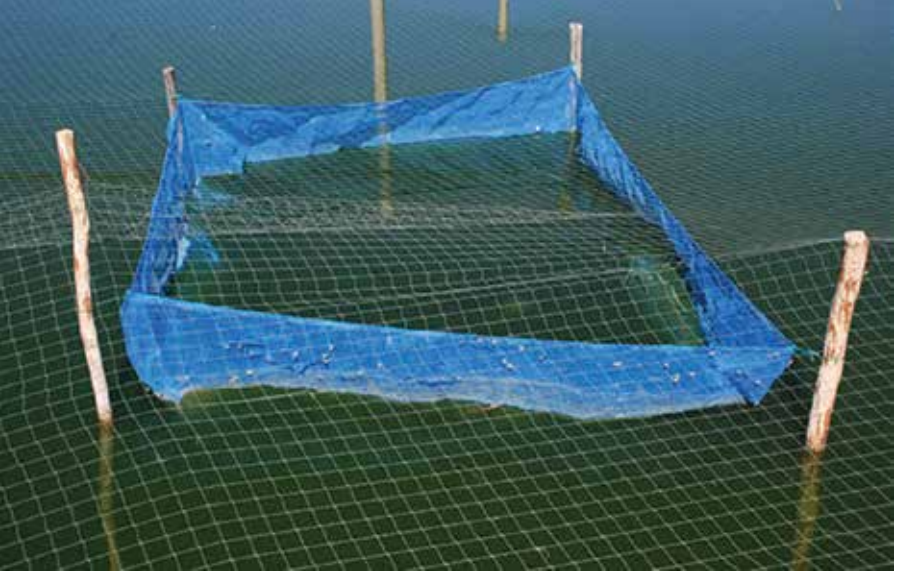

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2014

FAO Aquaculture Newsletter

FAO's New Strategic Framework

Since taking his oath of office in January 2012, FAO Director-General Graziano da Silva launched a wide and inclusive initiative to modernize and transform FAO. This initiative seeks to improve the delivery and impacts of FAO's programme through effective translation of FAO's normative work into country-level impact, and FAO's global knowledge products into tangible change in policy and practice. There followed a long and rigorous task which included a review of the Strategic Framework 2010—2019 and launch of a Strategic Thinking Process. Such an exercise involved wide stakeholder participation from FAO staff, external experts, and Member Nations through various formal and informal consultations.

The five new cross-cutting Strategic Objectives (SOs) are:

Strategic Objective 1: Help eliminate hunger, food insecurity and malnutrition (by facilitating policies and political commitments to support food security and by making sure that up-to-date information about hunger and nutrition challenges and solutions is available and accessible).

Strategic Objective 2: Make agriculture, forestry and fisheries more productive and sustainable (by promoting evidence-based policies and practices to support highly productive agricultural sectors (crops, livestock, forestry and fisheries), while ensuring that the natural resource base does not suffer in the process)

Strategic Objective 3: Reduce rural poverty (by helping the rural poor gain access to the resources and services they need – including rural employment and social protection – to forge a path out of poverty).

Strategic Objective 4: Enable inclusive and efficient agricultural and food systems (by helping to build safe and efficient food systems that support smallholder agriculture and reduce poverty and hunger in rural areas).

Strategic Objective 5: Increase the resilience of livelihoods to disasters (by helping countries to prepare for natural and human-caused disasters by reducing their risk and enhancing the resilience of their food and agricultural systems).

The above five SOs, supported by a sixth objective focused on technical knowledge, quality and services, and two cross-cutting themes on gender and governance, which are integral to the achievement of the SOs, will provide guidance to the work of FAO during this biennium and the next.

Applying FAO's core functions to the organization's action plans that address issues and problems of each SOs are necessary to achieve concrete results. These core functions are:

- working with countries to develop and implement agreements, codes of conduct and technical standards;
- collecting, analyzing and monitoring agricultural data and information to support policy decisions;
- enabling policy dialogue at global, regional and country levels;
- working in partnership with a wide range of institutions, including international and regional organizations, universities, governments, civil society, the private sector and grassroots organizations;
- bulding the capacity of countries to meet their agricultural development goals;
- capturing and sharing knowledge internally and with partners;
- communicating about our work.

From the words of FAO Director-General Graziano da Silva:

"The Strategic Framework defines a new way of working for FAO and will require considerable changes in the way we operate: to be more focused in our priorities; to work more as a corporate team; and to have greater impact through partnerships. As such, it is a compact with the FAO membership to work together to achieve our common vision of a world free from hunger and malnutrition".

The aquaculture sector has an important contribution to assist FAO in achieving its goals of ending hunger and poverty. The Blue Growth initiative, one of the three global initiatives of FAO under its new strategic framework will focus on increasing sustainable contribution from the aquatic environment, including aquaculture. A new programme recently approved by the FAO membership, called the Global Aquaculture Advancement Partnership (GAAP) will provide the basis for aquaculture development activities under this initiative. At the regional level, the "Sustainable intensification of Asian aquaculture" will be implemented by the FAO Regional Office for Asia-Pacific (RAP). Together with the regional and sub-regional offices and our network of international partners, the Fisheries and Aquaculture Department is ready to take up the challenge of making sure that the Department, through its technical competence in the subject and its long field experience, will deliver high quality knowledge and services.

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FAN Editorial Team acknowledges the kind assistance of Elena Irde in the production of FAN 52

J.Aguilar-Manjarrez, FAO

Workshop participants. Front row, from left: Ms Nani Hendiarti Anugrahadi, Deputy Director of TISDA-BPPT, Mr Asep Muhammad, Senior Adviser to the Coordinating Ministry for People's Welfare, Mr Muhammad Sadly, Director of TISDA-BPPT, Mr Ngurah Widyadnyana, Deputy Director of MOMAF and Mr José Aguilar-Manjarrez and Ms Alicia Mosteiro of FAO

34th Asian Conference on Remote Sensing (ACRS 2013)

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The 34th Asian Conference on Remote Sensing (ACRS 2013), held in Bali from 20–24 October 2013 organized by the Indonesian Society for Remote Sensing (ISRS/MAPIN) and the Asian Association on Remote Sensing (AARS) had the theme of "Bridging Sustainable Asia". The event brought together 1 379 researchers, policy-makers, and practitioners from 52 developed and developing countries to share insights into the challenges and opportunities of remote sensing technology and application in solving global problems. The ARCS is one of the largest remote sensing conferences held annually in Asia. This conference, with the largest attendance in the history of ACRS, showcased cutting-edge research focused on themes of equity and risk, learning, capacity building, methodology, and investment approaches in remote sensing (www.acrs2013.com).

FAO actively participated in this conference with:

One plenary speech

- Global Land Cover-SHARE database (prepared by Messrs John Latham and Renato Cumani from FAO- Land and Water division and presented by José Aguilar-Manjarrez).

Two oral presentations

- Remote sensing for the sustainable development and management of aquaculture (José Aguilar-Manjarrez).
- Remote Sensing Applications for Sustainable Fisheries Management (Alicia Mosteiro).

One Memorandum of Understanding

- In parallel to the conference, discussions over a draft Memorandum of Understanding took place between the Ministry of Research and Technology of the Republic of Indonesia (RISTEK) and FAO concerning geospatial information for food security.

This is the second time that Indonesia hosted this conference; the first was in 1987 in Jakarta with 266 participants and 125 papers. The conference comprised of 4 welcome address speeches, 7 plenary speeches, 18 special sessions, 72 technical sessions, 8 workshops, and 43 sponsors and exhibitor booths. The top ten countries represented at the conference were: China, Japan, Thailand, Malaysia, Korea, the Philippines, Singapore, India, Australia and Viet Nam. The number of abstracts received were

1087 and the number of full papers submitted was 811. There were 366 oral presentations and 445 posters presented.

A one-day side event workshop "Remote sensing applications for tuna fisheries and aquaculture in connectivity with food security and climate change" took place on 23 October 2013 as part of the conference and was jointly organized by FAO, the Indonesian Ministry of Marine Affairs and Fisheries (MMAF) and the Indonesian Agency for the Assessment an Application of Technology (BPPT). Thirty five participants from the Indonesian Government ministries and agencies, Indonesian universities, representatives from cooperatives, industries, professional organizations and FAO met at this workshop to exchange ideas about challenges and opportunities and to outline steps to expand and strengthen the use of remote sensing technology in the development and monitoring of sustainable fisheries and aquaculture.

Conclusions

The conference gave evidence of the significant advances that are currently under way in the field of remote sensing, especially with regard to the variety of parameters for which data can be gathered; the increasingly higher resolution of the data that can be obtained; significant cost reductions in data; and the timeliness of data availability. These advances, combined with the increasing ease in integrating remote sensing data into GIS projects and the actual proliferation of data per se, mean that the prospects for the continuing use of remotely-sensed data are rapidly expanding. Moreover, remote sensing coupled with models (i.e. ocean numerical models, fish population dynamics, etc.) demonstrate the indispensable role of remotely-sensed data for the development and management of aquaculture and in support of sustainable fisheries management.

Key and/or recent applications of remote sensing discussed at the conference of relevance to FAO include: climate change and climate variability; disaster risk management (see photo below); food security and crop monitoring; and remote sensing in health and socio-economic sciences. Aerial surveys also received a lot of attention at ACRS because of the development of low-cost unmanned aerial vehicles (UAV) with digital cameras that could open new interesting opportunities in the different areas of work of FAO involving reconnaissance and assessment applications such as: flooding change detection, disaster management, planning of terrain development, in-depth prospecting and visual inspection of crops and plantations, and environmental monitoring for aquaculture.

Indonesia's BPPT proposed at the conference to move towards an "Asia Initiative on Remote Sensing for Climate Change" as climate change is a serious global threat and Asian countries are among the most impacted. Indonesia is very well-equipped with skilled manpower and remote sensing data and could play a key role in this effort. The general objective would be to synergize regional efforts on remote sensing applications to help mitigate climate change impacts through continuous monitoring, research, education, and informed policy-making.

The Infrastructure Development for Space Oceanography (INDESO) is being implemented by Collecte Localisation Satellites

C. Douaud, Copyright Astrium

The effects of Typhoon Haiyan, which hit the Philippines on November 8 2013, were photographed on 13 November 2013 by a Pléiades satellite, which had captured images of the same zone (Tacloban) on 7 March 2013. Astrium builds and operates the Pléiades high-resolution satellites that are providing such images within the framework of the International Charter on Space and Disasters (http://www.disasterscharter.org/home). These images are being made available to rescue teams and authorities

E. Sussenbach, Copyright GIS4C

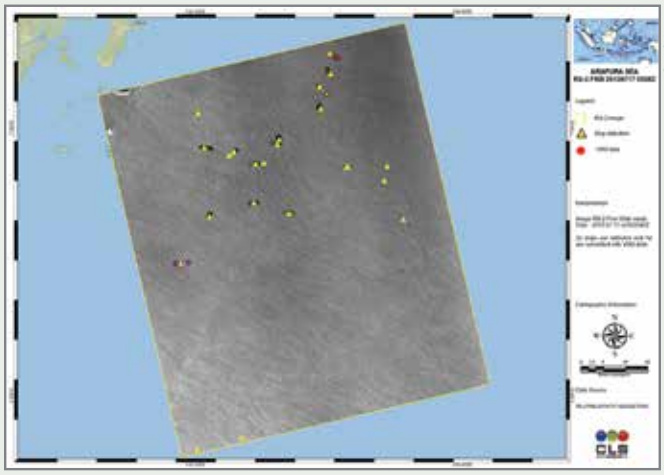
Unmanned aerial vehicle ready for launch. Curaçao, November 2013

(CLS), under contract with MMAF. This project includes a complete new oceanographic centre in Bali that could serve as a model for other regions/countries with similar needs and capacities. Discussions are underway for FAO to contribute to this effort. The project started in 2013 and seven pilot project applications have been chosen involving fisheries (1—2), aquaculture (3—4) and coastal and marine environment (5—7):

1. illegal, unreported and unregulated (IUU) fisheries surveillance;
2. fish stock management;
3. shrimp farm monitoring;
4. seaweed farming;
5. coral reef monitoring;
6. Integrated Coastal Zone Management (with focus on mangroves);
7. oil spill monitoring.

These applications are developed in close coordination with the different Indonesian National Agencies in charge of these 7 thematic areas, with the support of CLS and different French research institutes including the French Research Institute for exploration of the sea (IFREMER), the Institut de recherche pour le développement (IRD) and the Centre d'Etudes et de Valorisation des Algues (CEVA). At least three of these applications (1, 2 and 7) will be operationally implemented within the INDESO Centre in Bali.

In the framework of the INDESO project, satellite images (i.e. RADARSAT-2 SAR images)[1] will be operationally processed to detect fishing vessels at sea and compare their positions with the positions of the vessels monitored by the Indonesian fishing vessel monitoring system (VMS). In the satellite image shown here, the positions of most SAR-detected vessels (yellow triangles) are clearly linked with the positions of VMS-tracked vessels (colored circles). A few SAR-detected vessels however have no matching VMS position (such as the group of 4 vessels to the right of the image). These are thus suspect of illegal fishing activity. The map is obtained from an operationally produced vessel detection report, and INDESO will provide such information in near-real time to Indonesian authorities.



Copyright CLS,2014

An example of IUU fishing vessel detection in the Arafura sea (Indonesia), a main shrimp fishing area

The Memorandum of Understanding between the Ministry of Research and Technology of the Republic of Indonesia (RISTEK) and FAO concerning geospatial information system will strengthen collaborative work on remote sensing and geospatial information technology for sustainable food security.

[1]RADARSAT-2 is an Earth observation satellite that was successfully launched December 14, 2007 for the Canadian Space Agency. A Synthetic Aperture Radar (SAR), or SAR, is a coherent mostly airborne or spaceborne radar system

Second session of the Central Asian and Caucasus Regional Fisheries and Aquaculture Commission (CACFish)

The Central Asian and Caucasus Regional Fisheries and Aquaculture Commission (CACFish) is one of FAO's regional fishery bodies that have been established under the article XIV of the FAO Constitution. It was established in 2010 and currently has four members, namely Armenia, Kyrgyzstan, Tajikistan and Turkey.

The Second Session of the CACFish held in Dushanbe, Tajikistan on 16–17 April 2013, was attended by representatives of the four Members; Azerbaijan, Georgia, Turkmenistan and Ukraine participated as invited observer states.

The Commission adopted the scientific and technical advice and recommendations on the following issues which were submitted to the Commission for its consideration by the Technical and Advisory Committee (TAC): (i) Environmental impact assessment in aquaculture (EIA), (ii) Regional principles for responsible aquaculture in Central Asia, (iii) Responsible introductions and transfers of fish in Central Asia and the Caucasus and (iv) Improvement of collection, analysis, and dissemination of fisheries data and information. These advice and recommendations received unanimous acceptance by the Commission which also praised the quality of the results produced by the TAC. The Commission also underlined the importance of the gradual implementation of the technical and scientific advice of TAC in CACFish competence area. Additionally, the Commission urged its members and observers to give high priority to the implementation of the above-mentioned principles, advice and recommendations.

The Commission noted that in the promotion of better management practices for responsible aquaculture, special consideration should be given to local conditions and the production systems that might vary considerably in the CACFish region. With regard to fisheries data and information, an emerging need for improvement of institutional capacity for data collection, analysis and dissemination was noted.

The Commission approved the following priority areas that were identified by TAC for its medium term work: (i) intensive aquaculture techniques and methodologies, (ii) fish health management, (iii) fishing gear and technologies, (iv) small-scale fisheries and aquaculture, (v) fish passages and fish protection devices, (vi) fish breeding and broodstock management, (vii) technical advice on regulations governing fisheries and aquaculture, (viii) environmental security, and (ix) trade-related measures.

H. Fersoy, FAOSEC

The Commission agreed to consider the establishment of subsidiary bodies under TAC at a time when the Commission has more members and more programmes in place.

