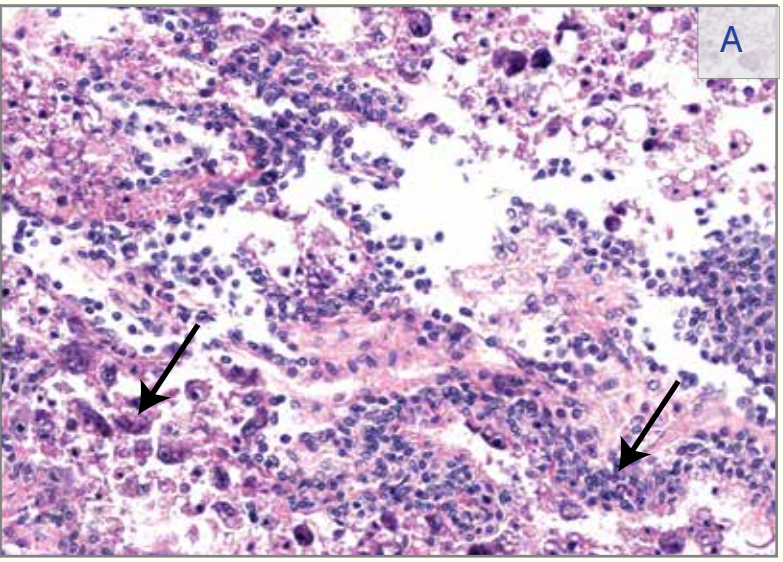
With such massive lesion, HP cell destruction and bacterial colonization, it will be difficult to imagine how young PL can survive.

TCP/VIE/3304 (E) Emergency assistance to control the spread of an unknown disease affecting shrimp in Viet Nam

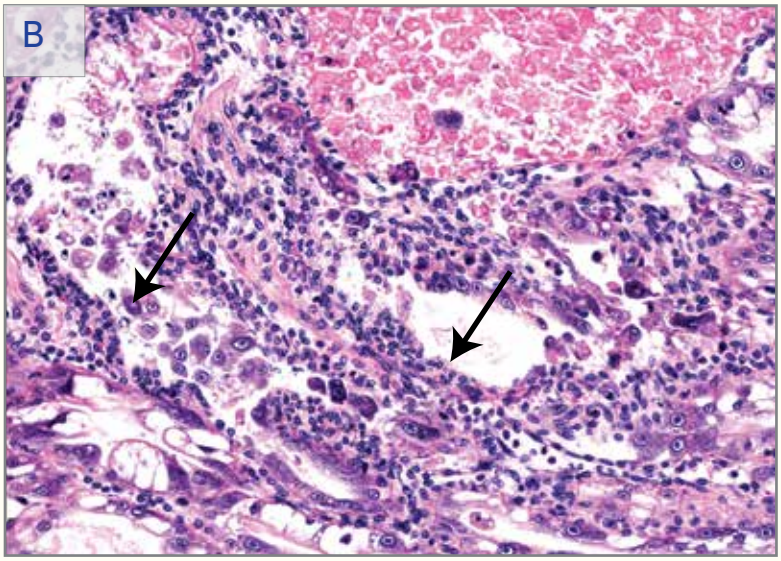
A Technical workshop on EMS/AHPNS jointly organized by FAO and MARD on 25-27 June 2013 was informed by the major outcomes of TCP/VIE/3304, the work carried out by UAZ, updated information from countries affected by EMS/AHPNS (e.g. China, Malaysia, Thailand) and other technical presentations. These and the deliberations from participating experts paved the way to a number of actions and measures to reduce

Continued on page 55

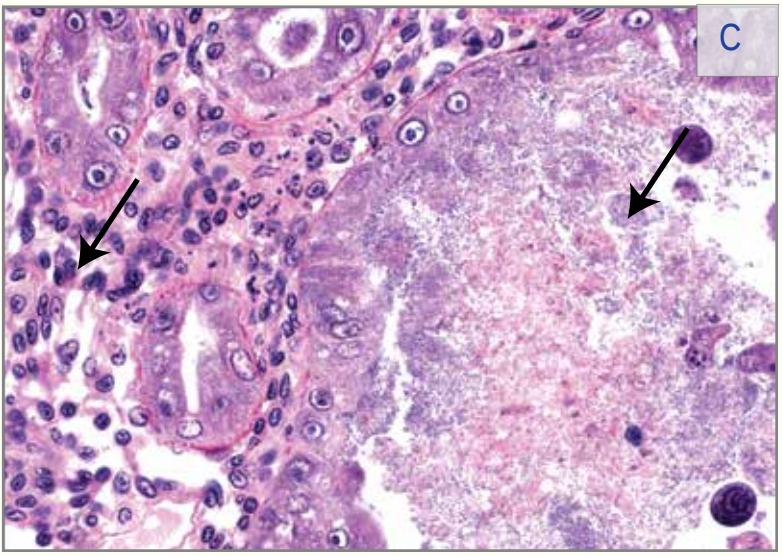
Figure 2. Histology sections of hepatopancreas showing the main pathological features of natural infection (A&C) and experimentally-induced (B&D) EMS/AHPNS *Penaeus vannamei* shrimp. All photos courtesy of Loc Tran (UAZ)



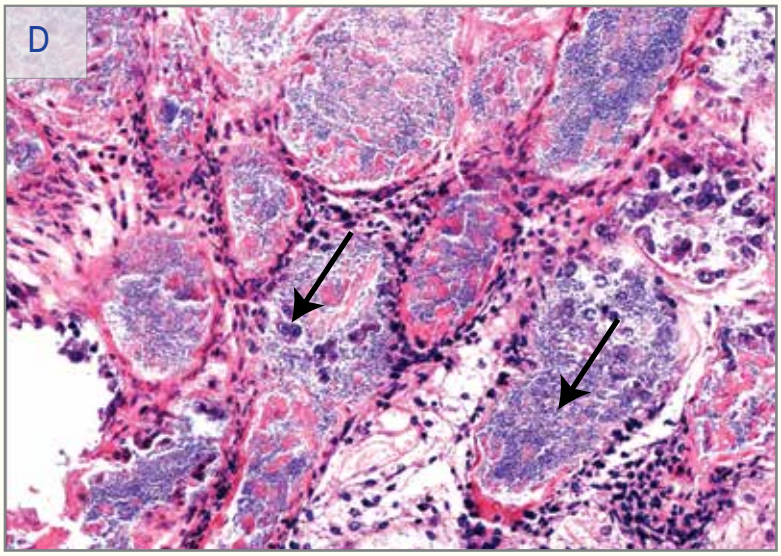
A: EMS natural infection of *P. vannamei*, acute phase. Arrows (L to R): acute sloughing of tubular epithelial cells, haemocyte infiltration. 20X magnification, H&E stain.



B: EMS experimentally induced *P. vannamei*, acute phase. Arrows (L to R): acute sloughing of tubular epithelial cells, haemocyte infiltration. 20X magnification, H&E stain.



C: EMS natural infection of *P. vannamei*, terminal phase. Arrows (L to R): haemocyte infiltration, bacterial colonization. 40X magnification, H&E stain.



D: EMS experimentally induced *P. vannamei*, terminal phase. Arrows (L to R): sloughed tubular epithelial cells, intratubular bacterial colonization, haemocytic infiltration. 40X magnification, H&E stain

Managing sea cucumber fisheries in the Indian Ocean and expansion of regional aquaculture operations

Sea cucumbers are harvested throughout the world to produce a dried product from its body, known as "bêche-de-mer" or "trepang", which is exported to eastern Asian markets as a luxury seafood. Sea cucumber fisheries are important sources of income for millions of people worldwide and have become the focus of a new frontier in mariculture of low-trophic-level animals.

Unfortunately, sea cucumber fisheries across the Indian Ocean are showing signs of significant decline by unsustainable exploitation rates and nearly half of these fisheries are overexploited. In some locations the situation is severe with widely depleted resources and an expansive clandestine fishery and trade undermining management efforts. This situation calls for increased support to improve management of wild stocks and a critical, and cautious, appraisal of aquaculture opportunities by each country.

At a global scale, FAO has supported the development of improved fisheries management systems and aquaculture for sea cucumbers through a series of multifaceted activities. Two outputs were a technical manual on the ecosystem approach to managing sea cucumber fisheries and a condensed guidebook on putting the approach into practice . The documents provide a "roadmap" for developing and implementing better management of sea cucumber fisheries, and complement a previous "toolbox" manual developed by the Australian Government.

S. Purcell, Southern Cross University, Australia

Woman fisher in Zanzibar with bucket of small sandfish collected from seagrass meadow

While the manuals have been widely distributed, the task still remains to assist fisheries agencies to use them to design modern and practical management plans to save or restore sea cucumber fisheries. This need has been taken up by a workshop series called Sea Cucumber Fisheries: an Ecosystem Approach to Management (SCEAM). The first workshop on Pacific sea cucumber fisheries, held in Fiji Islands in 2011, was recently followed by a second for the Indian Ocean, held at Zanzibar (Tanzania) in 2012. The workshop participants were practitioners, i.e. managers or senior officers, with an intimate knowledge of the fishery in their country.

