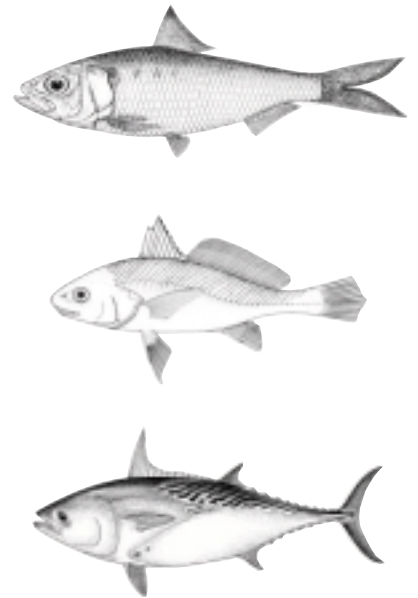


FOURTH APFIC REGIONAL CONSULTATIVE FORUM MEETING

Improving management and governance of  
fisheries and aquaculture in the Asia-Pacific  
region

Da Nang, Viet Nam  
17–19 September 2012





# **ASIA-PACIFIC FISHERY COMMISSION (APFIC)**

## **FOURTH APFIC REGIONAL CONSULTATIVE FORUM MEETING**

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### **Improving management and governance of fisheries and aquaculture in the Asia-Pacific region**

Da Nang, Viet Nam, 17–19 September 2012

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## PREPARATION OF THIS DOCUMENT

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### Distribution:

Participants of the RCFM  
Members of APFIC  
FAO Fisheries and Aquaculture Department  
FAO Regional Fishery Officers



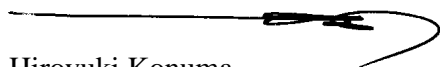
## FOREWORD

The Fourth Asia-Pacific Fishery Commission (APFIC) Regional Consultative Forum Meeting, *Improving management and governance of fisheries and aquaculture in the Asia-Pacific region* was convened in Da Nang, Viet Nam, 17–19 September 2012. As part of the APFIC strategy for communicating issues and building regional understanding, the fourth Regional Consultative Forum Meeting (RCFM) was held to precede the Thirty-second Session of APFIC and acted as a regional briefing on the activities of the Commission and her member countries. It also provided an opportunity to get an update on the work of various regional partner organizations that are relevant to the programme of work of the Commission. The meeting was attended by 73 participants from 16 countries and representatives from 12 regional partner organizations and projects.

The Fourth Regional Consultative Forum Meeting, identified a series of regional challenges based on reviews of regional fisheries and aquaculture, presentations by member countries and regional organizations, and reports of action plans of APFIC regional consultative workshops, and developed concrete recommendations on what needs to be done to address them in the Asian region.

Key challenges included more effective management of the trawl fisheries of the region and the responsible production of fishmeal. Effective fisheries management requires improved understanding of the changes affecting the resources of the fishery sector and increased adoption of science-based approaches to marine protected areas, habitat enhancement and seasonal closures. The RCFM identified the need for stronger governance to address fisheries overcapacity and illegal, unreported and unregulated (IUU) fishing in the region. Recommendations also covered the improvement of small-scale fisheries livelihoods and the need for improved planning and management of aquaculture for food security and social and economic benefit. Inland fisheries were noted as important to the region and the appropriate valuation of the role and importance of these resources was emphasized. Many of these challenges are significantly influenced by the effects of climate variability and the RCFM highlighted the need to take this into account when developing responses to these challenges.

APFIC member countries, regional organizations and partners recognize that the APFIC RCFM is a unique mechanism in the Asian region that allows the sharing of understanding and awareness of fisheries and aquaculture issues in the region and contributes to greater efficiency and reduction of overlap. This is based around one of the core functions of FAO, which houses the Secretariat of APFIC, which is to provide a neutral forum for the consideration of regional challenges in the fisheries and aquaculture subsectors. The Forum also allows greater opportunities for effective networking and coordination between members and regional organizations. I am pleased to see the Asia-Pacific Fishery Commission strengthening these networks and the further contribution of the Commission's work to supporting the region's fishery and aquaculture subsectors.



Hiroyuki Konuma  
Assistant Director General and Regional Representative  
FAO Regional Office for Asia and the Pacific





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## ABBREVIATIONS AND ACRONYMS

APFIC	Asia-Pacific Fishery Commission
ASEAN	Association of Southeast Asian Nations
ARFMM	ASEAN regional fisheries development and management mechanism
BOBP-IGO	Bay of Bengal Programme Inter-Governmental Organisation
BOBLME	Bay of Bengal Large Marine Ecosystem Project
CCRF	Code of Conduct for Responsible Fisheries
COFI	FAO Committee on Fisheries
COFI-AQ	FAO COFI Sub-Committee on Aquaculture
CTI	Coral Triangle Initiative
CTNI	Coral Triangle Network Initiative
EAF	ecosystem approach to fisheries
EEZ	exclusive economic zone
FAO	Food and Agriculture Organization
FMA	Fisheries Management Area
GEF	Global Environment Facility
GHG	greenhouse gases
HACCP	Hazard Analysis and Critical Control Point
ICSF	International Collective in Support of Fishworkers
IPOA	international plan(s) of action
IUU fishing	illegal, unregulated and unreported fishing
LME	large marine ecosystem
MRC	Mekong River Commission
MCS	monitoring, control and surveillance
MPA	Marine protected area
MSC	Marine Stewardship Council
NACA	Network of Aquaculture Centres in Asia-Pacific
NAPA	National Adaptation Programme(s) of Action
NPOA	national plan(s) of action
PSA	Productivity Susceptibility Analysis
RAP	Regional Office for Asia and the Pacific
RCFM	(APFIC) Regional Consultative Forum Meeting
RFLP	Regional Fisheries Livelihoods Programme
RFMAC	Regional Fisheries Management Advisory Committee
RPOA	regional plan(s) of action
SEAFDEC	Southeast Asian Fisheries Development Center
TAC	total allowable catches
TCP	Technical Cooperation Programme
UNFCCC	United Nations Framework Convention on Climate Change
VMS	vessel monitoring system
WCPFC	Western and Central Pacific Fisheries Commission
WorldFish	WorldFish Center
WWF	World Wildlife Fund



## **EXECUTIVE SUMMARY**

The report of the Fourth APFIC Regional Consultative Forum Meeting, *Improving management and governance of fisheries and aquaculture in the Asia-Pacific region*, Da Nang, Viet Nam, 17–19 September 2012.

### **Background to the Fourth APFIC Regional Consultative Forum Meeting**

The Fourth APFIC Regional Consultative Forum Meeting (Fourth RCFM), *Improving management and governance of fisheries and aquaculture in the Asia-Pacific region* was convened at the Sandy Beach Hotel in Da Nang, Viet Nam, 17–19 September 2012. The Meeting was attended by 73 participants from 16 countries and representatives from 12 regional partner organizations and projects. The Meeting was hosted by the Ministry of Agriculture and Rural Development, Government of Viet Nam together with the Food and Agriculture Organization of the United Nations (FAO) and Asia-Pacific Fishery Commission (APFIC) and received additional support from the Bay of Bengal Large Marine Ecosystem Project (BOBLME) and the Spanish funded Regional Fisheries Livelihoods Programme (RFLP).