The Commission discussed its 5-year Regional Work Programme (RWP) covering the period 2011–2015 and endorsed the 2013 work programme of the TAC.

The Commission adopted its 2013 autonomous budget of USD180 000. The importance of the external financial and technical contribution to the 5-year RWP of CACFish was underlined by the Session. The Session emphasized the importance of the following: allocating sufficient budget for the RWP, active functioning of the TAC, collecting and using fisheries information and data, and developing an annual work programme for RWP.

At the Session, the Commission approved its 2013 work programme which included the following activites: (i) an expert consultation meeting on fish breeding and broodstock management, and (ii) a regional workshop on small-scale fisheries in addition to the annual session of the TAC and CACFish.

The Commission reiterated its call on Non-CAC Fish Member States to consider becoming Commission member; this was considered important for the mid-term targets of the Commission.

More information can be obtained by writing to:
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FAO supported the 5th Offshore Mariculture Conference 2014

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The Offshore Mariculture Conference 2014 (www.offshoremariculture.com/) was the fifth of a series of mariculture conferences organized by Mercator Media Ltd. (United Kingdom). Previous conferences were held in Ireland (2004), Malta (2006), Alicante (2008), Croatia (2010) and Turkey (2012). Held in Naples, Italy, this 2-day international conference was followed by a third day to visit a local seabass and seabream marine fish farm off Gaeta, Italy.

Chaired by Mr A. Lovatelli of FAO, the conference had a theme "Investing in the future of offshore mariculture" and was attended by more than 100 delegates from 18 different countries. Participants included managing directors, investors, CEO's, researchers and fish farm operators from companies and institutions such as: BIM Irish Sea Fisheries Board, Carapax AB, PSP Investments, Cooke Aquaculture, Blue Ocean Mariculture, Cuna Del Mar and Badinotti Group SpA, Iranian Fisheries Research Organization (IFRO), Jeddah Fisheries Research Center (JFRC). The conference was opened by Mr Pier Antonio Salvador, President of the Associazione Piscicoltori Italiani (API).

The conference programme, which explored the progress and prospects for offshore aquaculture in both European and international waters, was organized in ten plenary sessions:

1. introduction and keynote presentations;
2. investment in offshore mariculture today;
3. equipment update by manufacturers;
4. technological innovations for offshore mariculture (cages and nets);
5. offshore mariculture past and present – moving on from 2012;
6. stock management;
7. fish nutrition and feed management;
8. integrating offshore mariculture with renewable energy;
9. equipment update by manufacturers, and
10. fish farm case study.


A. Lovatelli, FAO

Participants attending a session of the Offshore Mariculture Conference 2014

The conference programme is available at: www.offshoremariculture.com/about-the-conference/ it includes the title of the papers, the name of the speakers and shorts abstracts of the papers presented. All power point presentations (30 presentations in PDF format) and corresponding papers are available for download from the conference Web site (www.offshoremariculture.com).

FAO actively participated with several presentations:

Introductory presentation: Setting the scene for the Offshore Mariculture Conference 2014 (A. Lovatelli).

Keynote presentation: The what, where and how much of offshore mariculture: global development opportunities from a spatial perspective (J. Aguilar-Manjarrez).

Oral presentation: Cage aquaculture in the Kingdom of Saudi Arabia: current situation, sector development plans and support of the FAO UTF Project SAU/048/SAU (F. Cardia).

Two recent FAO publications on offshore mariculture were distributed at the conference. The *FAO Fisheries and Aquaculture Proceedings* No. 24 includes a reviews on the technical, environmental, spatial and governance challenges for offshore mariculture, while *FAO Fisheries and Aquaculture Technical Paper* No. 549 estimated, for the first time, measures of the status and potential for offshore mariculture development from a global perspective for all maritime nations.

At the end of the conference, FAO participated in a brief meeting organized and chaired by Ms Marianne Rasmussen-Coulling, Head of Events, Mercator Media Ltd. with the Mexican delegation (Mr Marco Linné Unzueta Bustamante, Deputy Director General of Research on Aquaculture, from the National Institute of Fisheries (INP) at the Secretariat of Agriculture, Livestock, Rural Development, Fisheries and Food (SAGARPA), and Mr Salvador Meza, Director General, Panorama Acuícola magazine) to define the aims of the next offshore mariculture conference to be held in Mexico in 2015, define the dates, programme, supporters and event timelines.

A. Lovatelli, FAO

Changing the net of one HDPE cage at the P2G fish farm

A. Lovatelli, FAO

Different HDPE cage sizes are employed at the P2G fish farm off the coast of Gaeta, Italy ranging from 16 to 28 m in diameter

Conclusions

The Offshore Mariculture 2014 conference show-cased the work done by FAO and was an opportunity to meet experts involved in offshore mariculture development to exchange ideas and information.

There was a general consensus, that meeting the future demand for food from aquaculture will largely depend on the availability of space for aquaculture, and that "marine spatial planning" is needed to ensure the allocation of space for offshore mariculture as a means of realizing offshore mariculture development activities sustainably.

Technical support to the development of desert and arid lands aquaculture in Algeria

The Algerian government, represented by the Ministry of Fishery and Fisheries Resources (MPRH), requested for FAO technical assistance to elaborate a national programme for the development of aquaculture in the southern part of the country. A mission composed of two FAO aquaculture officers, one international consultant, two national consultants and staff from the MPRH was undertaken in October 2013 to visit five Wilayas (districts) namely Ouargla, Ghardaïa, Laghouat, El Oued and Biskra located in arid lands, about 600–800 km south of Algiers.

The mission team met and discussed with a wide range of aquaculture stakeholders ranging from small-scale farmers (i.e. owning small plot of 1-2 ha and one earthen pond mainly used for irrigation), to medium-large scale farmers (i.e. farms covering a surface area between 10 to 20 ha with several ponds). There is a high potential for aquaculture development (e.g. cage culture) within the numerous dams across the country. The mission found that there is a growing interest by the local farmers in starting aquaculture as an additional business to their agriculture activities. However, the lack of technical competences and availability of inputs (feed and fingerlings) represent the main obstacles to the development of the sector. The environment seems to be suitable due to favourable weather conditions, presence of high quality underground water and variety of agricultural cultures. Based on the field visits, the team concluded that the most suitable aquaculture practice using local conditions is an aquaculture system fully integrated with agriculture. These farming systems allow farmers make efficient use of water; in many cases, ponds are located close to agricultural crops and the water fertilized by the fish can be used for irrigation.

At the end of the mission, the team produced a comprehensive report including short to medium and long-term recommendations that will be integrated in the national strategy (2014—2020) for the development of fishery and aquaculture, recently elaborated by the MPRH. Five models of fish farms integrated with agriculture were elaborated by the team including technical drawings of the fish farm, an estimation of investment costs and the equipment needed to run an aquaculture farm.

A parallel mission was undertaken by a FAO International Consultant on Mariculture to provide technical advice to the government on the development of marine aquaculture in cages along the Mediterranean coast of the country. The MPRH is currently supporting the launching of 23 projects for fish and mollusc culture at sea and requested the technical advice of FAO.

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For more reading on desert and arid lands aquaculture see:
www.fao.org/docrep/015/ba0114e/ba0114e.pdf

Support technique au développement de l'aquaculture en milieu désertique en Algérie

Le Ministère de la Pêche et des Ressources Halieutiques (MPRH) algérien, a présenté une requête d'assistance technique visant à développer la filière de l'aquaculture continentale en milieu désertique afin de contribuer au développement des zones rurales et à la lutte contre la pauvreté. Une équipe composée de deux fonctionnaires de la FAO, un consultant international en aquaculture saharienne, deux consultants nationaux et des fonctionnaires du MPRH ont effectués une mission (d'une semaine) sur le terrain en octobre 2013, ayant pour objectif une évaluation de l'état des lieux et du potentiel de développement de l'aquaculture saharienne dans les wilayas du sud notamment, Ouargla, Ghardaïa, Laghouat, El Oued et Biskra.

La pisciculture représente une valeur ajoutée aux activités agricoles dans les régions sahariennes du pays ; en effet les résidus de matières organiques aquacoles constituent une source de fertilisants pour les sols agricoles. Dans les zones arides du pays caractérisées par des ressources hydriques précieuses, la promotion d'une aquaculture intégrée à l'agriculture, permet d'améliorer le niveau de vie des populations locales grace à un apport en protéines animales notamment le poisson.

D'après les constats sur le terrain, le modèle d'aquaculture le mieux adapté en environnments arides et aux conditions climatiques locales serait une aquaculture intégrée à l'agriculture qui assurerait une meilleure gestion de l'eau et des ressources disponibles.

Les visites sur le terrain ont été l'occasion pour l'équipe de rencontrer et de discuter avec un bon nombre de personnes. Cela a permis notamment de constater un intérêt croissant de la part des agriculteurs et investisseurs privés pour le secteur aquacole en tant qu' activité rentable.

Le sud-est du pays présente un énorme potentiel de développement pour l'aquaculture. Il dispose d'importantes ressources hydriques souterraines (fossiles et non renouvelables) et de nombreux lacs d'eau salée éparpillés à travers les régions du Sahara offrant des conditions favorables au développement aquacole.

Pour que le sous-secteur de l'aquaculture saharienne puisse contribuer à la croissance économique durable du pays permettant aux petits et moyens agriculteurs nationaux de mieux valoriser leurs exploitations agricoles, la mise en place de mécanismes efficaces pour faciliter l'accès aux intrants devient prioritaire :

V. Crespi, FAO

V. Crespi, FAO

V. Crespi, FAO

V. Crespi, FAO

1. Un bassin piscicole chez un petit producteur dans la wilaya de Ouargla
2. Un bassin d'irrigation ensemencés avec des tilapias dans la wilaya de Ouargla
3. Un bassin d'irrigation dans la wilaya de Ghardaïa
4. Rencontre et débat avec les agriculteurs de la Commune de Hassi-Ben Abdellah, wilaya de Ouargla

des alevins, des aliments pour le poisson de bonne qualité pourront garantir un accompagnement technique aux investisseurs qui veulent s'engager dans l'activité aquacole.

La première alternative consiste à promouvoir l'aquaculture intégrée chez les petits agriculteurs (par le biais de parcelles de terrain de 2 hectares) pour améliorer leur niveau de vie et leur permettre de bénéficier d'une alimentation en poisson même de proportions modestes. Le fait d'associer plusieurs composantes de production diminue l'élément de risque qu'entraîne l'agriculture; en effet, si l'une des composantes échoue, l'autre peut fournir la production compensatrice nécessaire à sa survie. Les différentes composantes interagissent d'une manière symbiotique et synergique, tout en augmentant ainsi la production globale, et en optimisant l'utilisation des ressources nécessaires à la famille pour subsister.

La deuxième alternative vise à améliorer la production de poissons issue de l'aquaculture intégrée pour la substituer aux importations. Cette alternative passe par des productions plus importantes qui peuvent être catégorisées comme des agriculteurs de type moyen, c'est-à-dire d'exploitations agricoles de tailles moyennes (entre 5 et 20 hectares). Ces dernières possèdent des ressources en eau suffisantes et des infrastructures (bassins d'irrigation) permettant de renforcer la capacité de production de la ferme et d'assurer des possibilités de diversification vers l'aquaculture.

Un troisième choix consiste à soutenir les investisseurs privés intéressés à réaliser des projets aquacoles valables avec une vision d'aquaculture en tant que « business ». Cette alternative aussi passe par des productions plus importantes basées sur l'élevage de poissons en cage flottantes dans les barrages ou à travers la construction d'un nombre majeur de bassins aquacoles. Dans chaque cas, la stratégie envisageable doit se baser sur le concept d'aquaculture intégrée à l'agriculture.

A la fin de la mission, l'équipe a rédigé un rapport comprenant des recommandations techniques à court, moyen et long terme qui seront intégrées dans le Programme de développement de la pêche et l'aquaculture (2014—2020) élaboré par le MPRH.

Dans le même rapport cinq modèles de fermes d'élevage en bassins dans les terrains agricoles et en cages dans les barrages ont été élaborés. Ces modèles permettront au Ministère de fournir les éléments techniques nécessaires aux petits, moyens et grands agriculteurs leur permettant de démarrer une activité aquacole dans leur ferme.

Pour de plus amples informations:
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Pour de plus amples informations aquaculture en milieu désertique voir:
www.fao.org/docrep/015/ba0114e/ba0114e.pdf

V. Crespi, FAO

V. Crespi, FAO

V. Crespi, FAO

V. Crespi, FAO

5. L' écloserie mobile pour la production des carpes dans la wilaya de Sidi Bel Abbes
6. Le barrage de Fontaine des Gazelles dans la wilaya de Biskra
7. Un bassin piscicole de 150 m^2 contenant des tilapias dans la wilaya de Ouargla
8. Photo de l'équipe

Update on the support to the "South-South cooperation technical assistance programme between Namibia and Viet Nam" (GCP/NAM/014/SPA)

In 2010, an FAO-facilitated South-South Cooperation (SSC) exchange was launched to improve the aquaculture sector in Namibia through aquafeed production, species diversification and the application of modern aquaculture techniques. Viet Nam provided three long-term experts and five technicians; they were supported through funds from the Government of Spain. An Aquaculture Officer and a Food Security Officer from FAO headquarters undertook a second 10-day backstopping mission in November 2013 to review the progress of the project implementation in relation to the work plan and to initiate the work planning process for 2014 (for the outcomes of a previous mission see page 16 of in FAN 51).

The mission visited two sites where most of the planned activities are taking place in the northern regions, the Inland Aquaculture Centres (IACs) in Ongwediva and Onavivi. The mission reviewed the progress of the activities made so far including the proposed work plan, progress of several studies so far undertaken, procurement of equipment and materials needed for the planned activities and the missions undertaken by the different consultants assigned for on-going studies.

Two consultancy missions were undertaken in 2013 by Professor Paul Skelton who provided hands on training to Namibian staff on sample process chain of the collection including fish collection methodology, specimen preservation and species identification for the establishment of a freshwater fish museum at Kamutjonga Inland Fisheries Institute (KIFI).

To develop a research programme for initiating indigenous and non–indigenous species for aquaculture practice, Mr Francois Rajts travelled twice to Namibia during 2013, to assist national counterpart in assessing possible domestication of African river prawn (*Macrobrachium vollenhovenii*) and largemouth bass (*Micropterus salmoides*) in the country and to prepare the plan for start-up operation for domestication of these species.

V. Crespi, FAO

Broodstock of red tilapia

V. Crespi, FAO

Feeding fingerlings in an earthen pond

V. Crespi, FAO

Hapas in a earthen pond for tilapia fingerling production

To strengthening project implementation, Mr Pedro Bueno undertook two missions in 2013 to the country, to assist the SSC team in revising and improving existing training materials on fish farming , to provide on-the-job training courses on aquaculture practices to fish farmers throughout

the country and to assist national counterpart in establishment an aquaculture extension strategy.
A fourth expert Mr Chrishen Rana was sent to Namibia to assist SSC team in the elaboration of a research programme for the production of all-male three-spotted tilapia and Mozambique tilapia (*O. mosambicus*) through hormonal sex reversal techniques by application of 17 α-methyl testosterone. The 17 alpha methyl testosterone (a synthetic androgen) has been permitted by Namibia Medicines Regulatory Council for a pilot study only and apparently the consumption of fish treated with 17 α-MT is not allowed in Namibia. Hence at this stage, this pilot study will be confined to very limited scale and will only be carried out in KIFI.

Early results showed a substantial improvement in aquaculture techniques and research programmes. The Ongwediva IAC has successfully carried out seed production of North African catfish (induced breeding using ovaprin) and three-spotted tilapia and achieved substantial success in all stages of breeding and rearing, thus improving national capacity on seed production. Early results showed a substantial improvement in North African catfish survival rates, by increasing feeding frequency and the use of live food and artificial feed.