The ability of sea cucumber fisheries managers in the Indian Ocean to implement strengthened management is limited by barriers such as lack of data to define the situation, limited capacity and a wicked complexity in resource use. An overarching conclusion from the discussions and workgroups over the week-long meeting was that the sea cucumber fisheries are diverse in many aspects, so each country has different management needs. Similarly, the institutional systems differ between these nations. This emphasizes that it is not possible to provide an "off-the-shelf" universal solution and that improvements will require approaches tailored to the fishery and governance context.

Each fishery manager categorized the status of sea cucumber stocks in their fishery based on six indicators. Management objectives were nominated and prioritized by each fishery manager, which had not been done for most fisheries. A major output of the workshop was new sets of regulatory measures and management actions proposed by each fishery manager for their fishery, following the seminars and workgroups sessions. These outputs set a pathway for the fishery agencies to revise or develop their management plans towards an ecosystem approach to fisheries.

Sea cucumber aquaculture is gaining momentum in the Indian Ocean, primarily encouraged by the expansion of sea-based farming with communities in Southern Madagascar. The workshop participants reported the aspirations of their governments to

support the development of farming species of high-value, such as the sandfish *Holothuria scabra* (most prioritized), as well as those of medium- and low-commercial value. This finding from the workshop exposed a beckoning need for mariculture research in the region, because culture and or grow-out technology is largely undeveloped.

The "dark side" of mariculture was also conferred at the workshop. Many sea cucumber species are not pre-disposed to farming in coastal waters and the financial returns to participating communities may not turn out as lucrative as business proponents' promise. The uncertainties of this nascent industry may lead to poorly used investments by governments in supporting such ventures and disappointment within communities. A key lesson from the workshop was that fisheries management agencies should not be distracted into pursuing mariculture as a solution to bringing about sustainability of exploitation within their fisheries.

Three elements of future research and action were identified at the workshop:

H. Eriksson, Stockholm University

SCEAM Indian Ocean participants on a reef flat in Zanzibar, Tanzania

1. Regional/subregional coordination for fisheries management. Cross-border activities are limiting the ability of management agencies to manage stocks within their own country. Research would help to identify conditions that could enable cooperative management and governance partnerships.

2. Addressing knowledge gaps for understanding sea cucumber population status and ecology. In particular, research is needed to better understand the life-history, connectivity and habitat utilization of commercial sea cucumber species. Those studies will assist definitions of ecological scales and inform decision-making towards an ecosystem approach to management.

3. Meeting the needs for training. Species identification training programs that target relevant management levels were requested. These should include live animals and basic identification procedures. Training export officers in identifying bêche-de-mer would be valuable for improving monitoring and the ability to enforce species restrictions.

More information can be obtained by writing to:
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Steven.Purcell@scu.edu.au or
Hampus.Eriksson@su.se

[1] Purcell, S.W., Mercier, A., Conand, C., Hamel, J.-F., Toral-Granda, M.V., Lovatelli, A. & Uthicke, S. 2013. Sea cucumber fisheries: global analysis of stocks, management measures and drivers of overfishing. Fish and Fisheries, 14, 34–59.
[2] Conand, C. 2008. Population status, fisheries and trade of sea cucumbers in Africa and the Indian Ocean. In Toral-Granda, V., Lovatelli, A., Vasconcellos, M. eds. Sea cucumbers: a global review on fisheries and trade. FAO Fisheries Technical Paper No. 516. Rome, FAO. (available at ftp://ftp.fao.org/docrep/fao/011/i0375e/i0375e05a.pdf).
[3] Eriksson, H., Robinson, G., Slater, M.J. & Troell, M. 2012. Sea cucumber aquaculture in the western Indian Ocean: challenges for sustainable livelihood and stock improvement. AMBIO: A Journal of the Human Environment, 41, 109–121.
[4] Purcell, S.W. 2010. Managing sea cucumber fisheries with an ecosystem approach. Edited/compiled by Lovatelli, A., Vasconcellos, M. and Y. Yimin. FAO Fisheries and Aquaculture Technical Paper No. 520. FAO, Rome. 157 pp. (available at www.fao.org/docrep/012/i1384e/i1384e.pdf).
[5] FAO. 2010. Putting into practice an ecosystem approach to managing sea cucumber fisheries. FAO, Rome. 81 + vii (available at www.fao.org/docrep/013/i1780e/i1780e00.htm).
[6] Friedman, K., Purcell, S., Bell, J. & Hair, C. 2008. Sea cucumber fisheries: A manager's toolbox. ACIAR Monograph No. 135. Australian Centre for International Agricultural Research, Canberra. 32 pp (available at www.aciar.gov.au/publication/mn135).
[7] FAO. 2013. Report on the FAO Workshop on Sea Cucumber Fisheries: An Ecosystem Approach to Management in the Indian Ocean (SCEAM Indian Ocean), Mazizini, Zanzibar, the United Republic of Tanzania, 12–16 November 2012. FAO Fisheries and Aquaculture Report. No. 1038. Rome. 92 pp. (available at www.fao.org/docrep/018/i3223e/i3223e.pdf).
[8] Robinson, G. & B. Pascal. 2012. Sea cucumber farming experiences in south-western Madagascar. pp. 142-155. In Hair, C.A, Pickering, T.D. & D.J. Mills. Asia-Pacific Tropical Sea Cucumber Aquaculture. Proceedings of an international symposium held in Noumea, New Caledonia February 2011. ACIAR Proceedings No. 136. Australian Centre for International Agricultural Research, Canberra. 209 p.
[9] Eriksson, H., de la Torre-Castro, M. & Olsson, P. 2012. Mobility, expansion and management of a multi-species scuba diving fishery in East Africa. PLoS ONE, 7(4): e35504.

Aquaculture development in Kenya: towards a thriving business venture

Driven by the Fish Farming Economic Stimulus Programme (ESP), aquaculture production in Kenya leaped forward from approximately 5 000 tonnes in 2009 to 12 000 tonnes in 2010 and 22 000 tonnes in 2011.[1] The share of aquaculture in the country's total fish production increased from 3.5 percent in 2009 to 11 percent in 2011.

Impressive progress notwithstanding, the history of aquaculture development in Africa did not lack incidence of short-lived success driven by government or donor-led projects. Would things be different this time? The fish farmer and policymaker in Kenya apparently think so.

Voice of the fish farmer[2]

Mr George Ambuli, trained as a welder and a mechanic, described his experience on fish farming: "To me the whole thing started as a hobby. I did not at any one time imagine that this initial pass-time would turn out to be a major business enterprise that in my area alone is creating wealth to over 1 000 farmers. We started in a very crude way with a small pond but got a boost in 2004 through assistance from our local Constituency Development Fund (CDF) that donated catfish fingerlings. After about four months we harvested some 180 pieces. The success of the group that brings together several clusters within the region saw them benefit from a Sh800 000 Fish Feed Pelletizing machine for making feed to sell to farmers. Currently, we have a tender to supply 88 bags to the government feed farms, which is being distributed to farmers for free under the ESP. We have ordered for a state-of -the-art feed processing machine from China after getting a grant from a micro-enterprise organization. This machine could arrive anytime next month. From this machine, we will be in big business targeting thousands of fish farmers who are now embracing aquaculture. The cost of feed is very expensive because it comes all the way from Uganda. Most of the farmers are currently benefitting from the government ESP and once that ends, it means the demand for feed will be very high; hence, the needs to offer competitive prices to encourage more people come on board."

Mrs Dephine Okota, a female fish farmer, narrated: "My husband, a civil servant, encouraged me to start fish farming and at first we incurred a big loss because we did not have any of the knowledge that I have acquired through various trainings and interaction with other farmers. I am now working on the fifth pond. Even though there are still some grey areas especially with regard to fingerlings and feeds, the future of aquaculture is very bright especially with the support we are getting from the government and organizations such as FAO."

Mr William Kiama, who has been very successful in fish farming but would not want to consider himself a large scale-fish farmer, disclosed: "It was not easy at first because of the perception people in my locality had about fish. Traditionally people from Central Kenya were not eating fish; now we cannot satisfy the demand for fish in the area. I harvest about 1 000 catfish every month from the ponds but my vision is to increase production to about 10 000 fish per month."

Voice of the policymaker[2]

Assistant Director of Fisheries Ms Betty Nyandat reported "The Ministry has carried out an aquaculture suitability survey in the whole country and preliminary results indicated that there is enormous potential to farm fish. The country's potential to produce fish amounts to 1.4 million hectares of farming area."

According to Ms Nyandat (Kenya) has yet to tap into its huge potential for aquaculture because of various technical and economic constraints, such as inefficient farming technologies, inappropriate farming practices, and inadequate attention to and a lack of understanding of the economic dimension of aquaculture (market dynamics, risk management, etc.).

Ms Nyandat, is optimistic that the department policy on shifting fish farming from subsistence to commercial enterprise could turn the situation round. But she stressed the importance of more training of fish farmers not only on good aquaculture practices but also business skills. "The department is collaborating with FAO, SmartFish project and other partners to ensure that they are able to train as many farmers as possible," said Ms Nyandat.