The Fourth APFIC RCFM was held to precede the Thirty-second Session of APFIC and acted as a regional briefing on the activities of the Commission and her member countries. It also provided an opportunity to get an update on the work of various regional partner organizations that are relevant to the programme of work of the Commission. The APFIC RCFM was requested to develop and agree on ways of implementing policies and action plans developed to address major issues of importance to the region. The Fourth RCFM was organized around six thematic sessions and a final session dedicated to developing RCFM summary recommendations for presentation to the APFIC Thirty-second Session. The thematic sessions were:

- Regional overview of fisheries and aquaculture.
- Regional initiatives promoting improved assessments for strengthening management.
- Country experiences improving fisheries management and the CCRF.
- Adaptation to and mitigation of climate change, livelihoods and support to small-scale fisheries.
- Country experiences improving aquaculture management and the CCRF.
- Priorities and capacity building for implementation of the CCRF.

Based on reviews of regional fisheries and aquaculture, presentations by member countries and regional organizations, and reports of action plans of APFIC regional consultative workshops, the RCFM considered the major issues outlined in the agenda and developed a report and recommendations to inform the APFIC Session. The RCFM recognized the very valid and important work in sustainable fisheries and aquaculture development being undertaken by various APFIC members, regional institutions and processes, notably the ASEAN/SEAFDEC Resolution and Plan of Action Towards 2020, the BOBP-IGO, and the BOBLME. It was also recognized that the regional outcomes developed within this document would contribute to the ongoing activities of these regional organizations and initiatives.

### **Conclusions and recommendations of the Fourth APFIC RCFM**

The APFIC member countries, regional organizations and partners, emphasize that the APFIC RCFM is a unique mechanism in the Asian region that allows the sharing of understanding and awareness of fisheries and aquaculture issues in the region and contributes to greater efficiency and reduction of

overlap. The Forum also allows greater opportunities for effective networking and coordination between members and regional organizations. The RCFM requested that these functions of APFIC be continued and strengthened.

Marine and inland capture fisheries are typified by small-scale operations and high levels of participation, although there are also large-scale commercial/industrial fishing vessels operating throughout the region. The complex combination of numbers of people and geographical range of activities necessarily means that fishery management is a challenge of managing human activity rather than managing fish.

Tools for management using ecosystem approaches exist, but there remains a capacity and awareness gap in practical fishery management at provincial and local levels. Aquaculture now produces more fish for food than capture fisheries in the region. The region maintained strong growth trend in aquaculture production during the 2009/2010 biennium and is making significant progress in improving sectoral performance through increasing implementation of the CCRF. Production growth and performance improvements vary across countries and commodities.

A significant percentage of the region's capture fishery is directed to feed/fishmeal. Within the region, 50 percent or more of fishmeal comes from trimmings, but this often needs to be mixed with fresh fish to increase protein quality.

The region uses 68 percent of its fishmeal for aquaculture production. The majority of this fishmeal usage is directed to coastal aquaculture (freshwater species use relatively little). The successful growth of coastal aquaculture and mariculture utilizing marine fishery resources for feeds is largely underpinned by the products of marine trawl fisheries.

The RCFM was informed of the wide range of activities and initiatives that the APFIC member countries of the region are implementing in direct response to the articles of the FAO Code of Conduct. The range and variety of the actions reflect the huge variety of national contexts and the range of challenges facing member countries as they seek to develop and manage their fishery and aquaculture subsectors.

### ***Some of the key challenges facing fisheries and aquaculture in the region***

- Overfishing, especially in coastal areas, particularly trawling.
- The decline of nearshore resources and deteriorating habitats.
- Ecosystem effects of overfishing, non-selective gears – high proportion of trash/low-value fish.
- The need to sustain and improve the livelihoods of large numbers of small-scale fishers and their communities.
- Socio-economic issues, such as low economic return to fishers and aquaculture farmers; urbanization and other socio-cultural changes significantly changing the structure and performance of the subsectors.
- The migration of labour into fisheries from agriculture and increasing movement of fishing labour between countries.
- The inadequate recognition of the role and place of women in fisheries and aquaculture, and the harvesting, processing and marketing of aquatic products.
- The contribution and role of inland fisheries remains poorly acknowledged and there is a strong need for improved visibility of inland fisheries based on a better understanding of their status and trends.
- Lack of implementation of strategies in addressing fishery management particularly at provincial/local level.



- Lack of political will, collaboration and coordination between agencies to make fishery management more effective.
- Illegal fishing and transshipment, which is undermining management.
- High demand for low-value fish/trash fish for feeds in (marine/coastal) aquaculture in a context where certification of fishmeal and feeds from sustainable fisheries is becoming more important, especially for export markets.
- Aquaculture development remains constrained by some technological bottlenecks e.g. the limited availability of quality formulated feed at reasonable cost, as well as high quality, healthy seed.
- Aquaculture overcrowding leading to environmental impacts and health problems, including concerns regarding residues and contaminants.
- The increasing interest to boost aquaculture production in the region as a source of affordable fish as well as an economic export opportunity must be achieved sustainably and in a socially acceptable manner.
- Changing market demands resulting from economic downturn, changing global trends, and requirements for improved food safety will require new markets and trading measures with a greater focus within Asia.
- Adapting fisheries and aquaculture to and mitigating the impacts of climate change, climate variability and natural disasters.

The trawl fisheries of the region, particularly in coastal areas, provide an opportunity to explore these issues, even in countries that do not have this type of fishery. Effective zoning, combating transboundary IUU fishing and proposals for developing bycatch-based fishmeal production are clear examples where the management needs of trawling affect almost all APFIC member countries in some way.

### ***Challenge 1: Managing the trawl fisheries of the region more effectively***

Can we develop a vision for more effective management of the trawl sector in Asia? A regional vision would seek to balance the demand for fish for human consumption (e.g. fresh/frozen and surimi) and feeds for aquaculture, with the need to sustain ecosystem functions in the marine fishery and improve capture fishery quality. Addressing this challenge will require approaches relating to spatial management, better assessment of fisheries, innovative gear approaches and, importantly, how multigear multispecies fisheries can be managed in a way that yields catch from multiple trophic levels and segments of the fishery (“balanced harvest”).

#### *Regional outcomes*

- Trawl fishery risk-based assessment method developed and available.
- Best practice advice for trawl management available.
- Reduction of trawl bycatch (REBYC II regional outcome).
- Reduction of juvenile catches prioritized over reduction of total effort.
- The composition (species) and locations of capture of the low-value and trash fish component needs to be more clearly elaborated.
- Ecosystem assessment methodology developed and used.
- Ecosystem indicators developed and used to monitor fisheries performance.
- Private sector engaged with management (capture and post-harvest) and driving responsible practice as a regular part of doing business.
- Co-management increasingly implemented as the principal management model for fisheries in the region, inclusive of large, medium and small-scale operators as well as women.