During the first half of the project life (2011—2013), the permanent presence of Vietnamese experts in the country along with the punctual intervention of international consultants enabled the Department of Aquaculture to identify and promote improved aquaculture practices and technologies at the national level, strengthening in particular the technical skills of national staff in the research institutions. During the second phase of the project (2014—2015) up to the end, an effective extension strategy will ensure the dissemination of acquired skills and information and capacity transfer to the local fish farmers.

There are already two community-based small-scale aquaculture projects incorporating the low-input aquaculture which are in the process of being implemented: one in Ondangwa, Oshana Region to be implemented by Oonte OVC Organization and the 2nd one in Onemedhiya Village, Omusati Region. Necessary technical assistance for these two projects will be provided respectively by Ongwediva and Onavivi IACs.

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Nursery in a green house in the Inland Aquaculture Centre of Ongwediva

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Vietnamese experts in the Inland Aquaculture Centre of Ongwediva

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Beneficiaries of the project

Acknowledgements

The FAOR and his team are acknowledged for the excellent support and assistance received throughout the mission, and especially during the field trips and the various meetings. Special thanks also to the National Coordinator and the SSC Technical Team in the regions visited, including the Vietnamese counterparts and the regional focal points.

Milkfish fry collection and supply systems in Palau (TCP/PLW/3402)

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The FAO TCP Facility Project, TCP/PLW/3402 "Milkfish fry collection and supply systems in Palau", approved in June 2013, supports the development of the local milkfish fry collection and supply systems in Peleliu State in order to have a local milkfish fry supply and reduce dependence on imported milkfish fry, thus reducing milkfish production costs and supporting a viable commercial milkfish farming in the country

The Government of Palau has considered aquaculture as a priority. This project responds to an immediate technical need for assistance because local milkfish fry collection and supply systems have not yet been established, although milkfish farms have been regularly harvesting fresh milkfish for the domestic market (see FAN48, pp 38–39: "*Prospective milkfish industry in Palau*"). Milkfish fry have been regularly imported from Taiwan Province of China and Indonesia at significant costs to the farmers in Palau.


J.E. Basco, Palau
Milkfish fry collection during the training workshop in Peleliu

Under this project, a three-day training workshop on milkfish culture system and fry collection was conducted by the FAO TCDC Expert and the FAO National Consultant in the Peleliu State, from 21 to23 August 2013, in cooperation with the Bureau of Marine Resources (BMR) and the Peleliu State Government. The workshop, attended by 11 participants, was aimed at building the technical capacity of the Peleliu State Government staff, fisherfolks and staff of identified private milkfish farms currently operating in Palau. The workshop included practical aspects of milkfish farming such as fry collection techniques, culture methods, harvesting and post-harvest activities. Practical field activities included construction of fry collection gear (i.e. fry dozer) and milkfish fry collection, identification, handling and transport. A practical exercise on milkfish deboning was also demonstrated to the participants to give them an idea how to add a value to the harvested milkfish as one of the post-harvest activities that may be considered for future markets in the Peleliu State and Palau.

The sampling results of milkfish fry during the workshop and the information provided by local fisherfolks indicated a potential for the intensification of milkfish fry collection in Peleliu. For stimulating milkfish fry collection, the involvement of local fisherfolks on proper fry collection and farming trainings is a key. A follow-up training workshop was conducted on milkfish fry collection including construction of fry collection gear, identification of milkfish fry, fry collection timing and techniques, and proper milkfish fry handling and storage.

Under the project, a mission by the Fishery Officer of the FAO Sub-Regional Office for the Pacific Islands on 21—26 July 2013 conducted a stakeholder consultation meeting, discussed the draft training workshop programme with the BMR and toured the potential milkfish farming sites in Peleliu in preparation for the training workshop.

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Community-based mullet farming in Papua New Guinea (TCP/PNG/3401)

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M. Izumi, FAO

Female participants to the Project Inception Workshop in Loniu, Manus Island

The FAO TCP/PNG/3401 Project "Sustainable development of community-based mullet culture in Loniu, Manus Province, Papua New Guinea (PNG)", approved in June 2013, supports the establishment of mullet farming systems in an island in PNG.

FAO carried out a feasibility study on mullet farming in PNG in November—December 2011; the positive results and recommendations of the study paved the way for the development of this TCP project. Three main issues being addressed by the project are: 1) enhancement of the wild stock population of mullet fish fry and fingerlings through the conservation of traditional mullet migration pathways and spawning grounds, 2) development of a sustainable mullet farming using cages in Loan Lagoon in Loniu, Manus Province, through best management practices, and 3) establishment of community policies and guidelines concerning the specific use of Loan Lagoon.

The primary aim is to develop a commercially viable and environment-friendly mullet fish farming systems in the Loniu community, Manus Province. Successful implementation of this project will address food security in the target community and other communities in the Manus Province, provide livelihood and means of income for local residents, that will lead to increased local economic status. The project is being executed by the National Fisheries Agency (NFA) in PNG. The Loniu community with some 160 households will benefit from access to mullet fish as good protein source. Extra production of mullet fish could be marketed for income generation and be provided to the surrounding communities. People along the northern coastal area will also benefit from the project through conservation and management measures for mullet fish resources. Women and youth in the Loniu community are the direct beneficiaries through income generation, employment and increased labour demand. As part of a wider community development strategy, the project shall provide a base for community involvement and participation. Such community development activities should contribute to the overall community vision and goals.

The first duty mission of the Fishery Officer of the FAO Sub-Regional Office for the Pacific Islandsfrom 11 to 18 August 2013, discussed the detailed work plan with the NFA and conducted a Project Inception Workshop in Port Moresby and Manus Island in cooperation with the NFA, the Department of Agriculture and Livestock (DAL), the Manus Provincial Administration and the Loniu community. The TCDC Expert's first mission to PNG (Port Moresby and Manus Island) from 30 October to 22 November 2013 initiated field activities including preparation of cage culture facility and training on mullet cage culture in Loniu.

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Micronesian Association for Sustainable Aquaculture or MASA takes shape (TCP/SAP/3403)

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It shall be a regional intergovernmental organization to be called the Micronesian Association for Sustainable Aquaculture (MASA). It will operate as a network. These are the major recommendations of an Inception Workshop which launched the two-year project TCP/SAP/3403 "Assistance in the establishment of a Micronesian Network on Sustainable Aquaculture". The meeting was held in the US Territory of Guam on 30 September — 02 October 2013, and the participants were government representatives of four Micronesian States (Federated States of Micronesia, Republic of the Marshall Islands, Republic of Nauru, and Republic of Palau), the US Territory of Guam, a scientist from the University of Guam, and an officer from the Western Pacific Regional Fishery Management Council. The workshop was guided by the Fishery Officer of FAO Sub-regional Office for the Pacific Islands (FAO SAP) and a project consultant. The meeting received advice from and engaged in discussions with officers of FAO's Development Law Service (LEGN), the Aquaculture Service (FIRA) and the Regional Office for Asia and the Pacific (RAP) via Skype. The same remote communications enabled the FAO Sub-regional Coordinator for Pacific Islands, Gavin Wall, to deliver the keynote message, the gist of which was to assure the governments that FAO will work with them to successfully achieve the objective of the project and to continue its participation, as a partner, after that. He stressed that the formation and sustained operation of a regional autonomous body owned by its members is largely in the governments' hands.

The workshop drafted a 2-year work plan. Its main output would be the official establishment of MASA, which will be achieved mostly by activities of a legal nature: developing its founding document and administrative instruments, negotiating an agreement with the government that will host the secretariat, formulating a schedule of government contributions, crafting an organizational structure and constituting its organic bodies (i.e. governing body, technical advisory body and secretariat). The legal and administrative instruments will be adopted by governments towards the end of the project in July 2015. However, the work will not be solely to establish an inter-governmental organization; the meeting drafted a framework for a regional technical work programme to be implemented through technical cooperation. The legal process of creating MASA will go hand in hand with aquaculture development activities. The initial task of the work programme is to elevate aquaculture in Micronesia into a duly recognized economic sector worth investing in. For the long term, the MASA is envisioned to provide the impetus to aquaculture becoming a commercially vibrant industry for development and resilience.


M. Izumi, FAO
Participants of the project inception workshop in Guam

The Government of Palau, in the meeting held in Palau between the Honourable Minister for Natural Resources, Environment and Tourism, F. Umiich Sengebau, and FAO SAP Fishery Officer following the Inception Workshop, has provisionally agreed to host the interim secretariat and set aside a furnished and wired office at the Bureau of Marine Resources.

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Community-based milkfish farming in the Kingdom of Tonga (TCP/TON/3402)

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Following the project approval of the TCP/TON/3402 (Development of community-based milkfish farming in Nomuka Island and Tonga'tapu in Tonga) in March 2013 (see FAN51, p. 23), the project commenced with an Inception Workshop in Nomuka Island and Nuku'alofa on 7 May and 10 May 2013, respectively. During the workshops, the detailed project work plan and arrangements were discussed and confirmed with representatives from the communities and the project executing agency (Fisheries Department, Ministry of Agriculture & Food, Forests and Fisheries). The workshops also confirmed the community's active participation in the project activities and the project ownership with the communities.

In September 2013, the first mission was carried out by the FAOTCDC Consultant in milkfish farming which assessed and identified an ideal site for establishing a milkfish nursery pond and grow-out milkfish pen in careful consideration of the land ownership and the suitable milkfish farming. Particularly, a milkfish pen culture is best suited in the environment like the lagoon in Nuku'alofa and the lake in Nomuka Island where the water depth is within 1.5 to 2.0 meters and with the water in high nutrient levels. The selected nursery pond site in Nuku'alofa would support the milkfish stock requirements of the proposed fish pen site both in Nuku'alofa and Nomuka.

At the both project sites in Nuku'alofa and Nomuka Island, a one-day training workshop was conducted on 20 September and 25 September 2013 respectively, on milkfish farming system by the TCDC Expert in order to develop the capacity of the staff of the Fisheries Department, fisherfolks, women's group and community members who are interested in milkfish farming. The workshop consisted of technical and practical sessions on milkfish farming from fry collection techniques to culture methods and included some harvest and post-harvest activities. During the practical sessions, the construction of fry collection gear (i.e. fry dozer), fry collection demonstration and practice in the nearshore area, and fry identification were highlighted. A video on post-harvest value-adding practice (i.e. milkfish deboning) was shown to the workshop participants to provide them with an idea for value-adding to the harvested fresh milkfish that may be considered for domestic markets in Tonga in future.

For developing an environment-friendly milkfish farming systems in Tonga as one of the primary objectives, an EIA (Environment Impact Assessment) was conducted prior to the site selection and the environmental conditions (e.g. water quality, siltation, vegetation, aquatic fauna and other factors) at the project sites were continuously monitored. The TCDC Expert's second mission in the first quarter of 2014, construction of the nursery pond (e.g. dike and gate construction) in Nuku'alofa and fish pen (e.g. net mending and net pen installation) in Nuku'alofa and Nomuka Island will be completed as planned.

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[2]TCDC Technical Cooperation among Developing Countries

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Participants in the training workshop in Nuku'alofa

Aquaculture future: an analysis

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Background

According to FAO estimates, to feed the world through to 2050, agricultural output, originating from crops, livestock and fisheries, including aquaculture, must increase by over 60 percent (FAO, 2014)[1]. Meeting this target is a formidable challenge for the international community considering that an alarming number of people, mostly in developing countries, still suffer from hunger and poverty. Hence, finding opportunities to alleviate poverty and increase food security is vital and timely. Agriculture, fisheries and aquaculture have a central role to play. Foods derived from aquatic resources have a significant role to play across the food supply and value chain, linking ecosystems, economic development and human well-being. Since the contribution of capture fisheries to global food fish supplies has levelled off, aquaculture production has taken over as a major supplier.

Aquaculture makes valuable contributions to the local, national and regional economies through goods and services sold on the domestic and export markets. Generally, subsistence and small-scale aquaculture contribute directly to the alleviation of poverty and achievement of food security. In addition, small-scale and large-scale commercial aquaculture, as practised in many developed and developing countries with species such as shrimp, salmon, tilapia, catfish, grouper and carps, can enhance the production for domestic and export markets and generate employment opportunities in the primary production, post-harvest processing and marketing sectors.

Indirectly, tax revenues from commercial aquaculture enterprises and foreign exchange export earnings allow governments to invest in sectors that add to the achievement of food security. Moreover, planned development of aquaculture (such as zoning, and the farmer cluster management approach) could lead to improved infrastructure such as roads, bridges and electricity, thus boosting local economies. In many countries, aquaculture's contribution as a proportion of total gross domestic product (GDP) is small, but its importance to the national economy in terms of poverty alleviation and nutritional benefits is significant, particularly in developing countries. At the regional level, aquaculture's contribution to the economies of many countries in the Asia–Pacific region is relatively higher, with Viet Nam at 16 percent of GDP in the lead.

As aquaculture production continues to grow it is important for fisheries policy makers to ensure that the growth does not have negative environmental impacts. Externalities from aquaculture production are many and varied both depending on species, production techniques and intensity. However, it is imperative to ensure green growth in aquaculture. The report "Green Growth and Aquaculture" showed that many developing and developed countries are embarking on improved policy frameworks and governance where addressing aquaculture production externalities is central (OECD, 2012)[2].

Global fish supply from aquaculture[3]

In the last three decades (1982–2012), world food fish production of aquaculture has expanded by almost 12 times, at an average annual rate of 8.6 percent. Global aquaculture production continued to grow, albeit more slowly than in the 1980s and 1990s. World aquaculture production attained an all-time high in 2012, at 67 million tonnes (excluding aquatic plants and non-food products), with an estimated total value of USD138 billion. When farmed aquatic plants and non-food products are included, world aquaculture production in 2012 was just above 90 million tonnes, worth USD144 billion, of which 24 million tonnes of aquatic algae (mostly marine seaweeds), and 22 thousand tonnes of non-food products such as pearls and shells. On average, global aquaculture provided 9.4 kg of fish per person for consumption in 2012. However, production distribution is extremely uneven across the globe. Aquaculture contributed 42 percent to the world total fish production in 2012 (158 million tonnes), up from 26 percent in 2000.

Future supply of fish has been estimated by using several models and different scenarios. According to the projections included in the OECD-FAO Agricultural Outlook: 2013-2022 (OECD and

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Pond digging close to Lake Robino, Haiti

M. Reantaso, FAO

Tilapia cages, Lake Harvest, Zimbabwe

L. Bigarré, France

Women working in a fish processing plant, Monastir, Tunisia

FAO, 2014), major increases in future fisheries production will derive from aquaculture. By 2022, world fisheries production is expected to reach 181 million tonnes compared to 147 million tonnes in 2010, of which 161 million tonnes will be destined for direct human consumption. As capture fisheries production is projected to increase only by 5 percent, most of the additional fish is expected to come from aquaculture. Aquaculture production should reach about 85 million tonnes in 2022, with an overall growth of 35 percent during the 2013–2022 period. By 2022, products derived from aquaculture will represent 47 percent of global fishery production and 55 percent of total fish destined for human consumption.

The recent projections proposed in *Fish to 2030* (World Bank, 2014), give a similar scenario. By 2030, these projections predict that aquaculture production will increase to the point where it equals global capture production by 2030 and contributes 62 percent of the global supply by 2030. However, according to these projections, annual production growth for aquaculture is expected to slow. OECD and FAO (2014) predict a growth rate averaging 2.5 percent per year in 2013–2022, compared to over 6 percent of the previous decade (2003–2012).

Geographically, aquaculture production is concentrated in Asia and will continue to do so. According to Fish to 2030, China's share in global aquaculture production will slightly decline from 63 percent in 2008 to a projected 57 percent in 2030. While all regions are expected to expand their aquaculture production, the largest expansion is expected in India (121 percent during 2010–2030), Latin America and Caribbean or LAC (120 percent) and Southeast Asia (107 percent). South Asia (excluding India) and the Middle East and North Africa are also projected to experience large aquaculture growth during 2010–2030, 91 percent and 76 percent, respectively. Sub-Saharan Africa also show substantial expected growth over this period, but starting from much lower production levels in 2010 compared to other regions.