Training workshop under the SMARTFISH programme

All the three farmers quoted above were beneficiaries of the "FAO-Government of Kenya Capacity Building Workshop on Conducting Aquaculture as a Business", held during 17 – 21 December 2012 in Kisumu, Kenya and aimed at enhancing the understanding and capability of Kenyan fish farmers in conducting business-oriented aquaculture.

B. Maptumo, Consultant, Zimbabwe

A moment of a practical demonstration during one of the training held in Kenya

This workshop was organized under the SmartFish (www.smartfish-coi.org), a regional fisheries programme managed by the Indian Ocean Commission, funded by the European Union and co-implemented by FAO covering 20 countries in the Indian Ocean and Eastern and Southern African region. Two of the five components of the programme, i.e, fisheries management and food security, are executed directly by FAO. Under the food security component, four countries (Kenya, Mauritius, Rwanda, Tanzania and Uganda) were selected for aquaculture-related activities.

"It is expected that the project beneficiaries and the training participants, in particular, will gain the necessary tools and understanding on how to plan and manage their aquaculture ventures with a business perspective, " said Davide Signa –fisheries officer and expert on food security of SmartFish.

Led by local extension officers, the workshop participants shared their experiences and understanding of conducting aquaculture as a business. They exchanged information on where to obtain high quality and/or inexpensive materials (feed, fingerlings, liner, etc.); they debated whether it is more profitable to grow smaller-sized fish because the local price of fish is often measured by piece instead of weight; they inquired about how to use on-farm materials to make their own feeds; and so on and so forth.

Assisted by two experts from FAO, the workshop participants used a user-friendly investment tool developed by FAO to evaluate the profitability of their farm operations. Working in groups, they discussed and verified the technical and economic parameters that they would input in the tool, presented the results of their analysis to other groups, commented on the results of other groups, and did not stop testing the tool until they obtained a profitable result.

Way forward

Aquaculture development in Kenya has had a good start on the way towards a thriving business venture. Learning by doing, with appropriate training and assistance, fish farmers and policymakers in the country have every reason to be optimistic about the future of the industry. But they are also well aware of the challenges ahead and need various assistance. In addition to more training on business skills, the farmer participants of the SmartFish workshop also requested assistance in:

1) obtaining high quality (mainly high-yield) seed,
2) getting high quality and cheaper commercial feed,
3) training on on-farm production of own feed,
4) tax reduction on feed and veterinary drugs,
5) access to loans and other credits,
6) setting up cooling facilities for storage,
7) upgrading information technology,
8) establishing better links between farmers and traders,
9) access to market intelligence (price, demand, species, etc.),
10) reducing the intermediary costs of fish trading,
11) protecting local farmers against imported fish products,
12) establishing exchange programmes between Kenyan farmers and farmers from other regions (e.g., Asia or Europe), and
13) enhancing formation of and providing funding and other supports to clusters and farm cooperatives.

More information can be obtained by writing to: Junning.Cai@fao.org; or Nathanael.Hishamunda@fao.org; or Davide.Signa@fao.org

[1]FAO FishSTAT Aquaculture Production Dataset (released March, 2013).
[2]Information provided by the SmartFish programme.

Aquaculture and fisheries in rice-based ecosystems: training activities and field studies under the FAO Asia Regional Rice Initiative Pilot Programme

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The Asia Regional Rice Initiative Pilot Programme

At the 145th Session of the FAO Council in December 2012, a regional pilot initiative entitled *Rice-based production systems in Asia and the Pacific* under FAO's Strategic Objective 2 *Increase and improve provision of goods and services from agriculture, forestry and fisheries sustainably* was proposed. Consequently, a multidisciplinary team from Headquarters (HQ) and the Regional Office for Asia-Pacific (RAP) developed the Regional Rice Initiative Pilot Project which has four component outputs: (i) water and rice/fish systems, (ii) biodiversity, landscape, and ecosystem services, (iii) management practices and (iv) social, economic and policy - cross-cutting issues. Among others, this pilot project is expected to bring attention to the full scope of the goods and services produced by, and in, rice agroecosystems, build assessment capacity of policy makers on feasible production practices, trade-offs and synergies and select the best options within a long term strategy.

Aquaculture and fisheries in rice-based ecosystems

Floodplain rice production systems and even upland rice systems can provide habitat and refuges, may increase connectivity and provide nursing, spawning and grow-out areas for fish and other aquatic animals. These aquatic animals are highly exploited in these systems by rice farming households and part-time fisher-folk. Wild and gathered foods from the aquatic habitat provide important nutrition and food security, as they often supply essential nutrients that are otherwise not adequately found in diets **(Photo 1)**. Various traditional and innovative methods are being applied by farmers to enhance aquatic production through water management and aquaculture-related techniques. Improving connectivity in rice systems and providing refuges for enhancement in permanent water bodies can significantly improve the productivity of rice-field systems. Yet this rich and important aquatic diversity, but also the threats and opportunities to ecosystem services

M. Halwart, FAO

Photo 1: Farmers selling their produce early morning in Vientiane, Lao PDR – bigger fish are captured from the Mekong river whereas the nutritionally particularly important smaller fish come from the ricefield environments

provided by these systems, are often not recognized in national statistics, policies, and legal frameworks and in water and irrigation policy arenas.

Pilot project activities

The pilot project is in full operation now following inception workshops in each of the three participating countries, namely Indonesia, Lao PDR, and the Philippines. In consultation with FAO Country Offices and local stakeholders, target sites have been identified and country documents specifying the particular outputs for each component have been prepared jointly. A Regional Training Workshop on Assessment of Aquatic Biodiversity in Rice-based Ecosystems was hosted by the Freshwater Aquaculture Center of the Central Luzon State University at the Philippine Rice Research Institute in Muñoz, Nueva Ecija, Philippines, 7-8 May 2013, bringing together trainers from the participating countries **(Photo 2)**. This was followed by training of local trainers in local/national training workshops already completed for Indonesia **(Photo 3)** and the Mindanao Region (in the Philippines), both in June 2013, and another one forthcoming in Lao PDR in July 2013. Following this training, the assessments of the utilized aquatic biodiversity in rice-based ecosystems will be implemented using a participatory approach and working directly with farming families and landless in the identified sites. In addition, work is being planned and implemented closely with Component 3 on sound management practices following the Farmer Field School (FFS) approach.

Photo 2: Participants at the Regional Training Workshop together with the President of Central Luzon State University in Nueva Ecija, Philippines

Photo 3: The national training workshop in Indonesia brought together participants from agriculture and aquaculture

Project outputs

The project outputs include national assessments of the availability and use of aquatic organisms in rice-based ecosystems for nutrition and livelihoods, increased capacity by local stakeholders, and a compilation of innovative farming systems and improved production practices which enhance biodiversity and result in multiple production. In addition, in Lao PDR, local market studies with current information about price ranges for aquatic organisms will allow an economic assessment of the ricefield catch and culture.

Findings from the project will be presented towards end of 2013 in national and regional workshops as well as selected international events and outcomes of this project are expected to be discussed and mainstreamed into the Regional Priority Framework for Asia which is currently being updated to reflect emerging issues in the region.

Acknowledgement: The excellent collaboration with the national counterparts and the kind support extended by colleagues in the SO2 Regional Pilot Initiative especially Mr H. Konuma, Mr. C. Campanhola, Mr. J. Jia, Ms. C. Batello and Mr. N. Minamiguchi are gratefully acknowledged.

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Indicator system for measuring the contribution of small-scale aquaculture to sustainable rural development

It is generally recognized that the small-scale aquaculture (SSA) sector has significant contribution to poverty alleviation and thus to sustainable rural development (SRD). However, with the exception of research studies and donor-funded projects, there is limited hard data to substantiate such claims.

In efforts to make a systematic assessment of the contribution of the SSA sector, FAO initiated a project and two expert workshops which developed an indicator system[1] (see Table 1) that can be used for such assessment with a follow-up project that pilot tested and up-scaled the application of such indicators.

Maureen Hart, an expert on sustainability indicators summed up the following definition, purpose and characteristics of indicators as:

> "An indicator is something that helps you understand where you are, which way you are going and how far you are from where you want to be. A good indicator alerts you to a problem before it gets too bad and helps you recognize what needs to be done to fix the problem... An indicator is something that points to an issue or condition. Its purpose is to show you how well a system is working. If there is a problem, an indicator can help you determine what direction to take to address the issue. Indicators are as varied as the types of systems they monitor".

Key lessons learned from the exercise of developing an indicator system for measuring the contribution of SSA to SRD were:

- Objectives: a very clear statement of objective of what is being assessed is very important as this will be the basis for determining what is the best framework that can be used in the assessment. In the case of this project the objective was to measure the contribution of SSA to SRD.

- Analytical framework: is needed in designing an indicator system. It sets the scope and boundaries by which the assessment will be carried out. It should have the ability to describe the relations between and the interactions between the different components being measured. It should be able to depict the constant interactions among the components being measured and thus be able to account for the changes in the system as well as in the broader context. It addresses the issue of "attribution" which is a common concern in identifying indicators. In the case of this project, the analytical framework used as the Sustainable Livelihood Approach and its five capitals: natural, physical, human, financial, and social.