### ***Challenge 2: Providing a better understanding of the changes in fish catch and structure of the fishery sector to manage them more effectively***

It is particularly important to assess ecosystem level changes in relative compositions. Linked to vessel and gear numbers this will allow determinations of appropriate fishing effort/capacity levels in both coastal/shallow water and offshore/deepwater fisheries, and strategies relating to zoning and seasonal measures to limit effort.

#### *Regional outcomes*

- Routine assessments of fisheries undertaken, particularly tracking the percentage catch and landings composition.
- Understanding the structure of the ownership patterns according to different fleet segments.
- Improved knowledge of economic and social structures of fishing (based on improved information about fishing communities).
- Fishing zones evaluated and fishing effort restructured, based on assessment information.
- Production of surimi and other processed products reported both in terms of final product and the raw fish equivalent.
- Sources of fish for surimi clearly identified to assist with food safety, traceability and catch documentation.
- Increased use of logbooks, vessel monitoring system (VMS) and tracking devices for improved monitoring, control and surveillance (MCS) and data collection.

### ***Challenge 3: Producing fishmeal more responsibly in the Asian region***

The composition (species) and locations of capture of the low-value and trash fish component needs to be more clearly elaborated. This is important where this is being directed into fishmeal or feeds so that the real value and or impact of this catch can be properly assessed. This would link to the International Fishmeal and Fish Oil Organisation (IFFO) Global Standard and Certification Programme on Responsible Supply of Fishmeal and Fish Oil (IFFO RS).

#### *Regional outcomes*

- The fish species composition of fishmeal is identified according the fishery/area of production. This would link to the IFFO RS.
- Regional source of responsible fishmeal available (IFFO RS).
- Certified aquaculture feeds based on responsible fishmeal or fishmeal alternatives available in the region.
- Stronger regulations regarding the production and composition of fishmeal.

### ***Challenge 4: Sustaining and improving small-scale fisheries livelihoods***

Small-scale fisheries represent 70 to 87 percent of the fisheries labour and fishing vessels across the region. This takes place in both inland and marine waters. Increasingly, migratory fishing labour is becoming a feature of some fisheries and places additional challenges on fishers' rights, decent work, labour conditions and safety according to national and international standards.

#### *Regional outcomes*

- Countries elaborate a vision for their small-scale fishery sectors.
- Improved (statistical and structural) information on the small-scale fishing sector contributes to raised profile in the development agenda.

- Small-scale fisheries instrument developed and informed by APFIC members responses.
- Promotion of improved livelihoods approaches in small-scale fisheries, particularly through engagement with other development partners and institutions beyond fishery agencies.
- Fishery management zoning and planning that separates the scales of fishing and mitigates impacts/conflicts (see trawl strategy above).
- Allocation and/or safeguarding of rights to resources, fishing zones, and land tenure, to secure the livelihoods fishers and fish farmers.
- Recognition of the contribution of fisheries gleaning/collecting activities and how these relate to resource and habitat management.
- Improved labour and employment conditions for fishing and fish processing labour (including the concerns regarding migratory labour, child labour, and women).
- Improved safety at sea and reduced vulnerability of fishers and fishworkers.

***Challenge 5: Addressing fisheries overcapacity and IUU fishing in the region through more effective governance***

Greater effort is needed to harmonize the records of fishers and fishing vessel employment to reflect employment in large and small-scale sectors. A social profile of labour in the different segments is also needed to inform policies on labour, rights, gender, as well as broader issues relating to migration.

*Regional outcomes*

- National vessel registration systems developed/strengthened in alignment with the requirements of the Global Record of Fishing Vessels, Refrigerated Transport Vessels and Supply Vessels.
- Preliminary measures to control the landing and movement of fishing vessels and products of IUU fishing are put in place.
- Mechanism to report or share IUU information in the region developed (linkage to RPOA work).
- Countries pilot Port State Measures in key ports.
- Traceability of catches strengthened.
- Limits are placed on fishing capacity, and stricter zoning of effort to protect nearshore zone (and reduce conflicts between small-scale and larger-scale fisheries).
- Basic MCS systems strengthened (wheelhouse markings, VMS in larger vessels).
- Fishing labour conditions and rights are in accordance with the International Labour Organization (ILO) Work in Fishing Convention.

***Challenge 6: Increasing the adoption of science-based approaches to marine protected areas, habitat enhancement and seasonal closures***

Spatial and seasonal measures applied in fisheries should be assessed in terms of their fishery effects. The use of science-based approaches to the establishment of marine protected areas (MPAs) and artificial reefs is strongly encouraged. Science and local knowledge should be used to determine key habitats or areas that should be protected/closed.

*Regional outcomes*

- Science-based management methods (that incorporate local knowledge) developed for MPA development, including evaluation of effectiveness for fisheries.

- Science-based identification of refugia/critical habitats (including artificial reefs) and other spatial measures for fisheries are established.
- Seasonal or periodic fishing closures and other temporal measures developed based on scientific information and local knowledge.
- Key habitats (based on depth, spawning or nursery areas or sensitive habitats) are identified and integrated into fishery management plans.
- Artificial reef construction follows science-based planning and supports the separation of large-scale and small-scale fishing operations.
- Fishery resources conservation areas are placed/aggregated so that they contribute to local stock recruitment and other fishery benefits.
- Inland fishery habitats and water connectivity in refugia are managed sustainably to provide fishery benefits.

***Challenge 7: Improving the planning and management of aquaculture for food security and social and economic benefit***

Asian aquaculture continues to be a major growth sector and contributes directly to rural/domestic food security as well as export income. Developing a regional vision of how to sustain the production and contribution of this subsector, that addresses challenges of resource use, unplanned development as well as its considerable potential for providing food for the future, requires the following outcomes.

*Regional outcomes*

- Advice for sustainable intensification of aquaculture developed and communicated.
- Spatial management of aquaculture for key commodities (best practice advice, aquaculture zoning inland, marine and brackish water).
- Appropriate planning and assessment tools developed and shared within the region.
- Greater understanding of how to establish national certification schemes and existing certification schemes harmonized with FAO guidelines on aquaculture certification.
- Water allocation and management (including effluent discharges) mechanisms for aquaculture developed in coordination with the competent authorities.
- Access to high quality broodstock and aquaculture seed improved based on better management of health and genetics.
- Certified aquaculture feeds available (based on responsible fishmeal or fishmeal alternatives).
- Quality marine fish feeds available in the market (requires private sector interest/market demand) at competitive cost.
- Effective mechanisms for communicating and controlling aquatic animal health threats developed.

***Challenge 8: Improving the valuation of the contribution of inland fisheries in the region***

Inland fisheries are another major contributor to food security in the region, especially in rural areas. The effective valuation of their contributions is essential for informing policy regarding inland waters and the people who depend upon these resources.