Over 600 aquatic species, including animals and plants, are cultured in close to 200 countries for production in farming systems of varying input intensities and technological sophistication. These include hatcheries producing seeds for restocking, particularly in inland waters. Out of the large number of farmed species, about 100 animal species accounted for 80–90 percentof the total food fish production, and less than 10 species of marine macroalgae algae constitute the majority of farmed aquatic plants. Of the 67 million tonnes of farmed food fish produced in 2012, two thirds were finfish species grown from inland aquaculture and marine aquaculture. Farmed crustaceans accounted for 10 percent of food fish aquaculture production in 2012, while molluscs contributed 23 percent. Other aquatic animal species, grown in both freshwater and seawater mostly in Asia, is low in production volume but it include some high value species such as sea cucumbers.In summary, inland aquaculture of finfish is by far the most important subsector of world aquaculture in volume terms, followed distantly by other forms and types of aquaculture

production of food fish. Finfish culture in freshwater, especially herbivorous and omnivorous species such as carps, tilapias, Pangasius catfish and milkfish, makes the greatest contribution to the supply of affordable protein food for direct consumption. It is particularly so in a number of populous developing countries in Asia, Africa and Latin America. This subsector of aquaculture production is also expected, through continued promotion and development in sustainable manner, to be the lead player to fulfil the long-term food and nutrition security and to meet the increased need for food fish supply by the growing population in many developing countries in the coming decades.

The percentage of non-fed species (filter-feeding carps and bivalves for example) in world production has declined gradually from more than 50 percent in 1980 to 33 percent in 2012, reflecting the relatively faster body-growth rates achieved in the culture of fed species and increasing consumer demand for higher trophic-level species of fishes and crustaceans. In Africa, non-fed aquaculture production potential is virtually untapped. According to Fish to 2030, production of tilapia is projected to more than double between 2008 and 2030. Some high-value species such as shrimp and salmon are expected to grow by 50 to 60 percent over the period. Some low-value species like carps also will likely grow fast. Overall, there is no evidence for a substantial shift in the major players in the global fish markets. South East Asia is expected to take some of China's share in the global shrimp supply, while LAC is likely to grow to account for a third of global salmon supply by 2030.

As with agriculture, aquaculture production is vulnerable to adverse impacts of disease and environmental conditions. Disease outbreaks in recent years have affected farmed Atlantic salmon in Chile, oysters in Europe, and marine shrimp farming in several countries in Asia, South America and Africa, resulting in partial or sometimes total loss of production. In 2010, aquaculture in China suffered production losses of 1.7 million tonnes caused by natural disasters, diseases and pollution. Disease outbreaks virtually wiped out marine shrimp farming production in Mozambique in 2011. A new wave of disease in marine shrimp farming is currently affecting major shrimp aquaculture countries in both Asia and LAC.

Global fish demand from aquaculture

Considering the projected total fish supply from both capture and aquaculture of 187 million tonnes by 2030 arrived at in Fish to 2030, if fish consumption patterns do not change significantly, fish prices should not significantly increase by 2030, in fact they may even decrease. Therefore, if countries could maintain their trends of aquaculture production growth during recent years, there would be enough fish to feed the growing population.

However, since people would tend to consume more fish as their incomes grow, countries' per capita fish consumption is unlikely to remain constant at the level in 2007. To account for the potential impacts of income growth on fish consumption, an econometric model was developed by FAO using countries' historical fish consumption and income patterns to estimate their "income elasticity" of fish demand, which measures the percentage change in fish demand caused by a percentage change in per capita income. With the estimated income elasticity of fish demand, the potential impacts of income growth on per capita fish consumption can be further estimated based on expected future income growth. As data on household income are rarely available for most countries, per capita GDP were used as a proxy of household income. The World Economic Outlook of the International Monetary Fund's (IMF) database provides data on historical and projected per capita GDP for most countries.

Based on these data, per capita fish consumption in 2030 has been estimated for most countries. Combining the estimated per capita fish demand and population projection together gives an estimated total fish demand for the growing and wealthier population of 261 million tonnes for 2030.It appears that should this additional demand of 74 million tonnes, as compared to the Fish to 2030 estimate, have to be satisfied solely by aquaculture production, the future food fish supply from aquaculture would need to be increased significantly. Even if aquaculture in every country continued growing according to its recent trend, which would double the aquaculture production during 2010–2030, the resulting 211 million tonnes of expected global fish supply in 2030 are still insufficient to satisfy the 261 million tonnes of expected future fish demand. If the supply and demand gap is not bridged, obviously the price of fish will increase and thus reduce many global communities access to fish. In order to have enough fish to satisfy the future demand, the world aquaculture production would need to triple during 2010–2030, truly a daunting task.

Conditions for green growth in aquaculture

Fisheries and aquaculture can be vital in the transition towards blue socio-economic growth due to their interconnectivity with and reliance on

aquatic ecosystems and the potential employment where people can act not only as resource users but also as resource stewards. Hence, realizing the full potential of the oceans and wetlands will demand responsible and sustainable approaches to its economic development. A more effective, socially and environmentally responsible aquatic food chain can contribute to sustainable growth, social cohesion and food security, reducing the pressure on marine and land resources. It can, in particular, influence the governance and management of these resources, the conservation of biodiversity and habitats, and the empowerment of concerned communities, including through better adaptation of vulnerable communities to climatic changes and improved resilience to emergencies, natural disasters and other forms of crises.

A variety of drivers contributed to aquaculture's spectacular growth in recent decades. While presenting a list of the most commonly recognized drivers, such as increased market demand, improvements in infrastructure and access to improved and cost-effective technology, Muir *et al.* (2010)[4] report that the relative importance of the growth factors or drivers varies with location and context and that, while each has a definable influence, positive features of all are usually required. The aquaculture sector is indeed remarkable for its diversity in operations, encompassing a very wide range of farming practices, species, environments and production systems, often with very distinct resource use patterns. The sector is also highly fragmented, ranging from smallholders of ponds or cages providing a few kilos of fish per year to international companies with annual turnover in excess of USD1 billion. This situation offers a wide range of lessons that are context and location-specific and accordingly requires crafting of appropriate strategies for addressing green growth.

All forward projections anticipate a need for increased supply of fish protein to meet the health needs and general aspirations of societies. Furthermore, this will need to be at affordable levels in relation to income and other proteins. The challenge, however, goes beyond the need for growth. Indeed, despite having achieved good progress in terms of expansion, intensification and diversification, the aquaculture sector is confronted with a set of key issues and challenges that needs to be proactively addressed in order to contribute to green growth.

The broad challenge is to produce sufficient quantities of aquatic food, particularly in the regions where the demand is high, using more energy and resource use efficient and low carbon technologies that strengthen sector sustainability while conserving the critical habitats during the process of expansion and intensification of systems and practices. In doing so, the sector needs to pay particular attention to most countries in the sub-Saharan Africa, the Pacific, Central and Eastern Europe and North Africa regions, which are relatively under-developed in terms of human and technical resources, as compared with advanced countries in Europe and North America. This daunting task clearly needs a concerted effort by all interested parties.

The growth of aquaculture is increasing pressure on natural resource inputs, notably water, energy and feed. Indeed, as with terrestrial animal proteins, production of fish protein is more ecologically expensive than production of plant protein due to the higher trophic level, although some systems (such as enriched polyculture ponds) compare very well. Bivalve shellfish should also not be overlooked as an animal protein already well ahead on sustainability criteria.

There is also the question of the use of, and impact on, environmental services, particularly for the dispersion and treatment of farm effluents. Better optimization of freshwater production systems with respect to water and feed management could triple production without increasing freshwater usage. Given the presently increasing pressures on freshwater supplies, future aquaculture development might be expected to utilize more abundant brackish and sea water resources. However, environmental issues are no less complex.

The energy cost of aquaculture activities and linked implications for carbon emissions is receiving greater attention. A distinction needs to be drawn in analysis between direct energy use (e.g. fuel and electricity consumed directly in the production process) and the more comprehensive approaches to auditing energy inputs as well as considering the use of renewable energy. Aquaculture affects climate change and climate change will affect aquaculture. To minimise the potential for climate change, energy consumption should be kept as low as possible and new aquaculture enterprises should not be located in regions that are already high in sequestered carbon such as mangroves, seagrass or forest areas.

Disease has proved a major constraint to efficient production in some intensive aquaculture systems. Major improvements in the understanding of the aetiology and epidemiology of fish diseases have been made in recent years and aquaculture

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Hand feeding in shrimp ponds, State of Sonora, Mexico

producers in many countries have dramatically improved their husbandry practices with increasing focus now on fish welfare. Control of many serious infectious diseases has been achieved through new medicines and vaccines, and this is especially true for bacterial diseases. However, new disease problems are emerging, and previously rare diseases becoming much more prevalent, so continued vigilance and solution development is required.

Moving aquaculture systems further offshore removes a number of the challenges faced by nearshore systems such as visual impacts, local environmental impacts and space constraints. In most cases, predation issues and disease risks could also be substantially reduced. Expansion of the offshore industry would allow increases in the scale of project and could therefore improve efficiency as well. Necessary governing structures, policies and regulatory frameworks for establishment of offshore maritime aquaculture are, however, still scarce. Besides, the new technology requirements for offshore aquaculture will have large capital requirements, which will restrict use until farms and companies reach a scale of operations where offshore investment becomes feasible.

The growing need for aquaculture to contribute to food security, especially in African and Asian countries will require governments to actively support growth of the sector and stimulate private sector investment. There are measures that policy makers can take which include providing support to innovative and technological developments, ensuring a suitable regulatory framework that captures environmental costs within aquaculture processes, building capacity for monitoring and compliance, and encouraging more research, and particularly on the supply and demand for fish and fish products.

Over the last three and a half decades, with the assistance of FAO and other development agencies and governments, three global milestone events on aquaculture have contributed to the progressive development of strategies for the sustainable development of the sector. These events were: the 1976 conference in Kyoto, Japan, the 2000 conference in Bangkok, Thailand, and the 2010 conference in Phuket, Thailand. The strategic elements adopted at these conferences, have been useful in assisting the States in positioning their aquaculture sector to achieve national goals and objectives. In particular, the most recent, the 2010 Phuket Consensus: a re-affirmation of commitment to the Bangkok Declaration continues to guide the development and management of aquaculture beyond 2010 through the first quarter of this century.

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Value chain efficiency of the mud crab *(Scylla serrata)* industry in Madagascar boosted by low cost interventions through the SmartFish Programme

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The SmartFish programme, is a regional fisheries project managed by the Indian Ocean Commission, funded by the European Union and co-implemented by the Food and Agriculture Organization of the United Nations. SmartFish, which operates in twenty countries throughout the Indian Ocean Region, Southern and Eastern Africa regions, focuses on fisheries governance, management, monitoring control and surveillance, trade, and food security. The first phase of the programme has been implemented from October 2012 to April 2014 and a second phase is expected to start from May-June 2014 for other 36 months.

Under the Trade and the Food Security components of the programme, SmartFish has been, over the past year, supporting a series of interventions aimed at improving the value chain efficiency of the crab industry in Madagascar.

The mud crab fishery in Madagascar is an exclusively traditional fishery, composed of on-foot or pirogue fishers using very simple fishing techniques and gears, such as handlines or hooks mounted on sticks.over 80 000 people are estimated to be involved in this activity. This is mainly due to the fact that mangrove forests, the natural habitat of the Scylla serrata crab, are often in remote and difficult to access areas.

However, the high demand for this variety of crab on the international market has pushed this traditional activity to become more export-oriented (over 75 percent of the total production), which has led to the development of complex collection channels and constant increases in production. Official figures, which are probably underestimated, show that between 1985 and 2010 annual catches of crabs increased from 500 tonnes to 2 000 tonnes. Current national production is approximately 3 500 tonnes annually. This production, however, remains well below the potential of Madagascar's mangroves (325 000 ha making up 20 percent of African mangroves), whose annual productivity offers a fishing potential estimated at 7 500 tonnes of crabs.

The SmartFish initiative was based on the result of a Value Chain Analysis carried out in 2012 which highlighted the limited value chain efficiency due to the high mortality rate of crabs. The analysis identified the critical stages in the chain where mortalities occurred, i.e. at the storage points at village level and during transportation. A deeper post-harvest loss (PHL) assessment carried out in June 2013 using the new mobile phone-based technology developed by SmartFish, confirmed that poor handling practices and inadequate equipment, were the main causes of the crab mortality which resulted to high post-harvest losses averaging 23 percent with peaks of over 50 percent during the rainy season. Due to food safety concerns, a dead crab of the species *Scylla serrata* cannot be eaten and has to be discarded.

The analysis also established baselines from which stakeholders (fisheries officials and crab fishers) set improvement targets for loss reduction, i.e. "a reduction of 1/3 by end of 2015". This commitment was the basis for the SmartFish Programme's interventions targeting the west and northern coasts of the Madagascar and which consisted of a combination of awareness raising activities and direct and on-the-job capacity building of mud crab collectors and trade operators through the design and use of improved but simple crab storage and transport facilities. The activities, conducted in 20 villages, included the following: (i) construction of fixed tanks and storage sheds using local materials, (ii) enhancement of carts, (iii) utilisation of boxes rather than fragile baskets to

prevent damage to the crabs and (iv) construction of storage shelves for canoes.

The effectiveness of the interventions was measured through the level of post-harvest losses occurring at different points in the chain, with a focus on the critical points initially identified, their level of adoption and their profitability. The results are summarized in Table 1 below .

The project is now introducing a low-cost, innovative type of trap for harvesting the crabs, a viable alternative to the traditional hooks that have, in the past, caused physical damage to the crabs.

Table 1. Summary of the cost-benefit analysis of the different innovations proposed

Stage of the Value Chain	Intervention	PHL before intervention (%)	PHL after intervention (%)	Additional revenue per unit (USD)	Amortization period (months)
Storage (fishermen)	Construction of tidal cages and pens	5.5	1.0	3/week	7 weeks (2 months)
Storage (small collectors)	Construction of storage sheds	11.5	7.3	55/shipment	6 shipments (2 months)
	Upgrading of previous storage sheds	14.0	10.3	16/shipment	6 shipments (2 months)
Ground transportation (collectors)	Upgrading of carts	14.0	5.8	12/trip	11 trips (4 months)
Maritime transportation (collectors)	Construction of wooden boxes	25.0	9.7	60/trip	3 trips (1 month)

Z. Kasprzyk, Poland

Storage shed made of local materials

This evidence-based success has been recognised by the Malagasci authorities.

To accompany the dissemination of the messages and to facilitate the adoption of the innovations promoted, SmartFish also produced a multimedia sensitization kit on post-harvest loss prevention and reduction composed of an operator's booklet, five radio talks, a documentary video, a set of five technical sheets and an awareness raising poster for schools. Tablemats and lambaoany (traditional cloth) were also printed for general sensitization and vulgarization purposes.

To increase their visibility and adoption rate, innovations and equipment promoted have been presented at the occasion of the first Fishers' Fair of the Menabe region, organized in collaboration with WWF and the Ministry of Fisheries. Following this event, local NGOs and State departments carried out further awareness raising activities in other villages.

The longer-term aim is to scale up these interventions to the entire coastline of Madagascar as well as integrate them with other actions related to marketing and management of this important resource.

Ultimately, given its proven cost-efficiency, the Malagasy experience will serve as a basis for regional exchanges with the aim to replicate interventions in other crab-producing countries. In this line the materials developed in Malagasci have been translated and adapted into French and English with the aim of making them widely available.