- Criteria: a set of criteria is important in order to draw "effective and good indicators" which should have the following features: relevance (indicators must fit the purpose for measuring); ease of understanding (should be easily understood even by non-experts; the meaning of the indicator should be clearly understood and what it means in order for it to be used as guidance on required action); reliability (the information that the indicator is providing can be trusted and gives a reliable picture of the system it is measuring); and data accessibility (information is available or can be gathered; indicators must provide timely information). In the case of this project, the criteria used was a slightly revised SMART[2] criteria, i.e. accuracy, measurability and efficiency.

- **Definition:** clear definition of the sector being measured and the indicators to be used for the assessment are important. A detailed indicator definition (i.e. name, description, unit of measurement) as well as in formation on its importance, what it measures (e.g. positive contribution or negative impact), for what it is being measured (e.g. sustainability, rural development) and how it can be measured (means of verification through questionnaires and other means; methods for data collection; and analysis). In the case of this project, the workshop agreed on a working definition and characterization of small-scale aquaculture (SSA) and a detailed indicator definition as seen in Table 1.

- **Evaluation and case study pilot testing of the indicators:** a review of selected indicators can be done through expert review; survey questionnaires, which need to be pilot-tested prior to field implementation. In the case of this project, the indicator system went through to two expert workshops; the case study from Thailand was pilot-tested first and served as a template for other country case studies.

- **Radar chart:** also known as web chart, spider chart—is a graphical method of displaying multivariate data that can show a two-dimensional chart of three or more quantitative variables represented on an axes starting at the same point (http://en.wikipedia.org/wiki/Radar_chart). In the case of this project, the radar chart was used to demonstrate which of the five capital assets give the highest or strongest contribution; i.e., the longer the spike, the higher is the contribution.

- **Manual for field application:** a practical, easy-to-follow instruction containing basic steps in carrying out a localized or a wider scaled-up national study is valuable in providing an explanation of the concepts, methodologies, tools, and guidance for for doing specific task, practical exercises and worksheets.

The Nha Trang indicator system **(Table 1)** for measuring the contribution of SSA to SRD has been pilot- tested and up-scaled in selected countries and the outcomes are contained in a report that is currently in preparation. More information will be provided in future issues of FAN.

Further information about this project and its outcomes can be obtained by writing to Melba.Reantaso@fao.org

[1]Bondad-Reantaso, M.G., Bueno, P., Demaine, H. & Pongthanapanich, T. 2009. Development of an indicator system for measuring the contribution of small-scale aquaculture to sustainable rural development, pp. 161-179. In M.G. Bondad-Reantaso and M. Prein (eds.). Measuring the contribution of small-scale aquaculture: an assessment. FAO Fisheries and Aquaculture Technical Paper No. 534. Rome, FAO. 2009. 180p.

[2]Specific, measurable, attainable, relevant, time-bound

Table 1: Nha Trang Small-scale Aquaculture Indicators (FAO, 2009)

Contribution	Indicators	Explanation	Means of verification	Methods for data collection
Natural capital				
1. Efficient use of materials and energy savings	1. Types and number of nutrient flows	Recycling of household and farm waste and by-product among various farm enterprises improve material use and save energy	Farm survey – questionnaire	- Ocular observation of farm Schematic diagram with farmer that depicts material flows in the farming system - RESTORE model as a template (Prein, 2009)
2. Efficient use of water	2. Number of farm production uses of water	Reuse of water in a farm indicates an efficient use of water resource; this contributes to environmental sustainability.	Farm survey – questionnaire	- Ocular observation of farm - Schematic diagram with farmer that depicts material flows in the farming system
Physical capital				
3. Build up of SSA farms and farm assets in rural area	3. Number of SSA far,s and farm areas increased over 3 years in the study area	Increase of SSA farms and expansion of farm areas indicate growth in physical capitals due to SSA	Key information survey Farm survey – questionnaire	- Discuss with village head on number of SSA farms and farm areas increased over 3 years in the study area - Ask farmer about farm enter[rises and land use changes over 3 years
4. Build-up of rural physical assets	4. Types and number of rural infrastructure investment induced by SSA	SSA induces a building up of rural physical assets (such as water system, rural market, rural road and energy distribution system)	Key information survey Farm survey – questionnaire	- Discuss with village head on number and types of rural infrastructure investment induced by SSA - Cross-check by asking farmers about types of rural infrastructure investment induced by his/her SSA business
5. More efficient use of build physical assets in rural area	5. Types and number of rural infrastructure investment induced not purposely for SSA but benefit SSA	More sectors including SSA using the built infrastructure would lead to more efficient use of the assets	Farm survey – questionnaire	- Ask farmer about the village infrastructure being used and shared with other households

Table 1 continued

Contribution	Indicators	Explanation	Means of verification	Methods for data collection
Human capital				
6.Food and nutrition security	6.Per capita annual consumption of fish in SSA household (only fish for their own SSA harvest)	The high per capita consumption indicates more food and nutrition security that SSA provides	Farm survey – questionnaire	- Ask farmer about the amount of fish harvest and the allocation of the harvest for household consumption that included fresh and processed products
7. Seasonal food security	7. Season of the year when household relies more on their own harvest than on fish from other sources	SSA contributes to seasonal food security if there is a season that household consumption much relies on their own fish harvest rather than on buying or fishing	Farm survey – questionnaire	Ask farmer: - Which months in a year when farmer harvests fish for household consumption and how much for each month - Substitution fish or protein sources when farmer does not harvest fish (processed fish, get from friend and relatives, fishing, eat other proteins, etc.)
Financial capital				
8.Household cash income	8.Percentage of cash income from SSA to total household cash income	This indicates reliance of the household on SSA for its cash income, i.e. liquidity	Farm survey – questionnaire	- Ask farmer to indicate the percentage rather than the absolute amount of income
9.SSA serves as a source of household economic security	9. Economic return from SSA to household	This indicates the household economic value obtained from SSA when both cash and non-cash returns/opportunity and economic foregone are considered	Farm survey – questionnaire	- Ask farmer on economic costs and revenue from SSA operation. Cash (tangible costs and revenue) and non-cash (intangible costs and revenue) data are classified - Cost-return analysis (amount/ unit/year)
10.Contribution to provincial economy	10.Percetnage of economic value from SSA production to the value of production from all aquaculture in the province	This measures the relative importance of SSA in provincial aquaculture sector	Government statistics	- Form the statistics data, classify the SSA systems and species in the study province - Estimate the SSA production value by systems and species - Calculate the sum of the SSA production value and the percentage can be calculated
Social capital				
11. Social participation	11. Percentage of farm households who are active members of SSA programes/ associations/organizations	The higher the percentage indicates the higher social participation brought by the SSA program/association/ organizations	Key information survey Farm survey – questionnaire	- Discuss with DoF local official and village head on the SSA programs/associations/ organizations - Ask farmer about programme/ associations/organization participation and then ask about type of activities, time spent, number of meeting per year participated, cost and benefit from being a member - From the above information, the active SSA household members can be noted for the calculation of the percentage
12. Women empowerment	12. Percentage of number of SSA farm activities in which women take the major decision-making role	The degree to which women are involved in various activities associated with SSA and in decision-making pertaining to SSA operations and household management	Farm survey – questionnaire by checklist of activities	Develop a checklist of decision-making in farm and household operation activities: 1) starting the farm business; 2) taking are of the farm operations; 3) buying/procuring farm inputs; 4) selling/distributing the harvest; 5) keeping income and record; 6)allocating household expenses; and 7)borrowing money.
13. Fostering social harmony	13.1 Number of SSA households that share the fish products and other farm resources 13.2 Number of activities in which farmers work together as to improve the shared resources in the community (such as water system, road and reservoir)	Sharing of farm products, farm resources and cooperating in community activities foster social harmony	Farm survey – questionnaire	Interview farmer on: 1)share of the fish products and other farm resources with other community members 2)types of activities in which farmers help each other to improve the shared resources in the community
14. Providing social safety net	14. Ratio of family labours who previously worked solely or mainly in non-SSA (including off-farm jobs) but now work in SSA (X) to total family labours (Y)	Increase family labour in SSA indicates the importance of SSA as a fallback employment/an opportunity to non-SSA and off-farm jobs and an alternative source of income	Farm survey – questionnaire	Checklist if family members and employment status over 3 years Calculate X:Y ratio

National training on aquafeed production and management in the Kyrgyz Republic

Under the auspices of GCP/KYR/003/FIN project "Support to Fishery and Aquaculture Management in the Kyrgyz Republic (the FAO Project)", funded by the Government of Finland, a national training programme was jointly undertaken by Aquaculture Service, FAO Rome and the FAO Project to develop capacity to manufacture farm-made aquafeeds in the Kyrgyz Republic. This training programme, implemented in close collaboration with the Department of Fisheries, the Institute of Biology and Pedology of the National Science Academy of the Kyrgyz Republic and the Centre of Innovation Technology in Agriculture of Agricultural University of the Kyrgyz Republic, was designed to: (i) build skills among the fish farmers and line institutions in developing farm-made aquafeeds based on locally available feed ingredients, and (ii) provide learning opportunities on formulation and preparation of farm-made aquafeeds, improving feed management, and increasing the productivity of their culture systems.