*Regional outcomes*

- Inland fishery valuations undertaken for the main river basins in Asia, and quantification of impacts of water development.

- Establishment of programmes that promote the use of inland fisheries resources for nutrition and food security and poverty reduction.
- Development of standardized approaches for tools for effective assessment of inland fisheries production, value and contribution to nutrition and food security.
- Contribution of inland fisheries to food security and nutrition quantified, supported by inclusion into national censuses and surveys.
- Regional guidance on responsible enhancement of inland waters is developed.

***Challenge 9: Increasing capacity building to meet regional needs***

The region is home to millions of fishers and millions of fishing vessels. The region also has millions of aquaculture farmers and farms. Decentralized governance systems and the predominance of small-scale operators mean that the administration and management of fisheries and aquaculture is a huge challenge to the region. There is a strong need to build the capacity of fishers, farmers and government institutions to effectively co-manage fisheries and aquaculture in the region, using ecosystem approaches to management.

*Regional outcomes*

- Regional training course for EAF management developed and rolled out in regional and national training institutions and universities.
- Development of fishery and aquaculture management courses that cover environment, production, planning, governance and policy for the region.
- Fishery managers and fishers organizations trained in practical application of the EAF.
- Capacity to undertake assessments to inform EAF/EAA management is strengthened.
- Better aquaculture management practices developed for key commodities/systems.
- Fishery and aquaculture producers are empowered through higher levels of organization, including legal formalization/institutionalization of these (and traditional) arrangements, to strengthen their capacity to engage in co-management.
- Fishers and farmers are empowered to enact change and improve their situation without over-reliance on the assistance of projects or programmes.
- Best practice advice developed for fish aggregating devices, conservation areas, co-management.
- Capacity building programmes are identified and resourced.
- Knowledge sharing in fisheries and aquaculture management is institutionalized in the region, using existing knowledge networks.

***Challenge 10: Responding appropriately to climate change and climate variability***

Climate change and climate variability already impact the fisheries sector and result in increased uncertainty in the supply of fish from capture fisheries and aquaculture. Much of the work and effort in better management of fisheries and aquaculture already directly contributes to resilience and mitigation of climate effects. As expected for a region as diverse as Asia and the Pacific, the focus and priorities of the countries vary according to the variety of issues that might affect them.

*Regional outcomes*

- Vulnerability and risk assessments (including socio-economic valuation) of both fisheries and aquaculture resources as well as their stakeholders are prepared to inform national planning and prioritization.

- The fisheries and aquaculture subsectors are properly integrated into disaster reduction and mitigation plans, national climate change strategies and National Adaptation Programme(s) of Action (NAPA) and the United Nations Framework Convention on Climate Change (UNFCCC) national communications.
- Dedicated funding to conduct research on adaptation and mitigation identified and programmes developed (including a programme for marine fisheries to inform the UNFCCC process).
- Sectoral climate change and climate variability resilience through adaptation strategies for aquaculture and fisheries activities and household livelihood diversification.
- Fishery and aquaculture sector improves its contribution to mitigation of greenhouse gases (GHG) emissions, especially in areas of refrigerant and fuel use and through the greater application of green technology.

## OPENING OF THE MEETING

The Fourth APFIC Regional Consultative Forum Meeting (Fourth RCFM), *Improving management and governance of fisheries and aquaculture in the Asia-Pacific region* was convened at the Sandy Beach Hotel in Da Nang, Viet Nam, 17–19 September 2012. The meeting was attended by 73 participants from 16 countries and representatives from 12 regional partner organizations and projects. The meeting was hosted by the Ministry of Agriculture and Rural Development, Government of Viet Nam together with the Food and Agriculture Organization of the United Nations (FAO) and Asia-Pacific Fishery Commission (APFIC). It also received additional support from the Bay of Bengal Large Marine Ecosystem Project (BOBLME) and the Spanish funded Regional Fisheries Livelihoods Programme (RFLP).

The APFIC Chairman, Mr Nguyen Viet Manh, welcomed the participants of the Fourth APFIC RCFM. Mr Manh recalled the Third RCFM in 2010 that had the theme “Balancing the needs of people and ecosystems in fisheries and aquaculture management in the Asia-Pacific region”, and that addressed important issues pertaining to the ecosystem approach to fisheries and the human dimensions in fisheries management. This, he noted, made important contributions to policy formulation in the region. He mentioned that enhancing governance and management in fisheries and aquaculture, based on practical approaches, is critical at this time, and he highlighted some of the major emerging issues and challenges (such as lack of fisheries resources assessment tools for small-scale fisheries, losses in the food production and supply chain, the need to support livelihoods for coastal communities and climate change adaptation). It is timely and significant to address these concerns to foster sustainable development and contribute to food security in the region, he said.

On behalf of Mr Hiroyuki Konuma, Assistant Director-General of the Food and Agriculture Organization of the United Nations, Mr Simon Funge-Smith, the Secretary of APFIC, welcomed all participants to the Fourth APFIC RCFM. Mr Funge-Smith noted that the theme for this biennial meeting reflects the importance that APFIC members have given to improving the management of fisheries and aquaculture in the region and recognizes that this can only be achieved through the strengthened governance processes that underpin all management actions. APFIC member countries will inform the Meeting of key successes or changes that have occurred in their capture fisheries and aquaculture and how this relates to the implementation of the FAO CCRF, as well as to climate change, small-scale fisheries, etc. The RCFM precedes the Thirty-second Session of the Asia-Pacific Fishery Commission (APFIC) and a key outcome will be a summary set of conclusions and recommendations developed on the basis of the discussions over the next three days that will be put before the Commission for their consideration.

The opening speech was delivered by Mr Vu Van Tam, the Vice-Minister of the Ministry of Agriculture and Rural Development of Viet Nam, which is the APFIC chair country for the period 2010–2012. Mr Tam noted that the discussions and sharing of knowledge during the three days will expand opportunities for cooperation among APFIC member countries and with international organizations. This would create a common voice in the region for sustainable fisheries development contributing to food security. He mentioned the importance of the Asia-Pacific contribution to the world’s total fisheries production, and the challenges for the fisheries sector in Asia, especially those faced by small-scale fisheries and fishing-dependent communities. Mr Tam further noted that the recommendations at the Fourth APFIC RCFM will inform the APFIC Thirty-second Session, and the adoption of the APFIC Strategic Plan for the period 2012–2018, providing a foundation for implementing regional policies and identifying priorities for the sustainable development of fisheries and aquaculture in the Asia-Pacific region.

## **THEME 1: REGIONAL OVERVIEW OF FISHERIES AND AQUACULTURE**

The first session of the RCFM included an introduction to the findings of the latest APFIC biennial publication *APFIC regional overview of fisheries and aquaculture in Asia and the Pacific region 2010*. There was also an introduction to the current (2012) status of fisheries in three focal fishery subregions in the Asia-Pacific region and the issues related to improving status and trend reporting in fisheries.