T. Rasoloarimanana, SmartFish

Fisherman holding a big live crab

Z. Kasprzyk, Poland

Crab collector sorting crabs and discarding dead ones

Utilizing genetics to meet future demand for aquaculture products[1]

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As the global population continues to increase and a growing middle class consumes more protein, the ability of the world's fisheries and aquaculture industry to meet future needs for seafood is a significant concern to policymakers, industry stakeholders and the public. Recent estimates by SOFIA 2012 (The State of the World Fisheries and Aquaculture 2012) report, published by the Fisheries and Aquaculture Department of the Food and Agriculture Organization of the United Nations (FAO), illustrates this trend. Not only is world per capita fish consumption to rise by 16 percent by 2021 from 2011 levels, but overall global seafood production is predicted to rise from 154 million metric tons in 2011 to 172 million tonnes by 2021.[2]

The capture fisheries industry has been fishing at its maximum rate of production for the past two decades, making it unlikely to be a significant part of the solution to dramatically increase the global seafood supply. It is the aquaculture sector, which has maintained the largest annual growth rate within the food production sector (averaging 8.8 percent per year from 1980—2010), which is better positioned to increase its production to meet future seafood needs.

Aquaculture currently provides 41 percent of the world's supply of seafood.[3] However, aquaculture operations are beginning to run into space and resource constraints that will soon force the industry to increase production through efficiency and improved techniques, rather than sheer expansion. One of the most promising approaches to increasing the efficiency and productivity of aquaculture operations is the utilization of genetic technologies.

As part of ongoing efforts by the FAO Fisheries and Aquaculture (FI) Department to prepare the first report on The State of the World's Aquatic Genetic Resources for Food and Agriculture (SoWAqGR), a report entitled "Adoption and Application of Genetic Technologies in Global Aquaculture Industries: Status and Trends" was compiled. Broadly, the report aims to address how responsible use of genetic principles and technologies can help the aquaculture industry become more productive and efficient while also protecting invaluable aquatic genetic resources in the wild.

Aquaculture has generally lagged behind other animal food industries in the use of genetic technology for improved commercial production purposes. However, the industry has seen increasing interest in various genetic technologies in recent years. A preliminary scoping survey of aquaculture industry magazines, newspapers and websites suggests that the industry is currently most focused on technologies for improving selective breeding, disease management and genetically engineered organisms (See Figure 1, next page).[4]

Short-term genetic technologies (including triploids and mono-sex populations) and the development of genetically engineered feed are also of industry interest. Methods for increasing industry traceability, which includes the use of genetic markers to trace a fish throughout the supply chain or to differentiate farmed escapes from wild individuals, appears to be a small, but increasing focus for the industry (Figure 1).

While traditional selective breeding programs have been implemented for some fish species and have shown good results, at present less than 10 percent (roughly 8.2 percent) of global aquaculture production is derived from species that have been domesticated or undergone selective breeding programs. Both traditional selective breeding programs and more advanced techniques, such as Marker-Assisted Selection (MAS), have potential to increase productivity through improving growth rates and disease resistance.

A successful example of a traditional selective breeding program is the Genetically Improved Farmed Tilapia (GIFT) project for Nile tilapia (*Oreochromis niloticus*). In the late 1980's, eight different populations of Nile tilapia indigenous to Africa were pedigreed and began to be bred

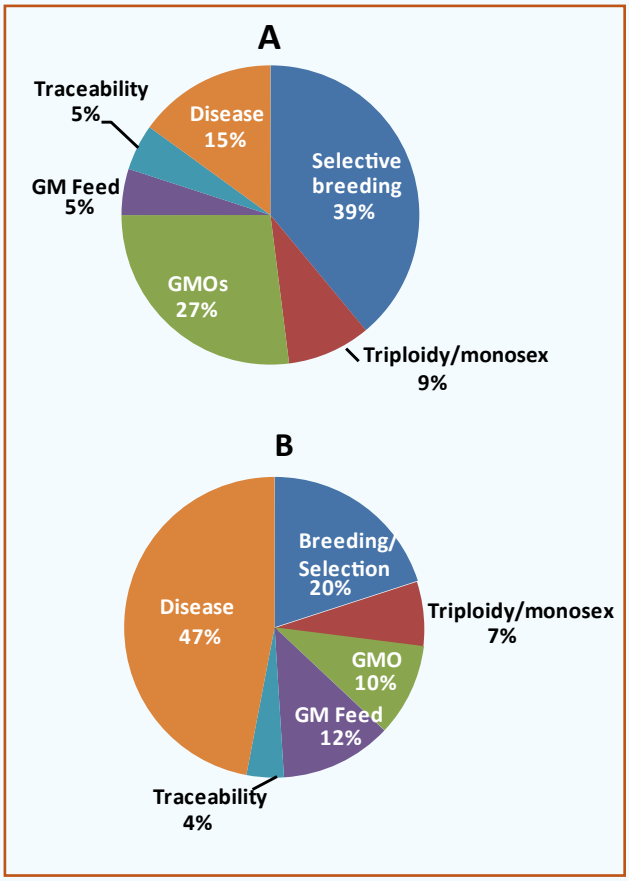

Figure 1. A survey of industry interest in various categories of genetic technologies related to aquaculture. Both print and web resources were reviewed and the articles addressing genetic technologies were recorded according to the specific technology that the article featured. A - Survey of 118 articles from the industry website, The FishSite.com. Search results from the keyword "genetics" were evaluated. B - Survey of 108 articles from 17 issues of the newspaper, Fish Farming International

for maximum genetic gain. The GIFT project ultimately succeeded in achieving an accumulated 85 percent genetic gain in growth performance after 6 generations of breeding.

Furthermore, recent developments in advanced selective breeding, particularly MAS, may help to improve both the accuracy and selection intensity of selective breeding programs. While the use of MAS at the commercial scale in aquaculture is still relatively uncommon, advanced breeding programs for salmonids, especially Atlantic salmon, serve as successful proof-of-principal examples. For instance, MAS is now used to breed Atlantic salmon populations resistant to infectious pancreatic necrosis (IPN), which previously caused substantial losses and large-scale antibiotic use in the salmon industry.

As with all farmed aquatic species, the primary risk associated with selective breeding techniques is escapes. If farmed escapes are fertile, they can interbreed and compete with wild populations. These interactions can negatively influence the genetic constitution of wild populations. Physical isolation and sterility are common approaches to mitigating escape risk.

While proper selective breeding programs require significant time and resource investments, the technique presents significant opportunities for increasing production within the aquaculture industry. Gjedrem *et al.* (2012) recently estimated the average yearly genetic gain from selective breeding programs in aquaculture species to be 5.4 percent. Using this statistic, if 100 percent of total global aquaculture production were based on genetically improved stock instead of the current 10 percent, total worldwide aquaculture production would be doubled in approximately 13 years, without requiring further industry expansion.[5] Thus, widespread genetic improvement programs in the aquaculture industry would represent a critical step towards filling the gap between seafood production and increasing global demand. While there is much media attention on the development of transgenic (genetically modified, GM) fish, no GM fish is currently approved for human consumption. Genetic modifications have been shown to effectively increase growth rates and reduce cultivation time for species such as Atlantic salmon, but substantial questions persist regarding potential hazards to human health and the environment. These risks, in combination with a challenging regulatory atmosphere and apprehensive consumer perceptions, raise doubt over whether transgenic fish will be available in the near future.

Short-term genetic technologies such as polyploidy and mono-sex populations can significantly increase production outcomes, especially when used in combination with selective breeding programs. In particular, polyploids (organisms with an extra chromosome) are often sterile and their use in aquaculture can reduce the risk of escapes by rendering farmed fish incapable of breeding with wild populations. However, these technologies lack reliability and need to be repeated with each generation. Thus, whether short-term genetic technologies improve the overall efficiency of aquaculture operations should be evaluated on a case-by-case basis.

Reducing the risk of disease outbreaks and epidemics in the aquaculture industry is also a critically important component of ensuring that

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H. Fersoy, FAOSEC

Group photo of participants at the ad-hoc regional training on trout culture

Regional ad-hoc Training on Trout Culture

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The Regional Ad-hoc Training on Trout Culture was held in Fethiye, Turkey from 24 to 28 September 2013. The training was designed as a fully practical training in close cooperation with Alka and Azer Altin Trout Company Ltd. whose total production capacity is > 3 500 tonnes/ year. The main trainers were Mr Ozgur AltanEight participants from Azerbaijan, Kyrgyzstan, Tajikistan and Uzbekistan received a very intensive training that was supported by a simultaneous Turkish-Russian-Turkish interpretation.

The main subjects of the training consisted of the following: spawning broodstocks, incubation, hatchery management, pond management, feeding, grading and transportation. Each participant actively worked during the training period in the three fish farms, each of which has a different production system.

The companies that supported the training had high level facilities with experienced staff on trout culture.

On the last day, A a study tour was organized to Oren Region of Fethiye, where 30 percent of the Turkish trout production (about 35 000 tonnes/ year) comes from. This study tour gave a good opportunity for participants to know understand better different types of farms and different production methods.

The private companies that supported the activity, showed a very good example of collaboration under the FAO's leadership. In addition, synergy created by FAO through this training stressed the important role that private industry can play in the delivery of high level practical trainings in the field.

More information can be obtained by writing to: Haydar Fersoy@fao.org

Photo 1: Twenty eight attendees [from Bosnia and Herzegovina (2), Croatia (16), Macedonia (2), Montenegro (1), Serbia (3) and FAO staff (1) and FAO consultants (3)] contributed to making the training workshop held in in Zagreb, Croatia from 27-31 January 2014, a successful one

Regional Introductory Training Course on the Use of Risk Analysis in Aquaculture

Under the auspices of FAO TCP/RER/3402 "Assistance to Western Balkan Countries for Improving Compliance to International Standards on Aquatic Animal Health", this introductory training workshop on risk analysis in aquaculture particularly for movements of live aquatic animals is the third of a series of capacity development activities which have been recognized by the project's five participating Member nations (i.e. Bosnia and Herzegovina, Croatia, Macedonia, Montenegro and Serbia) as having the highest priority to assist these countries in enhancing their compliance to international standards on aquatic animal health. The overall objective of TCP/RER/3402 is to strengthen regional and national aquatic biosecurity governance and capacities for dealing with transboundary aquatic animal diseases (TAADs), and in the process, improve compliance with international health standards for aquatic animals so that countries are better able to maintain and improve national aquatic animal health status, harmonize standards regionally, and better comply with the health standard requirements of regional and international trading partners.

The training workshop held in in Zagreb, Croatia from 27-31 January 2014, was attended by a total of 28 participants from Bosnia and Herzegovina (2), Croatia (16), Macedonia (2), Montenegro (1), Serbia (3) and FAO staff (1) and FAO consultants (3).

Risk analysis is a complex subject best learned by actual experience

A complex subject, risk analysis is best learned by actual experience. Building capacity on risk analysis as a decision-making tool has become more and more necessary to assist national competent authorities and others involved in the assessment and management of risks associated with the international or domestic moment of live aquatic animals in training professional staff and raising awareness and understanding among other stakeholders of the principles and methodology of risk analysis. FAO uses a structured step-wise process that guides trainees through the risk analysis process as applied in the analysis of ecological, genetic and pathogen risks.

Through the use of lectures (via 11 PowerPoint presentations), case study scenarios (three scenarios were used for TCP/RER/3402) and a series of seven linked working group exercises prepared in advance and adapted by trainers to reflect local situations and priorities, the course provided an in-depth look at risk analysis as currently applied for evaluation of risks due to pathogens (import risk analysis). Trainees were guided from the initial process of establishing a commodity description and scoping a risk analysis through to conducting the four risk analysis components of hazard identification, risk assessment, risk management and risk communication.

At the end of the course, as part of Working Group Exercise 7, participants were asked to discuss at country level the following questions: (1) How important is understanding and applying risk analysis to managing introductions and transfers of

Box 1: Working Group Exercises

Working Group Exercise 1: Identifying Issues and Potential Risks in Proposals for Species Translocations for Aquaculture Development

Working Group Exercise 2: Identifying Current Risk Analysis Frameworks and Procedures

Working Group Exercise 3: Pathogen Risk Analysis: Scoping to Preliminary Hazard Identification

Working Group Exercise 4: Determining an Appropriate Level of Protection (ALOP)

Working Group Exercise 5: Case Studies: Pathogen Risk Analysis –Estimating Risk of Exposure, Release & Consequence; Calculating a Risk Estimate

Working Group Exercise 6: Case Studies: Pathogen Risk Analysis – Risk Management

Working Group Exercise 7: Implementing Risk Analysis –Identification of Needs and Recommendations

aquatic species to/within your national territory?; (2) Rank the 7 areas of risk analysis according to their importance to sustainable aquaculture development in your country (financial, social, environmental, pathogen, food safety and hygiene, genetic, ecological (including pests and invasives); (3) What are the main problems/constraints to applying risk analysis in your country (list from highest to lowest importance) (for example, consider the general areas of budget, infrastructure, legislation, knowledge, manpower, capacity, etc.); (4) For each constraint, list some possible solutions (these should be practical and have a real possibility of being implemented, even if no external funding is obtained); and (5) What other recommendations would the WG like to make to their national competent authorities or to FAO?

Further information about introductory training courses on the use of risk analysis in aquaculture particularly for movements of live aquatic movements - can be obtained by writing to Melba.Reantaso@fao.org

Photos 2-6: At the end of the training course, participants from the 5 Western Balkan countries discussed and provided responses to the 5 questions that were part of Working Group Exercise No. 7

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aquaculture production continues to meet rising demand. Risk factors for disease epidemics such as intensifying farm systems, globalization and lack of sufficient regulation all threaten to further increase future losses within the aquaculture industry due to disease.

However, fish disease management tools such as vaccines and molecular disease diagnostics have already proven to be important in improving the safety and efficiency of aquaculture farms. Currently, 95 percent of salmon smolts produced in Norway in 2012 (approximately 300 million fish) were vaccinated against six different diseases. Antibiotic use in Norwegian farmed salmon has correspondingly dropped drastically.

Finally, the aquaculture industry is currently reliant on stocks of smaller, wild fish as the source of omega-3 fatty acids in the diet of most aquaculture species. As an alternative, preliminary research is being conducted on genetically engineering plants capable of omega-3 fatty acids production in order to reduce industry dependency on wild fish stocks.

As suitable sites for aquaculture operations decline and fish meal & fish oil needed for omega-3 fatty acids sources become scarce, increased production efficiency through genetic technology will become increasingly critical for the aquaculture industry to meet future seafood demand. Proper assessment and regulation of these technologies will be essential to reducing the risks. Coordinated and sustained funding should be sought from a variety of government, non-profit and private sector groups to ensure continued improvement and dissemination of genetic technologies throughout the aquaculture industry.

[1]Original article published in Fish Farming International
[2]FAO. 2012. The State of World Fisheries and Aquaculture 2012. Rome. 209 pp.
[3]Ibid.
[4]Genetically engineered or genetically modified organisms are defined in this study as living organism that possesses a novel combination of genetic material obtained through the use of modern biotechnology. [FAO. 2000. The State of World Fisheries and Aquaculture 2000. Rome. 142 pp.]
[5]Gjedrem, Trygve, Nick Robinson, and Morten Rye. "The importance of selective breeding in aquaculture to meet future demands for animal protein: A review." Aquaculture 350 (2012): 117-129.

New Staff Profile

FIRA welcomes 4 interns and 1 volunteer under the FAO Internship[1] and Volunteer Programme[2]

ANDREA DALL'OCCO, Italian (Volunteer)

Dr Andrea Dall'Occo, has a master's degree in veterinary medicine (2012) and a bachelor's degree on aquaculture and icthyopathology (2006) both from the university of Bologna. he was admitted to the veterinary surgery profession having passed the italian state examination in 2012. As a volunteer for 3 months from 15 february 2014 until 15 may 2014, he will be under the overall supervision of Dr Rohana P. Subasinghe, Branch Chief, and under the direct supervision of Dr Melba B. Reantaso (Aquaculture Officer – Aquatic Animal Health) and will be engaged in the following activities:

- literature research on: (i) aquaculture losses due to diseases and farm level biosecurity practices – towards a review paper; and (ii) emergency preparedness and contingency plan for aquatic animal disease outbreaks and present it during the Regional Workshop on Emergency Preparedness and Contingency Planning under TCP/RER/3402 to be held in Macedonia in April 2014;
- assist in writing Technical Cooperation Project (TCP) proposals on aquatic animal health management; and
- participate in the daily 15 min global disease (including aquatic diseases) tracking seminar (from 08.45-09.00 hrs – GLEWS disease tracking seminar) organized by the Animal Health group of FAO.