Developed for fish farmers, fisheries association members, technical staff of the Department of Fisheries, and academics and researchers of the Institute of Biology and Agrarian University involved in the development and management of aquaculture in the Kyrgyz Republic, the training was conducted from 18 to20th December 2012 at the Capriz Hotel, Issyk-Kul and was attended by 24 participants.

A series of seven training lectures were presented during Day 1. These training lectures provided the theoretical background for farm-made aquafeed production for carp culture. Issues covered during these lectures included: a) the importance of farm-made feeds to increase aquaculture production; b) the nutritional requirements of commonly cultured carp species; c) feed ingredient availability and use; d) feed types and manufacturing processes; e) the promotion of natural feeds in semi-intensive carp production systems; f) feed formulation, production and feed management. Day 2 was conducted using a workshop group exercise format where trainees were: (i) introduced to the concepts of feed formulation using an MSExcel feed formulation programme, and (ii) trained to formulate least-cost fish feed using locally available feed ingredients. Day 3 involved a site visit to the Tup fish farm which gave participants valuable practical experience about on-farm feed manufacturing techniques. As the site visit was designed to assess on-farm feed manufacturing processes and production technologies that were being used, resource persons provided advice to the feed manufacturer how to improve production efficiencies.

S. Siriwardena, FAO

Group photo of workshop participants and resource persons

M. Hasan, FAO

Samples of different sizes of extruded pellets for rainbow trout produced by an industrial feed mill in Bishkek, The Kyrgyz Republic

Two follow-up activities will be carried out under the project. These are:

1. Organize further follow-up activities on aquafeed production and use including capacity building for small-scale farmers of the Kyrgyz Republic; and
2. Finalization of training manual on preparation of farm-made aquafeed.

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Site selection, allocated zones for aquaculture and site management for coastal marine aquaculture

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Background

In recent years, issues relating to the sustainable development of aquaculture in the General Fisheries Commission for the Mediterranean (GFCM)[1] area of competence, particularly in relation to coastal zone management, have come to the fore. The increasing role played by marine aquaculture in terms of contribution to economic development and in providing GFCM Members and their populations with a reliable source of seafood and employment, calls for the implementation of a regional strategy to foster sustainable development of aquaculture during a period of stagnation or decline in marine capture fisheries production. Conflicts between aquaculture activities and other uses of coastal zones as well as the cumbersome leasing and licensing procedures to establish an aquaculture farm are negatively affecting, among others, the development of the sector. As a result, GFCM has paid more attention to "Allocated Zones for Aquaculture" (AZA)[2], a concept that is within the remit of the work of the Committee on Aquaculture – Working Group on Site Selection and Carrying Capacity (CAQ–WGSC) in order to better integrate aquaculture siting into the coastal area. Aimed to facilitate the sustainable development of aquaculture in the Mediterranean and Black Sea, AZA guidelines[3] were adopted by GFCM at its 36th Session held in Morocco, in March 2012.

In efforts to assist Member countries to increase aquaculture production in a sustainable manner, FAO addresses spatial planning for aquaculture (including site selection and zoning) through tools, publications and training workshops in close cooperation with regional commissions for fisheries and aquaculture networks. This workshop was taken as an opportunity by the FAO Aquaculture Branch (FIRA) to contribute to the above efforts.

Training workshop

The training workshop on "Site selection, allocated zones for aquaculture and site management for coastal marine aquaculture" (hereafter referred to as the workshop), was planned within the framework the GFCM–SHoCMed project. This project is aimed at enhancing the integration of aquaculture into coastal zone management by improving site selection and site management and by identifying

F. Massa, FAO

Workshop secretariat and lecturers. From left to right: Fabio Massa, Doris Soto, Guzel Yucel Gier, Giovanna Marino, José Carlos Macias, Cherif Toueileb, Ioannis Karakasiss, Pablo Avila Zaragoza, and José Aguilar-Manjarrez

environmental quality standards within the GFCM area of competence.

The objectives of the workshop were to:

i. introduce the concept of "Allocated Zones for Aquaculture" (AZA) within an ecosystem approach to aquaculture (EAA) framework;
ii. train participants on methods, processes and tools for the establishment, implementation and monitoring of AZA; and
iii. establish dialogue among participants to examine the possibility of implementing AZA in their respective countries and gather end-users' (producers and other relevant stakeholders) opinions, suggestions as well as indications about limiting factors for the AZA concept and implementation process.

The workshop was organized by the GFCM–CAQ, the Institut National de Recherche Halieutique (INRH) Morocco, FIRA, the FAO Sub-regional Office of West Africa (FAO-SNEA) Tunisia, and the Networking of Institutes of Fisheries Research of Maghreb. It was held from 4–7 February 2013 in M'Diq, Morocco, and was attended by 29 participants from seven different countries (including Algeria, Greece, Libya, Morocco, Spain, Tunisia and Turkey) representing decision–makers, heads of departments, directors, technical officers from national administrations involved in the process of

planning, monitoring and licensing for aquaculture and fish farmers.

The workshop was informative and participative with a well-balanced content combining theoretical presentations, practical sessions and facilitated discussions using case studies and experiences from the region. Many aspects were based on the recent progress and knowledge acquired about AZA in the GFCM area and within the CAQ–WGSA activities in Turkey, Greece and Spain. An essential part of the training workshop was a discussion on the process to national aquaculture zoning, site selection and carrying capacity within an EAA as described in FAO Proceedings[4]. Particular attention was also given to aspects pertaining to environmental monitoring.

Conclusions

Participants agreed that AZA requires: (i) clear and concrete objectives, (ii) good understanding of country (and local when appropriate) priorities and capacities, and (iii) voice and opinion on the demands and expectations of the communities that are involved and/or affected by zoning. The lack of legal framework and coordination among the authorities, the political willingness, capacity of administrators, financial resources, data availability and conflict among marine and coastal users were the most commonly identified constraints. Participants also concluded that zoning and carrying capacity are essential tools to ensure the sustainable management and growth of aquaculture, and that the process should be multi-sectoral, participatory, transparent and should have a legal basis to become effective.

Key recommendations derived from the workshop for advancing the concept of AZA within the EAA framework include: (i) greater emphasis to the social and economic aspects of AZA; (ii) a good understanding of the ecosystem monitoring and adaptive management for zoning and site selection; iii) guidance to zoning processes and initiatives specific to each country in the Mediterranean; (iv) practical hands-on training courses on: data collection and interpretation and spatial tools that are specific to zoning; and (v) sharing experiences, knowledge and data on aquaculture zoning and carrying capacity using the "Information System for the Promotion of Aquaculture in the Mediterranean (SIPAM) Web site (www.faosipam.org).

A number of follow-up activities related to FAO support on site selection and carrying capacities for inland and coastal aquaculture are taking place. For example: (i) a similar workshop took place recently within the activities of the GFCM WGBS (Working Group in Black Sea) in Trabzon, Turkey in March 2013, with the participation of experts from Bulgaria, Romania, Russian Federation, Turkey and Ukraine.

F. Massa, FAO

"Kimagro fish farming, Cyprus". Kimagro has two cage mooring sites for Seabass and Seabream. The deeper site is exposed to full open sea conditions further offshore and is reserved for large pens with good oxygenation and spacious conditions for large fish (www.kimagrofish.com/Home.aspx)

and (ii) a training workshop on the ecosystem approach to fisheries and aquaculture (EAF/EAA), was conducted at FAO, Rome in June 2013 under the program of work of the FAO component of the project "Strategic Partnership for the Mediterranean Large Marine Ecosystem", in cooperation with the FAO-led projects CopeMed II, AdriaMed, MedSudMed, EastMed and EAF-Nansen. Although this EAF/EAA training was more focused on fisheries issues, improved aquaculture management including zoning and site selection within an EAA framework attracted much attention from participants.

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[1]The GFCM is the FAO Regional Fisheries Management Organization (RFMO) - Mediterranean and Black Sea as competent area with a specific mandate also for aquaculture established under the provisions of Article XIV of the FAO constitution.

[2]For coastal areas, an allocated zone for aquaculture (AZA) is intended as a spatial planning system or zoning, carried out at local or national level; an AZA is also: (i) a marine area where the development of aquaculture is prior to other uses; (ii) an area dedicated to aquaculture, recognized by physical or spatial planning authorities, which would be considered as a priority for local aquaculture development (GFCM. 2010. Report of the workshop on allocated zones for aquaculture (AZA). Sevilla, Spain, 18–20 October 2010. GFCM:CAQVII/2011/Inf.12. 12 pp.).

[3]Resolution GFCM/36/2012/1 on guidelines on allocated zones for aquaculture (AZA) (www.faosipam.org/GfcmWebSite/docs/RecRes/RES-GFCM_36_2012_1.pdf).