### **Regional overview of capture fisheries in the subregions of Asia**

*Simon Funge-Smith, Secretary, Asia-Pacific Fishery Commission*

The review presented to the RCFM covered fisheries and aquaculture trends and issues related to reporting quality, management and sustainability. APFIC has moved towards a form of subregional reporting that takes various sources of fisheries related data and tries to present this in an integrated manner to illustrate the status of resources and fisheries. In this review, the focus was on current trends in the marine capture fisheries of the South China Sea and the Gulf of Thailand subregion and the Bay of Bengal and Andaman Sea subregion.

The current regional overview of capture fisheries in Asia and the Pacific presented the results of the ongoing biennial effort by the Commission to collate national sources of data so as to explain some of the background effects on the fisheries of the region. The objective is to “organize fisheries relevant information into meaningful geographical, biological and governance units so that the fisheries and their resources can be considered at a level of detail that is not possible using aggregated national catches or the FAO statistical areas.”

The overview is intended to provide a resource book of summary regional information and follows a recommendation of the Thirtieth APFIC Session to promote ecosystem approaches to management. The Thirty-first APFIC Session endorsed the review of trends in subregional fishing areas. In this way it adds value and supporting detail to FAO production statistics. The capture fisheries review divided the region into three subregions: the South China Sea, the Bay of Bengal and the Sulu and Sulawesi/Timor and Arafura Seas.

The principal fishery indicators that are covered in the overview fall into four categories: (i) resource related – catch composition by groupings of species, catch trends, fishing status of species groups, fishmeal production, surimi production; (ii) effort related – CPUE of gears and target species groups, vessel numbers and types; (iii) socio-economic related – employment; (iv) management related – zoning measures, types of management measures, definitions/classifications of small-scale and commercial fisheries, existence of protected areas or fisheries closed seasons/areas.

### ***Some general trends in marine capture fisheries in the APFIC region***

The Asia-Pacific region continues to be the world’s largest producer of fish. The capture production of the Asia-Pacific region has exceeded 50 percent of world production since 2006. The region’s capture production declined slightly from 2004 to 2006, after which it started to increase, with a 3.5 percent rise between 2009 and 2010. The latest FAO figures (2010) for the Asia-Pacific region are 48.7 million tonnes. Global capture fishery production has followed a similar trend over the past decade. Of the top ten producers of capture fish in the world, five are in Asia and the Pacific region. China is still by far the largest producer in the region (15.7 million tonnes) representing 32 percent of total regional production (a slight reduction over the previous biennium), followed by Indonesia (5.4 million tonnes, 11 percent) and India (4.7 million tonnes, 10 percent).



Excluding China, capture fishery production from marine waters in the APFIC region reached 26.5 million tonnes in 2008 (its highest ever recorded catch up until that time), but this was exceeded in 2010 with a catch of 32.0 million tonnes. Southeast Asian capture production (17.3 million tonnes) has continued to increase and there has been a slower increase in South Asia (7.4 million tonnes). The subregion Other Asia used to be the top contributor to capture fishery production in the region, but capture production has declined since 1988 and now shows signs of levelling off (6.1 million tonnes).

The general trend in global capture fisheries is one of stable capture fishery production with background fluctuations in different fisheries. Asian capture fisheries have generally been stable or increasing over the past decade.

- Capture fishery production in China has been very stable, rising and falling by only 1 or 2 percent over the past decade with a total decadal rise of 4 percent.
- In Southeast Asia, the trend is for consistent slight annual increases of 2 to 4 percent, with a decadal increase of 29 percent.
- In South Asia the changes are more dramatic increasing and decreasing by 5 to 8 percent, but an overall decadal increase of 28 percent.
- Other Asia is relatively stable with an overall decline of 16 percent over the decade.
- Oceania has had rather large decreases in production over the past five years, but the decadal trend is an increase of 9 percent.

The consistent increases in capture fishery production that are being achieved in the South Asian and Southeast Asian subregions of APFIC member countries can be attributed to several effects, namely the increase in fishing effort, expansion of the geographical range of fishing activities, and increasing the overall biomass of the fishery by fishing down effects (i.e. removing larger longer lived species and allowing a higher biomass of shorter lived small fast recruiting species).

The expansion of new areas and transshipment of fish between fishing areas complicates trend reporting by area and the determination of the status of stocks in specific localities. This may also lead to the false assumption that there remains significant potential for further expansion of fishing.

#### ***Issue of reporting species composition – not elsewhere included (nei)***

There remains a considerable proportion of the region's capture production that is not identified at the species level but instead is recorded as marine/freshwater fish nei, marine/freshwater molluscs nei and marine/freshwater crustaceans nei. In 2010 the amount of capture production that was reported in Asia and the Pacific region and not identified at species, genus, or family level in these groups reached 15.8 million tonnes (32 percent of the regional total production). This is an increase over the 2008 figure of 30 percent (14.3 million tonnes). The quantity reported under these categories has been consistently about 30 percent for the APFIC region over the past six years. Southeast Asia reports 41.7 percent, South Asia 35.7 and China 32.1 percent of their total capture fishery production as nei. It is notable that China has improved its reporting on individual species. The consistently high reporting of nei marine fish (9.6 million tonnes, 19.7 percent of total regional fishery production) may also reflect a strong trend towards the capture of smaller, lower-value species. The percentages of these are high in the assessed catch composition. These small, low-value or trash fish species may not be considered worth reporting in detail as part of catch landings. This hides the effects of overfishing on the capture of juveniles of higher-value species.

## **Marine capture fisheries in the South China Sea and Gulf of Thailand subregion**

### *Changes in catch composition and status of species groupings*

The production trends of the past ten years do not reveal clear changes in the fishery, as the majority of the impact is presumed to have taken place during the massive expansion of fisheries effort between 1975 and 1985. There have been ecosystem level effects, and the recent data for the past ten years may indicate that the South China Sea area has reached a low level plateau and the large composition shifts of previous decades have now settled down to favour an ecosystem dominated by small species. These lower-value species are being utilized variously (surimi, canned fish, fishmeal, aquaculture feeds), but the loss has been in the higher value larger species and thus fishers are increasingly having to work harder to catch a lower-value product. In economic terms this is rather inefficient. However, it may also reflect the tendency towards maximizing employment in the fishery at the expense of economic efficiency and product quality in many of the developing countries that comprise this region.

In the northern part of the South China Sea there is a trend of decreasing catches of large demersal species (37 percent of catch in the 1950s down to 17 percent in the 1970s after which it has been stable). There is also a decline in relative catch of large demersals in Malaysia and the Gulf of Thailand, but it is stable in the Philippines and even increasing in Indonesia (FMA 711). The stocks of large demersal species are overfished in all areas and comprise only 2 to 5 percent of the relative catch. The exception is Indonesia FMA 711 where they are fully fished and comprise 14 percent of the relative catch.