Andrea Dall'Occo can be reached by email: Andrea.Dallocco@fao.org

[1]http://www.fao.org/employment/opportunities-for-students-and-young-graduates/internship-programme/en/. Interns receive a monthly stipend from FAO up to the amount of USD700. In some cases, the terms of sponsored internships may vary depending upon the agreement between FAO and the institution sponsoring the intern.

[2]http://www.fao.org/employment/volunteering-with-fao/en/. Volunteers are not paid by the Organization; The costs and organization of travel, accommodation and living expenses both to reach the duty station and during assignment are the responsibility of the Volunteer.

XUE YAN, Chinese (Intern)

Ms Xue Yan (or Alice), graduated from Nanjing Agriculture University with a Master's Degree in Information Science, has been working with the Chinese Academy of Fishery Sciences for a year at the Department of Information and Economic Research Center. Her main tasks are to apply what she has learned to her work, help colleagues find information they need, conduct research and write study reports based on that research. She has participated as a core researcher in two research projects on "Evaluation of competence in research based on scientific literature". During a 6-month internship (from February to July 2014) under the supervision of Dr. Junning Cai in close collaboration with other officers, her main activity is to update and refine the World Aquaculture Performance Indicators (WAPI) tool based on FAO and other official data. She will also undertake online training provided by FAO and perform other duties that would help her learn how FAO works.

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JIANBO LUO, Chinese (Intern)

Mr Jianbo Luo, obtained a Bachelor of Science on Environment Sciences from Sichuan University (2008), and a Master of Science on Environment Sciences from Nankai University (2011). His master degree thesis was on "Monitoring persistent organic pollutants (POPs) in water". He is currently working as a Research Assistance at the Department of Fishery Resources and Environment of the Chinese Academy of Fishery Sciences (CAFS). This department is responsible for monitoring and assessing the environment quality of fishery waters (fresh and sea water) in China. It has 47 monitoring stations all over China and covers the main fishery waters (seas, main inland rivers and lakes). His duty at CAFS concerns making monitoring plans, collecting the monitoring results, analyzing the data and writing the report on an annual basis to the State of Fishery Eco-environment in China, a joint publication by the Ministry of Agriculture and the Ministry of Environment Protection of China. He also assists aquaculture experts and environment experts in training fishery administrators in the assessment of damages and losses when a pollution accident happens. On average, about 200-300 people are trained every year. During a 6-month internship (from February to July 2014) under the supervision of Dr. Nathanael Hishamunda in close collaboration with other officers, his main activity is to review and comparatively assess the resource and environmental dimensions in aquaculture policies, strategies and plans worldwide with a focus on China. He will also undertake online training provided by FAO and perform other duties that would help him learn how FAO works.

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MINMIN LEI, Chinese (Intern)

Ms Minmin (Tina) Lei obtained a Bachelor of Arts in English Literature (2008) and a Master of Arts in Law (2011) from Beijing University of Chemical Technology. She acquired her legal professional qualification in 2011. She worked for two years at the Department of Personnel at the Chinese Academy of Fishery Sciences. She always seeks opportunities to enrich her knowledge. She published an article on Sustainable Development of China's Fishery Industry in the journal Outlook of Agriculture published by the Chinese Academy of Agriculture. Before coming to Rome, she had an internship at the Fisheries Bureau of the Ministry of Agriculture where her knowledge was extended and her interest in fishery policy and law making has further been developed. During a 6-month internship (from February until July 2014), under the supervision of Mr Uwe Barg and other officers she will work Aquaculture Policies for Food Security and Nutrition, and related capacity development needs and strategies in China, at national level and in selected provinces. She will also undertake online training provided by FAO and perform other duties that would help her learn how FAO works.

Tina Lei can be reached by email: Minmin.Lei@fao.org

LIE WANG, Chinese (Intern)

Mr Lie Wang, currently studying to obtain a Master of Agriculture in Aquaculture from Shanghai Ocean University, has research interests in aquaculture and biology. His thesis for his Bachelor of Science degree (2011) is about "Selective breeding of high-temperature-tolerant algae". He had a previous internship as Aquaculturist in Jiangsu Zhongyang Group in 2010, where he undertook the cultivation of live food organism for different development stages of puffer fish. After obtaining his bachelor's degree, Lie chose molecular biology studies of clam as his research topic for the master's programme; he also trained in the field of aquatic nutrition under this programmme. With only half a year to get his master's degree, he has published a paper on Detection of Single Nucleotide Polymorphism from Razor Clam and obtained a patent applied in aquaculture. As an intern, Lie hopes to contribute what he has learned to FAO and gain global aquaculture experience. During a 4-month internship period (9 January to 7 May), he will work under the supervision of Dr. Mohammad R. Hasan in close collaboration with Mr Valerio Crespi and Mr Pietro Gentiloni and will contribute/work on the following tasks:

- improvement of FI Web site Aquaculture Feed and Fertilizer Resources Information System (AFFRIS) (http://www.fao.org/fishery/affris/en/);
- completion of twenty one main aquatic species profile;
- compilation of aquaculture websites and information sources; and
- literature search on aquafeed regulation and standards from the top three aquaculture countries.

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DR TIPPARAT PONGTHANAPANICH
Aquaculture Officer (Economics)

A national of Thailand, Dr Pongthanapanich obtained her Ph.D. in Economics from the University of Southern Denmark, in 2006, a M.Sc. in Agricultural Economics (1995) and B.Sc. in Fisheries (1992), both from Kasetsart University (Thailand).

At Kasetsart University, she was Assistant Professor at the Department of Agricultural and Resource Economics, Faculty of Economics, since 1996. Her teaching and research activities were in the fields of aquaculture economics, agricultural economics, environmental economics and interdisciplinary natural resource management. Dr Pongthanapanich was Editor-in-Chief of Applied Economics Journal, from 2007 to 2014. She worked for the Network of Aquaculture Centres in Asia and the Pacific (NACA) as Research Associate in 1994, and later with the Thailand Development Research Institute (TDRI) in 1995. Dr Pongthanapanich also brings with her a wealth of field experience, having worked on several aquaculture and non-aquaculture projects for many years.

At FIRA, Dr Pongthanapanich will focus her work on assessing and monitoring the social and economic performance of the aquaculture sector at the global, regional and national levels, especially on employment and insurance.

FIRA team eagerly welcomes her aboard and is looking forward to helping her fill the technical void it has experienced for some time.

NGUYEN SONGHA
Assistant FAO Representative for Viet Nam (Programme)

Mr Nguyen Songha joined FAO as Assistance FAO Representative (Programme) in February 2014. Mr Songha obtained a Bachelor of Arts in Judiciary Law (1999) from Hanoi Law University and a Master of Law (2010) from the Vietnam National University. Prior to joining FAO, he served as Consultant for Fisheries Co-Management under the Coastal Resources for Sustainable Development Project of the World Bank (September 2013 to February 2014); National Project Coordinator of the FAO/Spanish Government Regional Fisheries Livelihoods Programme for South and Southeast Asia (GCP/RAS/237/SPA) from October 2010 to August 2013. From October 2009 until July 2010, he served in various capacities as interpreter, researcher and Project Manager of fisheries-related projects; and from July 1999 to October 2002, he served as short-term consultant at various fisheries and aquaculture-related projects of FAO, NACA, European Union, University of Stirling, Japan Bank for International Cooperation. From October 2002 to September 2007, he served as National Communications Hub Manager of NACA. He brings with him a wealth of experience in the field of fisheries and aquaculture.

JIANSAN JIA
Deputy Director
Fisheries and Aquaculture Resources Use and Conservation Division (FIR)
Fisheries and Aquaculture Department

Effective 01 January 2014, Mr Jiansan Jia assumes the post of Deputy Director of the Fisheries and Aquaculture Resources Use and Conservation Division (FIR) of the FAO Fisheries and Aquaculture Department.

A Chinese national, Mr Jia joined FAO on 14 March 1998 as Chief of the then Inland Water Resources and Aquaculture Service (FIRI) of the Fishery Resources Division after occupying several senior positions in a number of institutions under the Government of China. There, he supervised and coordinated bilateral and multilateral cooperation with various governmental and international organizations in the fields of agriculture, animal husbandry and fisheries and aquaculture.

Since joining FAO in March 1998, continuously and without fail, Mr Jia has provided leadership and vision to the Fisheries and Aquaculture Department on aquaculture with the aim of promoting a technically fit, environmentally friendly, economically feasible and socially equitable sector development worldwide. After 16 years in FAO, Mr Jia's balance sheet is too heavy to display here. Some milestones of his career with the Organization are worth noting.

Mr Jia's relentless efforts led to raising aquaculture flag high in many FAO member countries' development agenda. With his leadership and dedication, Member countries successfully established the FAO Committee on Fisheries' Sub-Committee on Aquaculture in 2001, which has since convened seven successful sessions. In partnership with other major players in the sector, Mr Jia effectively organised two Global Conferences on Aquaculture, in 2000 and 2010, respectively. These two events were defining moments, occurring as they did, at the turn of the millennium and helping the world to shape the development of aquaculture for many years ahead. Owing to his long-standing experience in international cooperation, Mr Jia harnessed "South-South Cooperation" in aquaculture, and, as a result, cooperation within and between Africa, Asia, Latin America and the Caribbean regions has improved, boosting training, capacity building, and technology transfer and diffusion within and across regions. Networking has also become an important vehicle for inter- and intra-regional cooperation. Hence, the Aquaculture Network for Africa (ANAF), the Network of Aquaculture of the Americas (NAA) and the Network of Aquaculture Centres in Central Eastern Europe (NACEE) were born. Cooperation between the Network of Aquaculture Centres in Asia-Pacific (NACA) and the rest of the developing world was enhanced.

At a time where the world is searching for means of closing the expected gap between the demand and supply of fish and fish products in years ahead, Mr Jia's appointment to this important post cannot be any timelier. Mr Jia envisions a world where aquaculture develops and fisheries management evolves in such a way as to supply humanity with adequate and safe fish and fish products while creating decent employment, reducing rural and urban poverty, and significantly contributing to national economies. Let us join hands to convey our heartfelt congratulations and best wishes to Mr Jia. His promotion is a sign of dedication, sacrifice and success. Let us bid him our lasting support for further success. His success is our success.

ROHANA SUBASINGHE
Chief
Aquaculture Branch

Dr Rohana Subasinghe has been appointed as the Chief of the Aquaculture Branch (FIRA) of the Fisheries and Aquaculture Resources Use and Conservation Division (FIR), FAO Fisheries and Aquaculture Department, effective from March 2014.

A Sri Lankan professional with passion for leadership and community service and a founding member of the Fish Health Section of the Asian Fisheries Society, he joined FAO in 1994 as the first designated Aquatic Animal Health Officer of then Fisheries Department. In an era where transboundary aquatic animal diseases have become a major threat to aquaculture development, his main responsibility was to advise FAO Members on aquatic animal health issues. Within a very short period, Rohana established a sizable global programme on aquatic animal health, bringing together a large number and variety of partner institutions worldwide to assist FAO Members. From 1994 through 2000, he designed, formulated and implemented many regional and national programmes and projects and produced many high quality technical publications and manuals. He engaged in extensive and at times complicated frontline negotiations and discussion with FAO Members and regional organizations, and brought together several important regional agreements and consensus which resulted in significant policy changes at national and regional levels. After six years of service, Rohana was appointed as a Senior Aquauclture Officer in 2000.

As a Senior Aquaculture Officer, he assisted the Chief of the Aquaculture Service in formulating the service's Programme of Work and Budget (PWB). He provided leadership in coordinating staff groups and implementing the service PWB. Besides his long engagement with aquatic animal health, he was also responsible in status and trends analysis and reporting on global aquaculture, serving as the Technical Secretary to the COFI Sub-Committee on Aquaculture (COFI/SCA), which was established in 2002. He has over the years organized and conducted many expert consultations and workshops, several technical consultations, two international coinferences and all seven sessions of the COFI/SCA. He had been in the forefront of developing FAO technical guidelines on aquaculture certification, agreed by the FAO Members in 2010. His continued efforts resulted to the recent approval of the conformity assessment framewok for aquaculture certification schemes. He was responsible in assembling the first ever Asia Regional Ministerial Meeting on Aquaculture, bringing seventeen Asian countries together, which resulted in Colombo Declaration - an Asia Regional Ministerial Declaration on Aquaculture Cooperation, in Colombo, Sri Lanka in 2011.

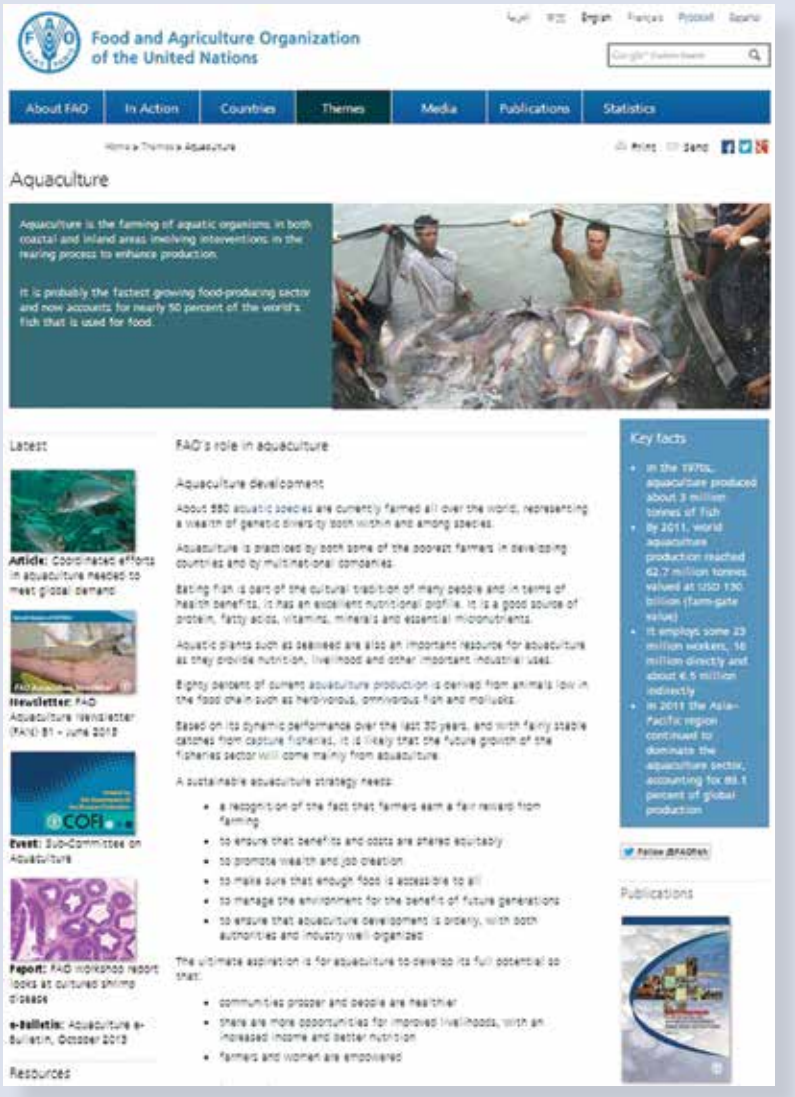
During the recent FAO restructuring and reform process, he took up additional responsibilities in representing the Fisheries and Aquaculture Department in various FAO bodies and task forces.