[4]Ross, L.G., Telfer, T.C., Falconer, L., Soto, D. & Aguilar-Manjarrez, J., eds. 2013. *Site selection and carrying capacities for inland and coastal aquaculture.* FAO/Institute of Aquaculture, University of Stirling, Expert Workshop, 6–8 December 2010. Stirling, the United Kingdom of Great Britain and Northern Ireland. FAO Fisheries and Aquaculture Proceedings No. 21. Rome, FAO. 46 pp. Includes a CD–ROM containing the full document (282 pp.).

Small-scale aquaponics launched in Ethiopia by FAO under the SmartFish project

In recent years, the increasing competition for land and particularly water use for a wide range of economic activities is driving the expansion of aquaculture operations towards new frontiers such as in exposed and offshore marine areas or harsh regions such as arid and semi-arid lands which can now be better exploited through the use of water saving practices such as the so called "aquaponics". Aquaponics is a sustainable food production system that integrates aquaculture (growing fish) and hydroponics (growing plants without soil) where both agriculture practices mutually benefit from the others presence in one production unit.

The Addis Ababa University (AAU) has already initiated a research programme on the applicability of aquaponic systems in Ethiopia and has formed a team of trained professionals. In order to introduce this technology to the private sector, the application of which does not necessarily require significant investments and can be used for self-subsistence as well as small-scale commercial purposes, the EU-funded FAO SmartFish Project signed an agreement with the AAU to assist them with the promotion and technology transfer of small-scale aquaponics with the aim of supporting sustainable aquaculture development through the smart use of water.

Two aquaponic demonstration units (which include the Flood and Drain and the Nutrient Film Technique (NFT) systems) have been built in Ziway and Shewa Robit, Ethiopia; these represented a concrete opportunity for local communities to be introduced to this innovative food production system, i.e. farming fish and plants without the significant reliance from natural resources and rainfall.

Training courses

Following the constructions of the production units, two 3-day training courses were conducted in April 2013 covering the essential topics for small-scale aquaponic food production. The sites hosted over 40 trainees including local beneficiary farmers and university students along with staff from local community-based organizations and non-governmental organizations. The training courses were full of lively and informed debate particularly on the most applicable forms of the technology for different areas in Ethiopia.

One participant, Edassa Tibesso, after the training, remarked: "I am happy to learn these innovative techniques, which can help to provide food in arid areas where water is a serious problem. I enjoyed the initiative and hope that it will be expanded in other parts of the country."

The training courses were successful in that the units showcasing the different aquaponic methods were functional. Furthermore, by the end of the courses, the trainees demonstrated a good level of understanding on both the theoretical and practical aspects of aquaponics. These soon to be beneficiaries of the small-scale aquaponic units in Ziway and Shewa Robit showed enthusiasm at the prospect of managing the sites. Despite encouragement provided

C. Somerville, FAO

Pepper plants growing in the Nutrient Film Technique (NFT) aquaponics unit

C. Somerville, FAO

Aquaponics demonstration site at Ziway: Nutrient Film Technique (NFT) and Flood and Drain units

C. Somerville, FAO

Trainees at Ziway learning how properly acclimatize fish into new tanks

by this result, problems exist for the development of aquaponics in Ethiopia, particularly for small-scale units. There is virtually no market for key aquaponics materials such as small-scale submersible pumps and water test kits, which makes the purchasing of necessary materials difficult and, unfortunately, importing goods is a lengthy and challenging process. Knowing these realities, the future focus should be on larger/commercial-sized operations which can easily obtain the larger external pumps widely available locally. Larger commercial units, however, face the challenge of a very high initial set-up costs relative to the more traditional methods of food production in Ethiopia.

Next steps

The next step of the initiative will be the installation of six beneficiary units in the surrounding villages of the demonstration sites. Over the next two months, small-scale flood and drain aquaponic units will be installed in the households of beneficiaries who successfully completed the training course. These units will be monitored over the coming months by the AAU staff and troubleshooting support will be provided to insure the beneficiaries will successfully grow their fish and vegetables. Separate cost/benefit studies will be carried out on the demonstration units during this same time frame. Some high value vegetables in Ethiopia will be trialled using both unit methods to give some initial indicators on the viability of larger-scale aquaponic units in Ethiopia.

Finally, to mark the end of this first phase pilot project with aquaponics in Ethiopia, the AAU will host a public awareness event in late August 2013 demonstrating the fully functioning demonstration unit which is being set up in the university campus. At this time, information on the cost/benefit studies completed at the Ziway and Shewa Robit demonstration units along with the on-going aquaponics research at AAU will be shared. The open day will seek to instigate informed discussion with stakeholders and practitioners/researchers on the future of aquaponics in Ethiopia including how and where this new technology is most applicable. As an additional follow-up activity, the FAO Aquaculture Branch (FIRA) in collaboration with the SmartFish Project, will be publishing later in the year a technical and highly practical reference manual on small-scale aquaponics. The manual will be mainly authored by Christopher Somerville and Moti Cohen both of whom have been working in this field for years and have been engaged in many technology transfer exercises. The chapters in the manual will include an introduction to the concept of aquaponics, the design of the production units, growing vegetables and fish, the economics of aquaponics, and a final chapter the management and troubleshooting of a production unit. The manual, when available, will be announced in one of the next issues of the FAO Aquaculture Newsletter.

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Christopher.Somerville@fao.org, or
moticohen37@gmail.com

Dr Francesco Cardia

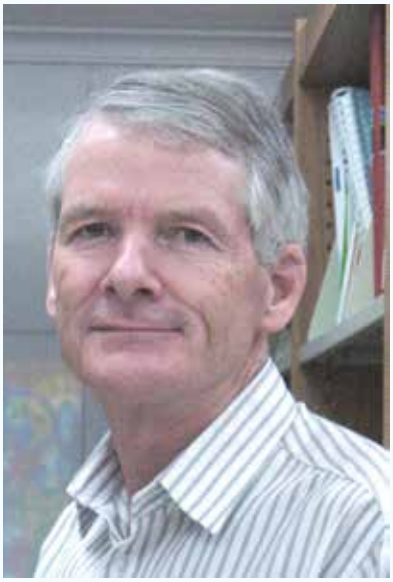
Dr Francesco Cardia an Italian national, has joined FAO as a Project Manager (Strengthening and supporting further development of aquaculture in the Kingdom of Saudi Arabia - UTF/SAU/048/SAU) under the current FAO/KSA UTF Agreement. Dr Cardia has a background in aquaculture, primarily working for private companies as consultant and operating in the field of marine cage aquaculture. He graduated from the University of Rome in 1993 in Natural Science, Ecology and then obtained his Ph.D. in Parasitology from the Veterinary Faculty of the University of Turin in 2002 with a thesis on marine finfish parasitosis affecting Italian aquaculture cage farms. From 1994 to 1998, he worked in an inland freshwater aquaculture farm, on breeding and selection of important commercial and ornamental cyprinids. In 1998, he started his marine cage aquaculture experience working full time in the field and, as production manager in charge of Mediterranean seabass and gilthead seabream cage farms operating in Sicily and on an offshore floating platform near Naples. From 2002 to 2013, he worked with several commercial fish farms in Italy, providing technical support. He was also involved in drafting and implementing a number of EU-funded projects. As an aquaculture consultant, he provided support to FAO through consultancy assignments, dealing with several aquaculture and fisheries issues since 2004. In 2010, he was involved as cage expert for the implementation of the cage culture component of the UTF/SAU/017 project where he became familiar with the aquaculture sector and related issues in the Kingdom of Saudi Arabia. Dr Cardia is based in Jeddah, Kingdom of Saudi Arabia, and can be contacted through his official FAO email address (Francesco.Cardia@fao.org).

He will be working under the coordination of the FAO/KSA Programme in Riyadh.

Mr David Currie

Mr David Currie joined the sub-regional office for the GCC countries and Yemen as FAO's Fisheries & Aquaculture Officer in August 2012. Since graduating from Southampton University UK in 1975 (BSC in Zoology; MSc Oceanography), he has worked for a mixture of private sector companies and development agencies in a variety of fisheries, aquaculture and coastal environmental management posts. His first job after university was a year on an oyster farm in the Outer Hebrides off the north-west coast of Scotland, but then he moved to Brunei as a government Fisheries Officer and has stayed working in the tropics ever since. His experience is mainly in Latin America and SE Asia, plus a few years in the Middle East and with a limited number of short term missions to East Africa. He has worked for FAO before, on several short term consultancies and as Project Coordinator 2007-10 in Aceh, Indonesia managing a post-tsunami fisheries and aquaculture rehabilitation and development project, funded by American Red Cross.

His previous experience in the SNG region includes short term missions to Kuwait, Oman, Saudi Arabia, UAE and Yemen and three years co-managing a multi-disciplinary coastal environment impact project in Kuwait 2004-07, looking at damage from the oil spills and ash fall-out from the first Iraq war.



Ms Caroline Laverriere

Ms Caroline Laverriere, an American national, and third year veterinary student at Cornell University College of Veterinary Medicine, served as a volunteer intern with the aquaculture service (FIRA) under the guidance of Dr Rohana Subasinghe from 9 June to 5 August 2013. Caroline received funding for her internship thanks to a grant from the Expanding Horizon's Program (http://www.vet.cornell.edu/gifts/documents/Scopes_FEB11_Schat.pdf) at Cornell University, which provides money to veterinary students interested in completing veterinary health related work in a developing nation and/or at an organization such as the FAO.