In the northern part of the South China Sea, large pelagics and sharks and rays have reduced greatly in the catch since the 1970s and are now at a low level. Conversely, there has been an increased catch of larger pelagic species in the eastern parts of the South China Sea (the Philippines, including areas outside the South China Sea) and in the Gulf of Thailand and in the southern part of the South China Sea (Indonesia) in the last ten years. Large pelagic species are fully fished in Viet Nam and overfished in the Gulf of Thailand. They are generally moderately fished or underfished on the eastern side of the South China Sea (Philippines, Malaysia-Sabah/Sarawak and Indonesia FMA 711).

Catches of shark and rays have increased in Thailand and Malaysia, and declined in the Philippines and Indonesia (FMA 711). Sharks and rays, where reported, are overfished or even depleted (China).

Landings of small demersal species have increased in the Gulf of Thailand, Malaysia and in the southern part of the South China Sea (FMA 711, Natuna Sea, Indonesia), whereas catches have declined in the northern part of the South China Sea (China), the Philippines and Viet Nam. Small demersal species are also overfished in a majority of the areas, especially the nearshore areas. They are fully fished in the more central part of the South China Sea.

Surimi species are the small demersal species specifically utilized for surimi production. Relative catches of these in the southern part of the South China Sea and Gulf of Thailand, (Indonesia FMA 711, Thailand and Malaysia), where they are specifically targeted have increased. Using a conversion of raw material to surimi (approximately 3.5:1), the total demand for raw material from the South China Sea area could be as high as 1 347 000 tonnes.

In the northern part of the South China Sea, small pelagic species have increased from 30 to 60 percent of the catch between the 1970s and 2000 onwards, and are now mostly stable (Viet Nam, Philippines). In the other parts of the South China Sea, the relative catches of small pelagics have increased (China, Thailand, Indonesia), but have declined in Malaysia. Overall they form 13 to 32 percent of the catch in the subregion. Small pelagic species are overfished or fully fished in China, northern Viet Nam and the Gulf of Thailand. They are fully fished in southern Viet Nam and the

northern part of the Philippines. In the southern and southeastern parts of the South China Sea they are underfished or moderately fished.

Relative catches of anchovy and sardines have declined throughout the South China Sea or remain stable (China only). This group comprises only 3 to 6 percent of the catch in China, Malaysia and Indonesia, but significantly more of the catch in Thailand (14 percent) and the Philippines (22 percent). The stocks of anchovies and sardines are overfished in the western side of the South China Sea and moderately fished or underfished in the northern and central Philippines.

The relative catch of low value/trash fish has declined in Thailand and Indonesia, and increased in China, Viet Nam and Malaysia. This group still comprises a large share of the total catch in the region (10 to 40 percent). Decline in the relative catch may be partly explained by greater classification of catch into that destined for human consumption, which has accompanied the massive rise in the region of the production of surimi. There may also be an effect of the rising costs of trawling reducing overall effort over the past decade. Low value/trash fish species are fully fished or overfished where assessed, but there is a lack of data for this component of the catch from several countries. This is partly because of the inclusion of the species that comprise this group elsewhere into the small demersal, surimi and anchovy sardine groupings. All the assessed stocks of surimi species are overfished in all areas.

The relative catch of squids and cuttlefish is variable according to the fishery, with no clear trend and they comprise a relatively small percentage of the catch landings, despite reports that they are on the rise (2 to 9 percent). Squids/cuttlefish are overfished or fully fished in the northern part of the South China Sea and the Gulf of Thailand. In the southern and eastern parts they are generally moderately fished.

In a majority of the areas, the relative catch of crustaceans has declined, and they form a relatively small part of the catch (3 to 9 percent).

#### *Catch per unit effort/catch rates*

For a majority of the assessed fisheries (by gear) in the region, the catch per unit effort (CPUE) and catch rates are declining. A majority of the assessed trawl fisheries show declining CPUE or catch trends. Also, a majority of the assessed purse seine fisheries showed declining CPUE or catch rates. All net fisheries assessed show declining CPUE or catch rates. Other reported fisheries also showed a general decline in CPUE. A few fisheries have shown increasing CPUE (e.g. west coast of Sabah).

#### *Low value/trash fish production*

Total production of trash/low-value fish species in the South China Sea subregion is estimated to be 1.7 million tonnes. This is a significant reduction (nearly 65 percent) over previous estimates and certainly reflects improved reporting of small demersals, anchovies, sardines and small pelagic species. It also perhaps reflects the increased utilization as fish for human food and the increased preservation of this catch. Overall, in the reported fisheries, low value trash fish is consistently more than 20 percent of the overall catch and will be a considerably higher percentage for the trawl fisheries (more typically 40 to 60 percent of the catch).

The composition of this low-value/trash fish catch and the fact that it is now typically used as aquaculture feed, has led to increasing interest in determining what exactly the impacts of the fishing for this component of the catch is on the wider fishery and ecosystem as a whole. All trawl fisheries will generate a proportion of this sort of low-value or trash fish, either because fish are damaged by the trawling action or the species are rather soft and easily damaged or bony and unusable as human food. The important issue to resolve is how to minimize the catch of species that have commercial value.

A recommendation is that the composition (species) and locations of capture of the low value and trash fish component should be more clearly elaborated. This is important where this is being directed into fishmeal or feeds so that the real value and or impact of this catch can be properly assessed.

#### *Fishmeal production*

The total fishmeal production for the South China Sea subregion is estimated to be approximately 641 000 tonnes (assuming the 2008 IFFO estimate of only 5 000 tonnes production for the Chinese provinces adjoining the South China Sea). This is derived largely from the low value/trash fish catch reported, although there are some targeted small pelagic catches that are directed into fishmeal production.

Production of fishmeal from processing wastes from capture fisheries and aquaculture is considered to be very significant in the region. These are trimmings and processing waste from fish processing converted to fishmeal (from canning, filleting, heading and from shrimp heads/wastes, pangasius processing wastes). IFFO estimates that up to ~56 percent of the fishmeal produced in the East Asian region is derived from this source. Globally this figure is only 25 percent.

There is an increasing interest in finding small pelagic fisheries that can be certified for fishmeal production in order to enable the production of certified animal feeds (e.g. pet foods and aquaculture feeds). The data on fishmeal production are rather difficult to obtain and typically refer to production by industrial-scale producers. A recommendation is that the fish species composition of fishmeal should be identified according to the fishery/area of production.

#### *Capture production of surimi species*

The production of surimi in the region has increased dramatically over the past decade and has reached more than 321 250 tonnes in the South China Sea region. This figure has not been updated over the previous APFIC reported figure. This is a reflection of several drivers: improved processing techniques and increasing use of species previously classified as low value trash fish.

The manufacture of surimi has implications for the identification of the species used and ultimately the source of those fish. Surimi, which entails pulverizing its constituent fish into a puree, is essentially untraceable unless the fish used for the surimi have some form of catch documentation and the surimi is produced on a batch basis. This is unlikely in most cases and multiple sources of fish are used for most batches of surimi. This challenges the principles of food safety and traceability, and has the potential for mixing IUU catches with legitimate catches.

A recommendation is that surimi production should be reported both in terms of final product and the raw fish equivalent. Sources of fish for surimi should be clearly identified to assist with food safety, traceability and catch documentation.