More recently, he was successful in establishing the Global Aquaculture Advancement Partnership (GAAP) programme, which has now become the aquaculture pillar of the FAO's global initiative, Blue Economy. He has been a strong advocate of aquaculture development globally. All these invaluable experience in leadership, management, communication, negotiation, and working closely with FAO Members on technical, political and geo-political issues related to aquaculture, paved his way to take up the new responsibilty as the Chief of the Aquaculture Branch from March 2014.

Continued on page 47

The New FAO Aquaculture Thematic Page

The Aquaculture Branch (FIRA) recently developed an aquaculture thematic page for the new fao.org web site. The FAO thematic pages have been conceived to provide a general overview of the main areas of work of the organization. In particular, the aquaculture theme has a section highlighting the key facts of aquaculture development and the body of the page gives a global view of the main characteristics of the sector. The page contains linkages to publications, production statistics, glossary, fact sheet collections, spatial analysis tools and photo library as well as other relevant FAO aquaculture web sites.



www.fao.org/aquaculture/en

Users who wish to learn more about FAO aquaculture ongoing activities are invited to subscribe the electronic aquaculture bulletin (www.fao.org/fishery/e-bullettin/en) which is produced and disseminated four times a year via e-mail.

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FAO. 2011. Aquaculture development. 6. Use of wild fishery resources for capture-based aquaculture. *FAO Technical Guidelines for Responsible Fisheries* No. 5, Suppl. 6. Rome. 81 pp.

These technical guidelines have been produced to supplement the FAO Code of Conduct for Responsible Fisheries (the Code). The Code and many international agreements and conferences highlight the benefits of and need for adopting an ecosystem approach to fisheries and an ecosystem approach to aquaculture through the principles and concepts elaborated therein. The objective of the guidelines is to assist countries to develop aquaculture, in particular that involving significant use of natural resources, in a sustainable way that produces the greatest social and economic benefits without compromising the underlying resource base for future generations. The heavy dependence of capture-based aquaculture (CBA) on wild resources and its implications for wild populations have been increasingly recognized in the last decade. These guidelines address the actual and potential impacts of wild-seed harvest on target and non-target (bycatch) species (including threatened species), on biodiversity, and on the environment and marine ecosystem. The guidelines also consider harvest and post-collection practices, grow-out, feed and broodstock, social and economic factors, and governance considerations. They also identify CBA principles and guidelines for good practices, and provide numerous illustrative case studies from a diverse range of species and fisheries.

The PDF publication can be found at the following url: http://www.fao.org/docrep/014/ba0059e/ba0059e.pdf
This publication is now available in ALL six official languages of the organization and have been included in the FAO Corporate Document Repository:

Arabic - Pdf:
http://www.fao.org/docrep/019/ba0059a/ba0059a.pdf
Title of the publication:
تطوير تربية الأحياء المائية. 6. استخدام الموارد السمكية الطبيعية في تربية الأحياء المائية القائمة على الصيد. الخطوط التوجيهية الفنية لمنظمة الأغذية والزراعة بشأن الصيد الرشيد. ملحق رقم 6، رقم.5

Chinese - Pdf:
http://www.fao.org/docrep/019/ba0059c/ba0059c.pdf
Title of the publication:
水产养殖的发展. 6. 将野生渔业资源用于以捕捞为基础的水产养殖. 5 补编 6.

French - Pdf:
http://www.fao.org/docrep/019/ba0059f/ba0059f.pdf
Title of the publication:
Dévelopment de l'Agriculture 6. L'utilisation des ressources halieutiques sauvages pour l'aquaculture fondée sur les captures. Directives techniques pour une pêche responsable de la FAO No. 5. Supplement 6.

Russian - Pdf:
http://www.fao.org/docrep/019/ba0059r/ba0059r.pdf
Title of the publication:
РАЗВИТИЕ АКВАКУЛЬТУРЫ. 6. Использование диких рыбных ресурсов для аквакультуры, основанной на вылове диких гидробионтов для выращивания в искусственных условиях. 5 Приложение 6.

Spanish - Pdf:
http://www.fao.org/docrep/019/ba0059s/ba0059s.pdf
Title of the publication:
FAO. Desarrollo de la acuicultura 6 - Uso de recursos pesqueros silvestres para acuicultura basada en la captura. FAO Orientaciones Técnicas para la Pesca Responsable.

For further information, or for requesting a hard copy contact:
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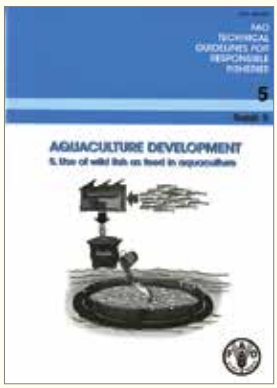

FAO. 2011. Aquaculture development. 5. Use of wild fish as feed in aquaculture. *FAO Technical Guidelines for Responsible Fisheries.* No. 5, Suppl. 5. Rome. 79 pp. Now available in French, Russian and Spanish.

These technical guidelines on the use of wild fish as feed in aquaculture have been developed in support of Article 7 (responsible fisheries management) and Article 9 (aquaculture development) of the FAO Code of Conduct for Responsible Fisheries, and in particular in support of Articles 9.1.3, 9.1.4 and 9.4.3. The objectives of the guidelines are to contribute towards the development of aquaculture and the sustainable utilization of feed-fish stocks. The guidelines cover a number of issues relevant to the use of wild fish in feeds in aquaculture, including ecosystem and environmental impacts, ethical considerations on the responsible use of fish as feed, aquaculture technology and development, and statistics and information needs for managing the development of aquaculture. Specific matters relating to the management of fishery resources that may be used as feeds are briefly considered in these guidelines, as these have been dealt with in detail in separate FAO guidelines relating to fisheries management and which, inter alia, would also apply to feed-fish fisheries. The guiding principles for these technical guidelines were developed and adopted at the FAO Expert Workshop on the Use of Wild Fish and/or Other Aquatic Species as Feed in Aquaculture and its Implications to Food Security and Poverty Alleviation, 16–18 November 2007, Kochi, India.

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FAO/Regional Commission for Fisheries. 2013. Report of the Regional Technical Workshop on a 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. 127 pp.

The Regional Technical Workshop on a Spatial Planning Development Programme for Marine Capture Fisheries and Aquaculture, held in Cairo, the Arab Republic of Egypt, from 25 to 27 November 2012, was attended by 12 delegates from 6 member countries of the Regional Commission for Fisheries (RECOFI) and FAO. The workshop achieved four objectives: (i) it created awareness and initiated capacity building through a technical seminar on spatial planning for marine capture fisheries and aquaculture – it received feedback from each RECOFI country presentation on recent and relevant spatial planning projects; (ii) it presented the results and analysis of the "RECOFI Spatial Planning Development Programme for Marine Capture Fisheries and Aquaculture Questionnaire Survey"; (iii) it prepared and finalized a "Proposal for a Spatial Planning Development Programme for Marine Capture Fisheries and Aquaculture" in RECOFI member countries based on the survey outcomes, workshop deliberations and brainstorming; and (iv) it identified potential pilot projects on marine capture fisheries and aquaculture, which were later elaborated in detail by international consultants after the workshop and in consultation with workshop participants.
The workshop report can be downloaded at http://www.fao.org/docrep/018/i3362e/i3362e00.htm
The workshop report was presented and adopted at the Seventh Session of RECOFI in Tehran, Islamic Republic of Iran, from 14-16 May 2013. The Commission noted that efforts by RECOFI Member countries will need to be made to obtain funds to proceed with an "operational phase" to implement the spatial planning development programme for marine capture fisheries and aquaculture.

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

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

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Shelton, C. 2014. Climate change adaptation in fisheries and aquaculture – compilation of initial examples. *FAO Fisheries and Aquaculture Circular* No. 1088. Rome, FAO. 34 pp.

This circular contains a selection of current and recent climate change adaptation activities and measures in the fisheries and aquaculture sector. These examples provide an overview of the types of adaptation activities and programmes rather than a comprehensive review of adaptation activities addressing fisheries and/or aquaculture. Some of the highlighted activities are specifically targeted at addressing climate change impacts in fisheries or aquaculture, and others address related areas (e.g. coastal management and capacity building activities) that also have benefits for fisheries or aquaculture. In addition to specific examples, the publication provides an overview of climate change impacts on global fisheries and aquaculture and potential adaptation and mitigation strategies. Descriptions for 26 current or recent activities and programmes focused specifically on or benefiting fisheries and/or aquaculture (and other sectors if relevant), primarily in developing countries, highlight the diversity of potential adaptation actions at the local to regional scales. This circular is intended to provide a starting point for planners, policy-makers and practitioners who are involved in sectors related to fisheries and aquaculture around the globe.
http://www.fao.org/docrep/019/i3569e/i3569e.pdf

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Lovatelli, A., Aguilar-Manjarrez, J. & Soto, D. (eds.) 2013. *Expanding mariculture farther offshore – Technical, environmental, spatial and governance challenges.* FAO Technical Workshop. 22–25 March 2010. Orbetello, Italy. *FAO Fisheries and Aquaculture Proceedings* No. 24. Rome, FAO. 73 pp. Includes a CD–ROM containing the full document 314 pp.

This document contains the proceedings of the technical workshop entitled "Expanding mariculture farther offshore: technical, environmental, spatial and governance challenges" held from 22 to 25 March 2010, in Orbetello, Italy, and organized by the Aquaculture Branch of the FAO Fisheries and Aquaculture Department. The objective of this workshop was to discuss the growing need to transfer land-based and coastal aquaculture production systems farther off the coast and provide recommendations for action to FAO, governments and the private sector. Offshore mariculture is likely to offer significant opportunities for food production and development to many coastal countries, especially in regions where the availability of land, nearshore space and freshwater are limited. The workshop report highlights the major opportunities and challenges for a sustainable mariculture industry to grow and expand off the coast. Furthermore, it recommended that FAO should provide a forum through which the potential importance of the sea in future food production can be communicated to the public and specific groups of stakeholders and to support FAO Members and industry in the development needed to expand mariculture to offshore locations. The proceedings include the workshop report, and an accompanying CD–ROM containing reviews covering technical, environmental, economic and marketing, policy and governance issues, and two case studies on highfin amberjack (*Seriola rivoliana*) offshore farming in Hawaii (the United States of America) and one on salmon farming in Chile.
The proceedings can be downloaded at: http://www.fao.org/docrep/018/i3092e/i3092e00.htm

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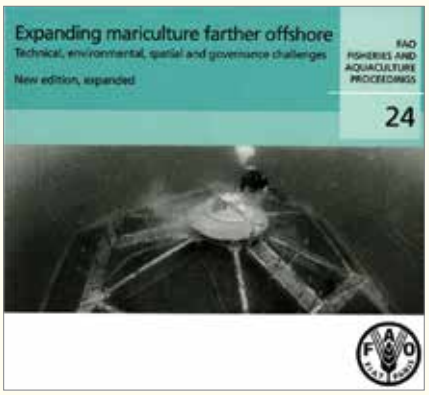

Lovatelli, A., Aguilar-Manjarrez, J. & Soto, D. (eds.) 2013. CD–ROM. New edition, expanded. Expanding mariculture farther offshore – Technical, environmental, spatial and governance challenges. FAO Technical Workshop. 22–25 March 2010. Orbetello, Italy. *FAO Fisheries and Aquaculture Proceedings* No. 24. Rome, FAO.

This document contains the proceedings of the technical workshop entitled "Expanding mariculture farther offshore: technical, environmental, spatial and governance challenges" held from 22 to 25 March 2010, in Orbetello, Italy, and organized by the Aquaculture Branch of the Fisheries and Aquaculture Department of the Food and Agriculture Organization of the United Nations (FAO). The objective of this workshop was to discuss the growing need to transfer land-based and coastal aquaculture production systems farther off the coast and provide recommendations for action to FAO, governments and the private sector. Offshore mariculture is likely to offer significant opportunities for food production and development to many coastal countries, especially in regions where the availability of land, nearshore space and freshwater are limited resources. The workshop report highlights the major opportunities and challenges for a sustainable mariculture industry to grow and further expand off the coast. Furthermore, it recommended that FAO should provide a forum through which the potential importance of the sea in future food production can be communicated to the public and specific groups of stakeholders and to support FAO Members and industry in the development needed to expand mariculture to offshore locations. This CD–ROM publication includes the workshop report, six reviews covering technical, environmental, economic and marketing, policy and governance issues, and two case studies on highfin amberjack (Seriola rivoliana) offshore farming in Hawaii (the United States of America) and one on salmon farming in Chile. As an additional output derived from the workshop, FAO Fisheries and Aquaculture Technical Paper No. 549 entitled A global assessment of offshore mariculture

Hasan, M.R. & New, M.B., (eds.) 2013. On-farm feeding and feed management in aquaculture. *FAO Fisheries and Aquaculture Technical Paper* No. 583. Rome, FAO. 67 pp. Includes a CD–ROM containing the full document 585 pp.

This technical paper provides a comprehensive review of on-farm feeding and feed management practices in aquaculture. It comprises of a) ten case studies on feeding and feed management practices carried out in seven selected countries of Asia and Africa for eight species that belong to four major farmed species of freshwater finfish and shellfish; b) an analysis of the findings of the above ten case studies and a separately published case study for Indian major carps carried out in India; c) ten invited specialist reviews on feed management practices from regional and global perspectives; and d) an overview of the current status of feed management practices. The broad thematic areas that were addressed in these case studies and invited reviews are i) current feed types (including fertilizers) and their use in semi-intensive and intensive farming systems; ii) on-farm feed production and management; iii) feeding and feed management strategies, feed procurement, transportation and storage; iv) environmental, economic, regulatory and legal frameworks of feeding and feed management practices; and iv) identification of research needs. Based on the information presented in the eleven case studies, ten specialist reviews and from other relevant publications, an overview paper presents concluding remarks and recommendations on some of the major issues and constraints in optimizing feed production, use and management.

http://www.fao.org/docrep/019/i3481e/i3481e.pdf
ftp://ftp.fao.org/FI/CDrom/T583/index.htm

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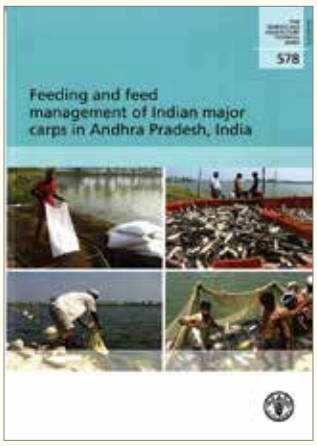

Ramakrishna, R.; Shipton, T.A.; Hasan, M.R. 2013. Feeding and feed management of Indian major carps in Andhra Pradesh, India. *FAO Fisheries and Aquaculture Technical Paper* No. 578. Rome, FAO. 90 pp.

This technical paper reviews the aquaculture of Indian major carps with special reference to current feeding and feed management practices in Andhra Pradesh, India. The study is based on a survey of 106 farmers from four regions in Andhra Pradesh (Kolleru, Krishna, West Godavari, and Nellore). While the study primarily focused on the feed management practices associated with major carp production, management practices that are used under polyculture conditions with other species-groups were also assessed. The study revealed that mash feed was the most popular and widely used feed type. De-oiled rice bran was used as the principal feed ingredient, followed by groundnut cake, cottonseed cake and raw rice bran. The poor quality of the mash feed ingredients, especially the de-oiled rice bran, groundnut cake, and cottonseed cake was an important issue of concern to the farmers. Commercially manufactured pelleted feeds were used by 33 percent of the farmers to complement their mash feeds, with the majority choosing to use sinking pellets. Since 2007, there has been a marked increase in the use of commercial pellets, most notably for the large-scale production of the striped catfish. Grow-out farmers feeding mash feeds used variants of a bag feeding method known as rope and pole feeding. In the nursery and rearing ponds, the commonly used feed ingredients included groundnut cake, de-oiled rice bran and raw rice bran. The most common feeding practice was broadcast feeding. Constraints to Indian major carp production were identified, and research and development needs characterized.
http://www.fao.org/docrep/019/i3146e/i3146e.pdf

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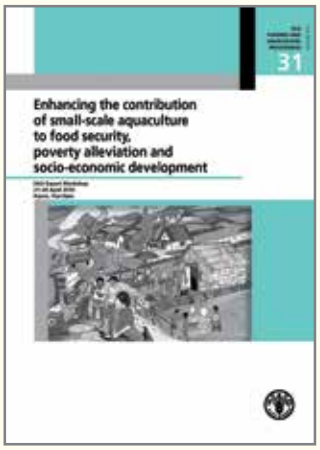
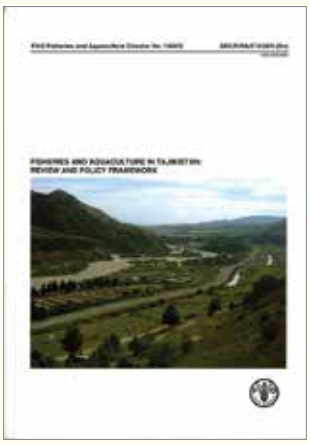


Bondad-Reantaso, M.G. and Subasinghe, R.P., (eds.) 2013. Enhancing the contribution of small-scale aquaculture to food security, poverty alleviation and socio-economic development. *FAO Fisheries and Aquaculture Proceedings* No. 31. Rome, FAO. 255 pp.