Caroline's particular interest within veterinary medicine is aquatic animal health and disease. After researching shrimp aquaculture production and designing a farm-level survey at the FAO headquarters in Rome, her project took her to Viet Nam for one month where she conducted her survey on 28 small-scale shrimp farms. In recent years, many shrimp crops in Viet Nam have been devastated by the bacterial disease Acute Hepatopancreatic Necrosis Syndrome (AHPNS), and her survey aimed to gather data on the farm-level economic losses resulting from shrimp disease. Working with the Research Institute for Aquaculture 1 (RIA1) in Viet Nam, Caroline was able to communicate with shrimp farmers directly and witness shrimp farming, shrimp disease, and its economic implications first hand. She found the experience to be invaluable and, in the future, hopes to continue her project with FAO and travel to other developing nations with a revised and refined survey to evaluate the impact of disease on small-scale aquaculture farms.

Continued from page 39

the risk from EMS/AHPNS pertaining to the following aspects: disease nomenclature; diagnostics; reporting/notification; advice to affected and non-affected countries; advice to pharmaceutical/feed companies, farm and hatchery facilities; training/capacity building; emergency response and researchable areas.

In terms of disease nomenclature, the consultation recommended to change the name of EMS?AHPNS to Acute hepatopancreatic necrosis disease (AHPND).

The workshop report is being finalized and will be disseminated in due course.

[1]CMC-AH RDT was composed of Melba Reantaso, Andrew Sobey, Koji Yamamoto and Flavio Corsin; local team from MARD/DAH led by Le Van Khoa assisted the team.

[2]Tran, L., Nunan, L., Redman, R., Mohney, L., Pantoja, C., Fitzsimmons, K. & Lightner, D.V. 2013. Determination of the infectious nature of the agent of acute hepatopancreatic necrosis syndrome affecting penaeid shrimp. Diseases of Aquatic Organisms 105:45-55.

[3]Gibson, R. & Barker, P.L. 1979. The decapod hepatopancreas. Oceanogr. Mar. Biol. 77:285-346; Diaz, C., Sousa, L. & Petriella, A. 2010. Functional cytology of the hepatopancreas of Palaemonetes argentinus (Crustacea, Decapoda, Caridea) under osmotic stress. 2010. Braz. Arch. Biol. Technol. 53(3): 599-608.

[4]Felgenhauer, B. 1992. Internal anatomy of the decapoda: an overview, pp. 45-75. In Microscopic Anatomy of Invertebrates Volume 10: Decapod Crustacea. Wiley-Liss Inc.; Bell, T.A. & Lightner, D.V. 1988. A handbook of normal shrimp histology. Special Publication No. 1. World Aquaculture Society, Baton Rouge, LA114pp.

Professor James Muir

Born: 7 March, 1951, in Lincolnshire.
Died: 1 May, 2013, in Edinburgh, aged 62

Prof James Muir was an internationally renowned aquaculture expert who was associated with FAO's work of the Fisheries and Aquaculture Department for over two decades.

James worked for the Institute of Aquaculture, University of Stirling, Scotland for 30 years. His background was in environmental engineering and economics, with specific expertise in the aquatic sector, including resilient production systems, energy and resources, trade, market, investment and development policy; climate-change mitigation and adaptation, research and education planning and management. But his experience crossed the academic, commercial and public sectors and embraced broad sustainable development food security issues globally. As a university professor, he taught and coached many students, developed and implemented many educational programmes, advised academic and research institutions worldwide and authored and edited more than 200 scientific papers, journals and books.

On his retirement from the Institute of Aquaculture, James became a Professor Emeritus and continued his key work as an international development and research advisor and evaluator. He was a member of the UK Foresight Lead Expert Group on the Global Future of Food and Farming, and Fisheries Adviser to DFID, and an adviser to CGIAR and a range of other development bodies.

We at the FAO Fisheries and Aquaculture Department respected James, as a true intellectual who provided guidance, advice and inspiration. He was an expert to some, a teacher to several, a fellow staff member to many and a friend to all. James always had a powerful mind which we drew on to develop some of our strategies and visions, whether related to climate change, food security or simply the future of fisheries and aquaculture. We respected him so much and especially when he challenged our thinking and our discussions with his relevant insights and enlightening ideas.

James will be warmly remembered by all of us at FAO. We are all glad and privileged to have known and enjoyed time with him and he will be sorely missed by many at FAO.

New Publications

Diffey, S. 2012. Developing fish landing centres: Experiences and lessons from Sri Lanka. FAO Fisheries and Aquaculture Circular No. 1063. Rome, FAO. 88 pp.

The Restoration and Improvement of Fish Landing Centres with Stakeholder Participation in Management Project was implemented between August 2008 and September 2011. The project was a partnership between the Food and Agriculture Organization of the United Nations (FAO), the Canadian International Development Agency (CIDA) and the Ministry of Fisheries and Aquatic Resources Development (MFARD). The goal of the project was to improve the livelihoods of fishers and fishing communities in tsunami-affected areas in Sri Lanka, which was broadened midway through the project to include post-conflict areas in the north of the country. This publication documents the experiences and lessons generated by the project which will serve as a source of information and inspiration for further work in the sustainable development of small-scale fishing communities and fish landing sites elsewhere. Attention focuses on the involvement of stakeholders, the practical aspects of the initial profiling and selection process for landing site development and the importance of capacity development in ensuring sustainability of the project outcome. The project's methodology with regard to infrastructure development, in particular the planning steps and procedures, the importance of the business planning process and training delivery is discussed, and the role of village-based institutions explored. Available for download at:
http://www.fao.org/docrep/017/i3083e/i3083e00.htm

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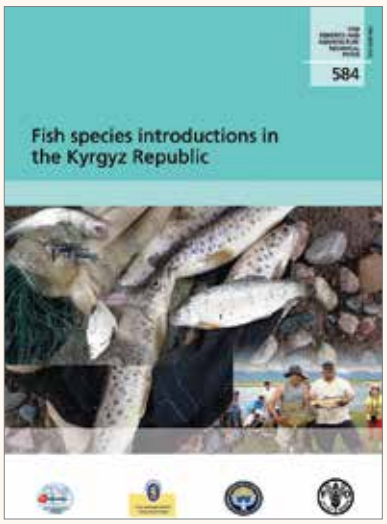


Alpiev, M., Sarieva, M., Siriwardena, S.N., Valbo-Jørgensen, J. & Woynárovich, A. 2013.Fish species introductions in the Kyrgyz Republic.FAO Fisheries and Aquaculture Technical Paper No. 584. Rome, FAO. 108 pp.

Although Kyrgyzstan is rich in water resources, the productivity of its waters is low and its indigenous fish fauna is relatively poor, with only a limited number of commercially valuable species. However, as the waters are suitable for growing valuable cold-water fish species, several fish species were introduced and regularly stocked when Kyrgyzstan was part of the Soviet bloc. As a consequence of these introductions, both the number and proportion of indigenous fish species gradually declined, particularly in Issyk-Kul Lake, a lake with high economic importance and biodiversity value. Lack of restocking, increased illegal fishing and possible release of predatory fish from cages further endanger the efforts to restore and maintain the original fish fauna of the lake. This report analyses the available information on historic practices, experiences and lessons learned on species introductions so that more suitable and improved practices can be used in future stocking programmes in Kyrgyzstan and elsewhere in the Central Asian region. The report includes a detailed inventory of all waterbodies, fishery and fish culture resources and historic fish introductions in Kyrgyzstan. Information is provided to support the management of exotic and indigenous species in Kyrgyz fisheries and aquaculture with an analysis of the long-term consequences of possible stocking programmes for exotic and native species and recommends feasible solutions for the sustainable utilization of natural waters, reservoirs and fish farms in Kyrgyzstan.

http://www.fao.org/docrep/018/i3268e/i3268e.pdf

Further information can be obtained by writing to: Mohammad.Hasan@fao.org

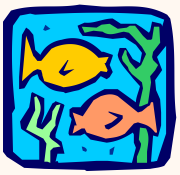
FAO Aquaculture publications 1999-2012

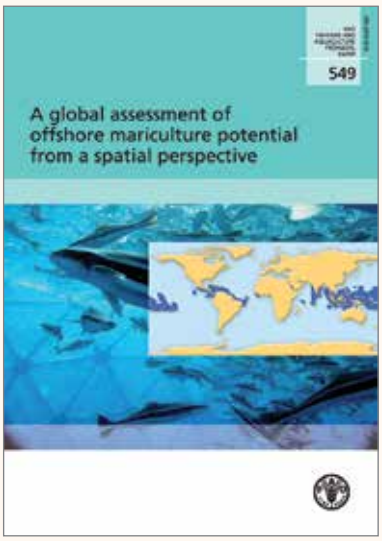
A new DVD containing all FAO aquaculture publications prepared during the period 1999-2012 has been produced by the Aquaculture Service of the FAO Fisheries and Aquaculture Department.