#### *Vessel numbers and employment*

Total vessel numbers are over 1.74 million in the South China Sea, with a predominance (86 percent) of small-scale vessels (approximately 1.5 million vessels). This has implications for the extent to which fishing is pursued into offshore areas or remains largely confined to shallower nearshore coastal waters. The implication for fishing vessel numbers is that the bulk of the fishing capacity is confined to nearshore waters. A recommendation is that the extent to which effort is also confined to this area should be investigated further, as the proportion of catch between the nearshore coastal fleet and other vessels is not clearly reported.

The summary figures for employment are 3.73 million people in the South China Sea area. The breakdown of these figures into full-time and part-time varies between countries and are rather inconsistently reported. A recommendation is that an effort should be made to harmonize the recording of fishing vessel employment to reflect employment in large-scale and small-scale fishing.

### *Fishery zoning and management measures (including protected areas)*

All the countries have zoning of their exclusive economic zones (EEZ), with two or more zones and even up to four different zones. Closed areas and closed seasons are common in the nearshore zone (Zone 1) of many countries in the subregion. Gear restriction and licensing, when applied, are used in all different zones. Size limits (e.g. fish length) and quotas are not used by any of the countries in the subregion as a management measure. Closed areas come in many forms, of which MPAs are the most common. The inclusion of artificial reefs in this overview indicates that this is something that could be tracked further as there are considerable numbers of these being deployed throughout the subregion. The total area/numbers of these is uncertain and will be updated in later reports if the information becomes available.

### ***Marine capture fisheries in the Bay of Bengal and Andaman Sea subregion***

Total catches have been steadily increasing in the Bay of Bengal and Andaman Sea subregion and there are no signs of the catch levelling off (they are now reaching 6.86 million tonnes). The overall picture for the fisheries of the Bay of Bengal subregion is more diverse than that of the South China Sea. This subregion does not have the extensive area of productive shelf fisheries found in the South China Sea and is more dominated by pelagic resources. These resources are still subject to overfishing and depletion in some areas.

### *Changes in catch composition and status of species groupings*

The trend in catch composition from the assessed fisheries in the Bay of Bengal subregion over the past ten years differs by fishing area. Initially, and up until relatively recently, the Bay of Bengal landings have been composed of large and valuable species, but over the last five to ten years increasingly the catch has been composed of lower value and smaller fish.

The trend for catches of large demersal species is increasing in the South Asian countries, but decreasing in the western side of the Bay of Bengal. Across the Bay of Bengal, large demersal species comprise 3 to 16 percent of the catch. The stocks of large demersals are overfished or fully fished in a majority of the areas. Only in Sri Lanka and northeast India are they moderately fished or underfished.

Small demersal species have an overall stable or increasing relative catch in the subregion. Surimi species in the Bay of Bengal area are not generally targeted for surimi production and are thus counted as small demersal species. Small demersals are overfished or fully fished on the western side of the Bay of Bengal and in southeastern India and the nearshore fisheries of Bangladesh. Elsewhere (Maldives, Sri Lanka, northeastern India and offshore in Bangladesh) they are moderately fished or underfished.

According to the latest advisory by the BOBLME Regional Fisheries Management Advisory Committee (BOBLME RFMAC), the regional hilsa stock is overfished. Widespread use of small mesh gillnets is leading to a large number of juveniles being caught, especially in riverine areas and this is reducing the parent population for the next generation and contributing to the population decline.

The catch of sharks and rays is decreasing in most of the fishing areas reported here, however it is increasing in Malaysia. This group comprises between 1 and 4 percent of the catch.

The relative catch trends for large pelagic species are stable. This group form a relatively large proportion of the catch in Sri Lanka (53 percent) and the Maldives (83 percent) as well as in the Indonesian FMA 572 waters (25 percent). Elsewhere in India, Myanmar, Thailand, Malaysia and Indonesia FMA 571 they comprise only 4 to 12 percent of the catch. Large pelagic species are fully fished in southeastern India, Sri Lanka, Thailand and Malaysia. They are moderately fished in the Maldives, northeastern India and Indonesia.

The relative catch trends of small pelagic species (including sardines and anchovies) are increasing, comprising 10 to 45 percent of the catch in Sri Lanka, India, Thailand, Malaysia and Indonesian waters. They are a small part of the catch in the Maldives (mainly baitfish), Bangladesh and Myanmar. Small pelagic species are moderately fished or fully fished in a majority of areas, moving to fully fished (Indonesia, Sri Lanka) or overfished (Thailand, Malaysia). Where reported, anchovies and sardines are overfished (Myanmar) or fully fished (Malaysia, where catches are declining, and Sri Lanka). In Bangladesh they are moderately fished or underfished.

The stock status of Indian mackerel (BOBLME RFMAC advisory) is unknown, but Indian mackerel is a highly productive species and this may protect it to some extent from heavy fishing pressure.

Trash/low-value fish relative catches have declined in the subregion over the course of the assessments. Although the total production of trash/low-value fish has risen slightly to about 941 000 tonnes, together with anchovies/sardines, it still makes up between 12 and 47 percent of the total catch in the subregion. The relative catches are stable in Malaysia over the assessment period. Where reported, low value and trash fish species are fully fished or overfished in Indonesia, Malaysia and Thailand as well as nearshore areas of Bangladesh. They are moderately fished in Sri Lanka.

The stocks of surimi species are overfished or fully fished in Indonesia, Malaysia and Thailand. They are moderately or fully fished in Bangladesh. The Maldives does not have a fishery for these species, which are predominantly derived from trawling.

Crustaceans are considered fully fished in a majority of the assessed fisheries.

Squids/cuttlefish form a relatively low proportion of the catch in the Bay of Bengal, somewhere between 2 and 6 percent. Crustaceans comprise 6 to 15 percent of the catch and catch trends vary by country. Squids/cuttlefish are fully fished in southeastern India, but elsewhere moderately fished to underfished.

No assessments were made for shellfish in this subregion and shellfish are almost always unreported, but these form artisanal fisheries in several countries.

#### *Trends in catch per unit effort*

For a majority of the assessed fisheries (by gear) in the region the catch per unit effort (CPUE) and catch rates are declining. The most significant changes are in the assessed trawl fisheries, which show declining CPUE or catch trends. The majority of the assessed purse seine fisheries show declining CPUE or catch rates, other seine-type fisheries are also declining. Maldives tuna fisheries have declined. A few areas have seen CPUE rising, notably for some gears in Indonesia (FMA 571 and FMA 572).

#### *Low value/trash fish production*

Total production of trash/low-value fish species in the Bay of Bengal subregion is less than 941 000 tonnes (this figure includes the whole of India, thus the actual Bay of Bengal figure will be lower). Overall in the reported fisheries, low value trash fish lies between 4 to 65 percent, with a more typical range of 14 to 64 percent. The principal source is trawlers.