About 70–80 percent of all those actors involved in fish farming worldwide are considered small-scale. The small-scale aquaculture (SSA) sector, is recognized as making an important contribution to food security, poverty alleviation and socioeconomic development. However, assessing its contribution in a systematic way has been an uphill task. An expert workshop on "Enhancing the contribution of small-scale aquaculture to food security, poverty alleviation and socio-economic development" was convened to: (i) understand SSA and its contribution/potential contribution and challenges/issues facing the sector and the SSA producers; (ii) identify and elaborate on entry points for enhancing its contribution to food security, poverty alleviation and socio-economic development; (iii) identify concrete action plans to strengthen the capacity of SSA producers and households to deal with threats, risks, shocks, crises and emergencies; and (iv) identify elements of a planned Technical Guidelines for Enhancing the Contribution of Small-Scale Aquaculture to Food Security, Poverty Alleviation and Socio-Economic Development within FAO's Code of Conduct for Responsible Fisheries technical guidelines series. Some 38 experts from governmental, inter-governmental, regional and international organizations, and universities participated in this expert workshop.
The report and proceedings of this expert workshop are presented in this publication. Part 1 contains the outcomes of the deliberations of the experts participating in the workshop; Part 2 consists of 18 technical papers presented during the workshop.



Khaitov, A.H., Gafurov, A., van Anrooy, R., Hasan, M.R., Bueno, P.B. and Yerli, S.V. 2013. Fisheries and aquaculture in Tajikistan: review and policy framework. *FAO Fisheries and Aquaculture Circular* No. 1030/3. Ankara, FAO. 90 pp.

The fishery sector currently plays a minor role in development of the rural economy of Tajikistan. Despite the availability of extensive water resources, fish production has fallen from 4 000 tonnes in 1991 to 214 tonnes in 2006. As a consequence, fish consumption per capita has decreased to a level less than 0.5 kg. Aquaculture provided 70–80 percent of the marketed fish before independence. After independence the reform process of the economy led to a partly privatized fishery sector. The poorly managed privatization process negatively affected the fishery and aquaculture sector. Combined with a general economic crisis, limited availability of commercial fish feeds and hatchery equipment, limited investment in research, training and education, the privatization process can be considered disastrous for the sector. At present the sector is slowly recovering but the severe winter in 2007/2008 set back the sector's growth. The principal fishery sector governing body is the Ministry of Agriculture. Scientific research is mainly carried out by the Department of Ichthyology and Hydrobiology under the Academy of Science of Tajikistan and the Faculty of Ichthyology and Physiology of the Tajik Agrarian University. This FAO Fisheries and Aquaculture Circular has three main aims. First, it is intended to inform those interested in fisheries and aquaculture in Tajikistan about the current situation with regard to fishery resources and their utilization in the country. Second, it attempts to provide background information in support of the national sectoral policy and strategy formulation process. Thirdly, it may serve as guidance for future interventions by the government and donors in support of the sustainable development and management of the sector.
http://www.fao.org/docrep/018/i3151e/i3151e.pdf

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FAO. 2013. Report of the FAO Scoping Workshop on Regional Cooperation Programme for Responsible Aquaculture and Fisheries Development in the Central Asian and Caucasian Countries, Urumqi, the People's Republic of China, 4–8 June 2012. *FAO Fisheries and Aquaculture Report* No. 1040. Rome, 60 pp.

The FAO Scoping Workshop on "Regional Cooperation Programme for Responsible Aquaculture and Fisheries Development in the Central Asian and Caucasian Countries" was convened in Urumqi, China, 4–8 June 2012. The workshop report comprises the workshop proceedings and the strategy for regional cooperation, the principal output of the workshop. The workshop recommended seven activities that need to be initiated are as follows: (1) development of regional projects, organization of training/workshops, and capacity development on feed production and management; (2) provision of technologies and equipment for the development and production of specialized fish feeds for different species; (3) training workshop to improve project development skills by actually formulating projects that are based on the identified priorities; (3) an action plan for the upgrading of national laboratories in order to comply with international standards for certification of fish and fish products; (4) workshop on harmonization of institutional management structure and legislation in fisheries and aquaculture in accordance with international fisheries and aquaculture laws/policy; (5) development of an action plan to identify activities for sharing and providing broodstock and seed material that are of high genetic quality, complemented by training on broodstock management; (6) programmes for increasing and conserving endemic fish stocks; and (7) establishing a working group linked to the Technical Advisory Committee of CACFish (Central Asian and Caucasus Regional Commission on Fisheries), to support the follow-up of the scoping workshop recommendations and immediate action plans.
http://www.fao.org/docrep/018/i3382e/i3382e.pdf

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FAO. 2013. Report of the Stakeholder Workshop on the GEF Climate Resilient Fisheries and Aquaculture Development Project in Bangladesh, 29–30 August 2012, Dhaka, Bangladesh. *FAO Fisheries and Aquaculture Report* No. 1056. Rome. 27 pp.

The workshop was hosted jointly by World Fish and the Department of Fisheries (DOF) Bangladesh, with financial assistance from FAO. The 60 workshop participants were policy-makers, professionals and practitioners. Presentations covered the understanding of climate change impacts and fisheries, adaptation for fisheries and aquaculture to the adverse impacts of climate change (CC) in the context of Bangladesh, and the process of Project Identification Form (PIF) development to access global funds for CC adaptation for the least-developed countries. A dozen presentations focused on: (i) CC impacts on fisheries and aquaculture; (ii) global perspective and adaptation funding opportunities; (iii) CC impacts on fisheries and aquaculture in Bangladesh; (iv) CC hotspots in Bangladesh and fisheries; (v) current efforts by government and other actors in addressing CC and fisheries; and (vi) Global Environment Facility (GEF) fisheries project proposal development (PIF) and next steps. Workshop discussions largely focused on CC impacts on fisheries and aquaculture systems, especially some CC-related hotspots (e.g. the coastal zone and haor basins). Participants emphasized the need to enhance understanding of CC impacts through conducting adaptive research on different CC hotspots. They also recommended possible interventions to adapt to CC threats. Sea-level rise, salinity intrusion, cyclones, drought, erratic rainfall, flash flooding and sedimentation were identified as the key CC-related threats to fisheries and aquaculture. Major recommendations included improvement of fisheries-related national policies and strategies by incorporating CC issues, including capacity building of DOF and communities dependent on fisheries and aquaculture for their livelihoods. Discussion also revolved around development of CC-resilient technologies for aquaculture and fisheries management for the CC hotspots in Bangladesh. Based on the workshop recommendations, a PIF for the adaptation of Bangladesh fisheries and aquaculture to CC will be developed with three components: (i) climate-resilient fisheries sector and relevant national capacity development; (ii) strengthening knowledge and awareness of fisheries/aquaculture-dependent communities facing the adverse impacts of CC; and (iii) enhancing local adaptive capacity to support climate-resilient fisheries/aquaculture management and alternative livelihoods in the face of CC.

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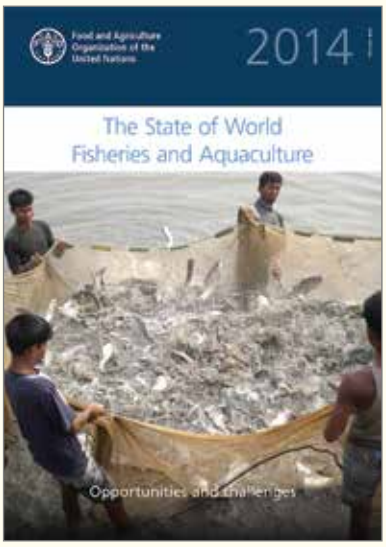

FAO. 2014. The State of World Fisheries and Aquaculture. *Opportunities and challenges.* Rome. 223 pp.

The fisheries and aquaculture sector – a vital source of livelihoods, nutritious food and economic opportunities – has a key role to play in meeting one of the world's greatest challenges: feeding a population set to rise to 9.6 billion people by 2050. This issue of The State of World Fisheries and Aquaculture reveals how aquaculture is continuing its impressive growth, in both increased quantity and improved quality. However, to meet rising demand from a growing population, the sector as a whole needs to increase production sustainably and reduce wastage in a context of climate change, greater competition for natural resources, and conflicting interests. Improved science, technology and governance are all combining with greater global understanding and commitment to help meet the goals of responsible and sustainable use of aquatic resources. In efforts to boost the supply of fish and fishery products, innovative approaches that adopt ecosystem approaches and safeguard social rights aim to secure valuable resources for the benefit of present and future generations.This edition uses the latest available statistics on fisheries and aquaculture to present a global analysis of the sector's status and trends. It also discusses wider related issues such as shark conservation and management, post-harvest losses in small-scale fisheries, and management of inland waters for fish. Selected highlights provide insights on specific topics such as tenure governance and utilization of fisheries by-products. Finally, the document explores the outlook and approaches for meeting future fish demand.

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FAO. 2013. Report of the FAO/MARD Technical Workshop on Early Mortality Syndrome (EMS) or Acute Hepatopancreatic Necrosis Syndrome (AHPNS) of Cultured Shrimp (under TCP/VIE/3304). Hanoi, Viet Nam, on 25–27 June 2013. *FAO Fisheries and Aquaculture Report* No. 1053. Rome, 54 pp.

Under the auspices of the FAO TCP/VIE/3304 (E) Emergency assistance to control the spread of an unknown disease affecting shrimps, being implemented by Vietnam's Ministry of Agriculture and Rural Development (MARD), the FAO/MARD Technical Workshop on "Early Mortality Syndrome (EMS) or Acute Hepatopancreatic Necrosis Syndrome (AHPNS) of Cultured Shrimp" held in Hanoi, Viet Nam from 25 to 27 June 2013 was attended by 63 experts and shrimp aquaculture stakeholders from public and private sectors. The Workshop participants were informed of: (i) relevant findings and outcomes of the work carried out under TCP/VIE/3304 project and (ii) updates on EMS/AHPNS situation and experiences in affected Asian countries. To assist in further understanding this disease in terms of its aetiology additional technical presentations from other experts were given. Nineteen technical presentations provided the basis for discussions on actions and measures to reduce the risk of EMS/AHPNS. The Workshop recognized that complacency in the shrimp aquaculture sector resulting in that laxity, during a period of relatively trouble-free shrimp production, led to vulnerability of the sector to any newly emerging pathogen that might arise unexpectedly, as is the case of EMS/AHPNS. Poor management practices, weak compliance with standard, good biosecurity and good aquaculture practices both at farm and hatchery facilities were evident. It is now clear that shrimp aquaculture needs to improve and continue to develop into a sector that implements responsible and science-based farming practices. With the current understanding that EMS/AHPNS has a bacterial aetiology, a strain of Vibrio parahaemolyticus, the Workshop recommended that a proper name be now given to EMS/AHPNS, i.e. acute hepatopancreatic necrosis disease (AHPND). The Workshop drew a number of recommendations on specific and generic actions and measures for reducing the risk of AHPND, directed to wider shrimp aquaculture stakeholders (public and private sectors) pertinent to important areas such as: AHPND diagnosis; AHPND notification/reporting; international trade of live shrimp, shrimp products (frozen, cooked), and live feed for shrimp; advice to countries affected and not affected by AHPND; measures at farm and hatchery facilities; advice to pharmaceutical and feed companies and shrimp producers; actions on knowledge and capacity development; AHPND

outbreak investigation/emergency response; and specific AHPND-targetted research on various themes (i.e. epidemiology, diagnostics, pathogenicity and virulence, public health, mixed infections, non-antimicrobial control measures, environment, polyculture technologies).

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As the Chief of the Aquaculture Branch, under the general supervision of the Director and the direct supervision of the Deputy Director of the Division, he will coordinate, administer and oversee the Aquaculture Branch and implement the programme activities under the responsibility of the Branch in line with FAO's rules and procedures. In particular, his main responsibilities include: (i) preparing, coordinating and managing detailed FIRA work plans including budget holder responsibility delegated, as appropriate, and the monitoring and reporting on implementation of work plans; (ii) to the level delegated, ensure appropriate management of the staff working in the Branch including their selection, supervision, administration, evaluation, communication and field operations; (iii) participation in the FI Department Management Team activities; (iv) providing technical guidance to the programme activities, collaborating with partners and undertaking technical work in the area of work that the incumbent covers as Technical Officer and developing the strategic direction of the programme and the delivery of advice, technical assistance and back-stopping to field projects; (v) supporting the Director and the Deputy Director to maintain effective links with the decentralized offices in the formulation and implementation of his/her technical area strategies and programmes; and (vi) representing FAO at high-level meetings as required on his disciplinary area or geographic areas covered.

The Thirty-first Session of the Committee on Fisheries (COFI) will be held in Rome from 9—13 June 2014.

The Committee on Fisheries (COFI), a subsidiary body of the FAO Council, was established by the FAO Conference at its Thirteenth Session in 1965.

The Committee presently constitutes the only global inter-governmental forum where major international fisheries and aquaculture problems and issues are examined and recommendations addressed to governments, regional fishery bodies, NGOs, fishworkers, FAO and international community, periodically on a world-wide basis.

COFI has also been used as a forum in which global agreements and non-binding instruments were negotiated.

The next Sub-committee on Aquaculture (SCA) will be held in Brazil in October 2015.

FAO Aquaculture Newsletter

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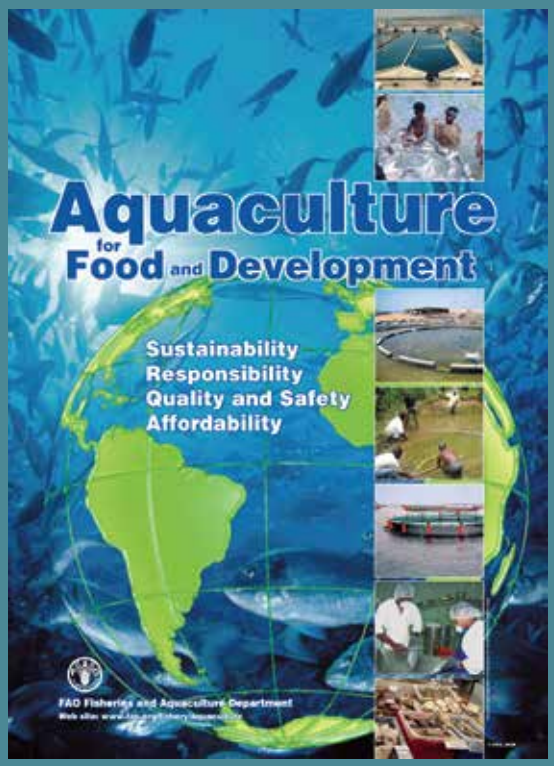
FAN 50, December 2012

FAN 51, June 2013



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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