More than six hundred publications related to aquaculture, including CD-ROMs, web-based products and newsletters have been published and distributed worldwide during that period, in both hard and electronic versions and in various FAO official languages. All these publications have been assembled on this DVD as Portable Document Format (PDF) files, in order to make them easily available, searchable and printable to all users.

The full aquaculture publications collection can be installed on your computer by double clicking on the INSTALL command or be accessed directly through the DVD. This application is readable in Windows, Linux and Mac environments. Users can easily search publications through the publication list or through a free text-based search engine which performs search on titles, abstracts, authors, keywords and year of publication.

For further information and/or to request a copy of the DVD please contact: Valerio.Crespi@fao.org





Ross, L.G., Telfer, T.C., Falconer, L., Soto, D. & Aguilar-Manjarrez, J., eds. 2013. Site selection and carrying capacities for inland and coastal aquaculture. FAO/Institute of Aquaculture, University of Stirling, Expert Workshop, 6–8 December 2010. Stirling, the United Kingdom of Great Britain and Northern Ireland. *FAO Fisheries and Aquaculture Proceedings* No. 21. Rome, FAO. 46 pp. Includes a CD–ROM containing the full document (282 pp.).

A summary of knowledge on the process of aquaculture site selection and carrying capacity estimates within an ecosystem approach to aquaculture (EAA) is now available online. "Site selection and carrying capacities for inland and coastal aquaculture" contains the proceedings of the FAO Expert Workshop on Site Selection and Carrying Capacities for Inland and Coastal Aquaculture held at the Institute of Aquaculture, University of Stirling, the United Kingdom of Great Britain and Northern Ireland, from 6 to 8 December 2010. It includes seven global reviews and ten regional reviews on site selection and carrying capacity encompassing inland aquaculture and coastal aquaculture. Four capacity categories appropriate for different types of aquaculture - physical, production, ecological and social - were agreed. Discussion also covered the range and capability of modelling tools, including spatial tools, available for addressing these capacities. The prioritization and sequence for addressing site selection and the different categories of carrying capacity were considered in detail in terms of both regional or national priorities and site-specific considerations. The workshop produced two major outcomes: (i) a comprehensive record of the workshop proceedings (this publication); and (ii) a set of guidelines for addressing site selection and carrying capacity in the context of the framework of the EAA, . This publication is organized in two parts: the workshop report and first global review and the full document (available on a CD–ROM accompanying the report.

Kapetsky, J.M., Aguilar-Manjarrez, J. & Jenness, J. 2013. A global assessment of potential for offshore mariculture development from a spatial perspective. *FAO Fisheries and Aquaculture Technical Paper* No. 549. Rome, FAO. 181 pp.

With the expected increase in human population and resulting competition for access to land and clean water, there is a growing need to transfer land-based and coastal aquaculture production systems farther offshore to increase the availability of fish and fishery products for human consumption. Mariculture, in particular offshore, offers significant opportunities for sustainable food production and development of many coastal communities, especially in regions where the availability of land, near-shore space and freshwater are limited. A new FAO Fisheries and Aquaculture Technical Paper, "A global assessment of potential for offshore mariculture development from a spatial perspective", provides, for the first time, measures of the status and potential for offshore mariculture development from a spatial perspective that are comprehensive of all maritime countries and comparable among them. It also identifies countries that do not yet practise mariculture but have a high offshore potential. The underlying purpose of this document is to stimulate interest in detailed assessments of offshore mariculture potential at the national level. An annex examines remote sensing for the sustainable development of offshore mariculture.

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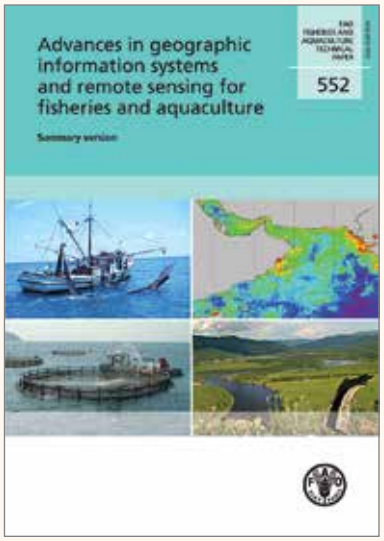

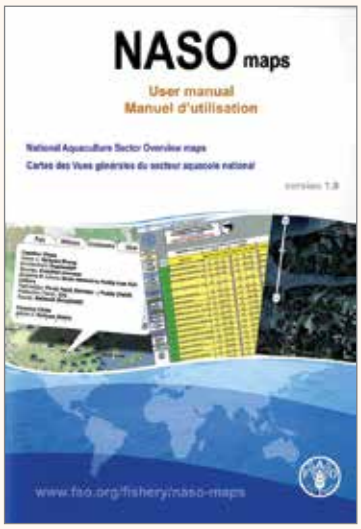

Meaden, G.J. & Aguilar-Manjarrez, J., eds. 2013. Advances in geographic information systems and remote sensing for fisheries and aquaculture. **Summary version.** *FAO Fisheries and Aquaculture Technical Paper* No. 552. Rome, FAO. 98 pp. Includes a **CD–ROM** containing the full document (425 pp.).

Meaden, G.J. & Aguilar-Manjarrez, J., eds. 2013. Advances in geographic information systems and remote sensing for fisheries and aquaculture. **CD–ROM** version. *FAO Fisheries and Aquaculture Technical Paper* No. 552. Rome, FAO. 425 pp.

The essential guide to understanding the role of spatial analysis in the sustainable development and management of fisheries and aquaculture is now available in an easy-to-understand publication that emphasizes the fundamental skills and processes associated with geographic information systems (GIS) and remote sensing. The FAO Fisheries and Aquaculture Technical Paper, "Advances in geographic information systems and remote sensing for fisheries and aquaculture", outlines the required spatial data and computer hardware and software as well as considerations necessary to implementing a GIS. It describes current issues, status and applications of GIS and remote sensing to aquaculture, inland fisheries and marine fisheries to illustrate the capabilities of these technologies. It addresses emerging thematic issues with a spatial context in fisheries and aquaculture in the near future and ways to overcome challenges in GIS work. This publication is organized in two parts: the first is a summary version for administrators and managers, while the second contains the entire document intended for professionals in technical fields and academics. The full document is available on the CD–ROM that accompanies the summary version of the publication.

Further information can be obtained by writing to:
José.AguilarManjarrez@fao.org

Aguilar-Manjarrez, J. & Crespi, V. 2013. *National Aquaculture Sector Overview map collection.* User manual. / *Vues générales du secteur aquacole national (NASO).* Manuel de l'utilisateur. Rome, FAO. 65 pp.

The National Aquaculture Sector Overview (NASO) map collection uses "Google Maps and Google Earth" technology to assist FAO Member countries to inventory and monitor aquaculture. The collection is in its early stages but holds potential use in a number of ways such as monitoring the status and trends of aquaculture development and addressing site selection and zoning issues. A Microsoft Excel form was created to facilitate the creation of the NASO maps, and this user manual aims to facilitate the completion of the Excel form. The manual is aimed for all FAO Member countries who are reporting aquaculture statistics to FAO and who also wish to inventory and monitor aquaculture in their respective countries. The NASO map collection is being developed by the Aquaculture Branch in collaboration with the Fisheries and Aquaculture Statistics and Information Branch of the FAO Fisheries and Aquaculture Department.

Further information can be obtained by writing to:
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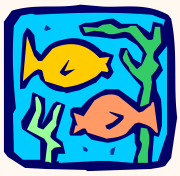

FAO Aquaculture Newsletter

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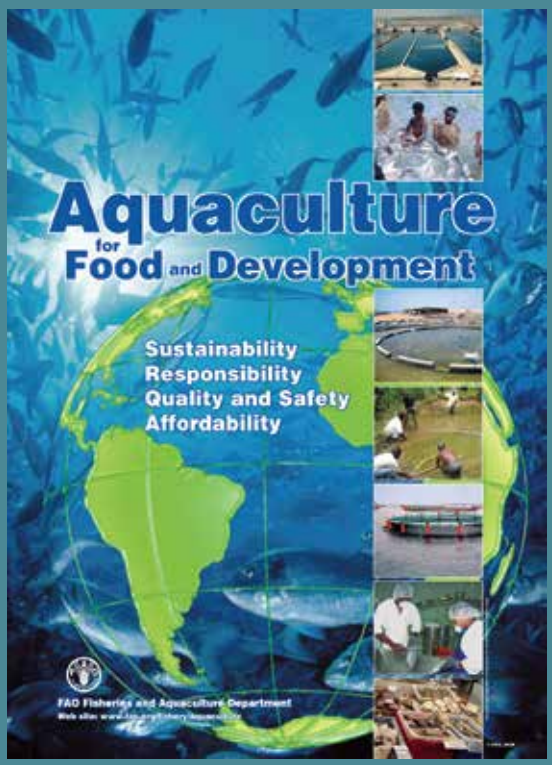
FAN 49, June 2012

FAN 50, December 2012



The FAO Aquaculture Newsletter (FAN) is issued two to three times a year by the Aquaculture Branch (FIRA) 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 and Aquaculture 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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