#### *Fishmeal production*

The total fishmeal production for the Bay of Bengal subregion is estimated to be 152 000 tonnes (production for Malaysia, Indonesia and Thailand is reported under the South China Sea subregion). This is presumed to be derived largely from low value/trash fish. The region produces large quantities of dried fish, which are powdered/pounded to form basic animal feeds or fish feeds or directly as human food, none of which are classified as fishmeal. There appears to be interest in some areas

(e.g. India) in increasing the utilization of discards (75 000 tonnes) for fishmeal by establishing a collection system at sea. This could start to drive direct targeting and mesh size reductions if a significant onshore market was established. This has been the experience from the South China Sea subregion.

#### *Capture production of surimi species*

The relative catch of surimi species has increased in all assessed areas and the total production for the subregion is roughly estimated to be 75 000 tonnes, requiring approximately 262 500 tonnes of raw material. Many countries in the Bay of Bengal subregion do not produce surimi in significant quantities.

#### *Vessel numbers and employment*

There are approximately 460 000 vessels operating in the Bay of Bengal and these are predominantly (67 percent) small-scale vessels without engines, or they use outboard motors (approximately 308 000 vessels). These vessels operate in nearshore coastal waters, although in the case of Sri Lanka and the Maldives they may operate in deep waters some way from shore. These figures are overestimated because of the inclusion of vessels from the west coast of India. A recommendation is to separate east and west coast fleets of India and establish the production from the different segments of the fishery. The summary figures for employment are 1.93 million fishers in the Bay of Bengal. The breakdown of these figures into full-time and part-time fishers varies between countries and the figures are rather inconsistently reported.

### ***Marine capture fisheries in the Sulu and Sulawesi Seas/Timor and Arafura Seas***

#### *Changes in catch composition and status of species groupings*

The trends for catch composition of large demersal species are decreasing in Indonesia (Sulu and Sulawesi Seas) and Malaysia (east coast of Sabah) but increasing in the Arafura and Timor Seas. There is a trend of decreasing relative catch of small demersal species in the east coast of Sabah and in the Timor and Arafura Seas (Indonesia). The relative catch is increasing in the Sulu and Sulawesi Seas (Indonesia). The stocks of large and small demersal species are moderately fished or fully fished in a majority of the areas. Only in FMA 713 and FMA 718 are they overfished.

The catch of sharks and rays is increasing in the east coast of Sabah, but decreasing in Indonesia (the Sulu and Sulawesi Seas and the Timor and Arafura Seas). Sharks and rays comprise 1 to 3 percent of the catch. There is no further information on sharks and rays.

Large pelagic species are declining in the catch forming between 6 and 15 percent of the catch. Large pelagic species are moderately fished throughout the subregion.

The relative catch trend of small pelagic species is increasing, comprising 15 to 30 percent of the catch. Small pelagics form up to 50 percent in Timor-Leste where the fishery is targeted by the small vessel fishers so this forms a disproportionate amount of the catch. Small pelagic species are moderately fished in the northern areas of the Sulu and Sulawesi Seas, but fully fished further south. They are overfished in the western side of the area (Indonesia FMA 712, FMA 713).

Anchovy/sardine relative catches have increased in Malaysia's east coast and the Sulu and Sulawesi Seas (Indonesia) and decreased in the Timor and Arafura Seas. There is no reported stock status data for anchovies and sardines.

There is no significant catch of fish for surimi production from this region. The relative catches of trash/low-value fish are increasing in the region, except for the Timor and Arafura Seas. They comprise 1 to 9 percent of the total catch in some areas, and they comprise 26 to 35 percent of the

catch in Indonesia (FMAs 714, 573 and 718). Where reported, low value and trash fish species are moderately fished or fully fished. There is some overfishing in FMA 718 and FMA 713. The stocks of surimi species are similarly fully fished or moderately fished and overfished in FMA 713 (this is next to FMA 711 where there is a heavily targeted surimi fishery) and overfished in FMA 718.

Squid/cuttlefish catches are increasing, but form relatively little overall at 1 to 4 percent of the catch. Squids/cuttlefish are moderately fished in the southern part of the subregion and are not reported elsewhere.

Crustaceans are considered overfished in a majority of the assessed fisheries and fully fished elsewhere. Only in the managed Australian northern prawn fishery are they fully fished or moderately fished. The trend of catches of crustaceans is decreasing except in the east coast of Sabah and overall they comprise 2 to 12 percent of the catch. In the Australian northern prawn fishery – managed and three main species (*Penaeus monodon*, *P. merguensis* and enadeavour prawns, are not overfished and not subject to overfishing. The *P. monodon* fishery is approaching the  $B_{msy}$  target. Banana prawns do not have a target set, but management arrangements currently promote a profitable and sustainable harvest. Bycatch reduced through mandatory use of turtle excluders, also particularly effective on sharks etc. Mandatory use of bycatch reduction devices (BRD) reduced bycatch ratio from 1:10 to 1:5.

#### *Trends in catch per unit effort*

The trends in CPUE indicate increasing CPUE in a number of trawl fisheries. This is achieved in the Australian northern prawn fishery through management controls. Elsewhere the increase is less easily explained (east coast of Sabah, FMA 573). Decreasing trawl CPUE is seen in FMA 712, probably as a result of overfishing. Purse seine CPUE is generally stable in the region or increasing (FMAs 714, 716, 718, east coast of Sabah). It has strongly decreased in FMA 573 (down 80 percent). Net fisheries are stable or increasing except in FMA 573. There is strong increase in FMA 713 (up 150 percent). Pole and line CPUE is strongly down (95 percent) in FMA 716. Longline CPUE has increased in FMAs 714, 715, 716, but decreased in FMA 573.

#### ***Inland capture fishery production***

Inland capture fisheries production in the region continues to increase, rising by 13.7 percent over the 2008 figure and reaching 7.6 million tonnes in 2010. The top countries producing 97 percent of the region's inland capture fish are China, India, Bangladesh, Myanmar, Cambodia, Indonesia, Thailand, Viet Nam, Philippines and Pakistan. The APFIC region now contributes 68 percent of global inland fisheries production. In inland waters, excluding China, the total production of the region reported in 2010 was 5.3 million tonnes a rise of 19.7 percent over the 2008 level. South Asia contributes 37 percent of the region's production, Southeast Asia 30 percent. For the Chinese subregion, inland production in 2010 was 2.3 million tonnes (30.2 percent of the total regional catch).

This overall rapid increase in inland fisheries is unlikely to be a result of massive increases in productivity per fisher, although there is undoubtedly increasing interest and effort being applied to enhance inland waters in the region to increase productivity. The increasing populations in the developing countries of Southeast Asia and South Asia mean that there are increasing numbers of inland fishers and thus effort is also increasing. Part of the increase is also considered to be a result of significant re-evaluation of the contribution of inland fisheries that led to an upward revision of previous underestimates of inland production. This is a cause for concern since actual production in some countries' inland fisheries may be declining.



## **Status and trends of aquaculture in the subregions of Asia**

*Weimin Miao and Simon Funge-Smith, APFIC Secretariat*

This review is based on the new *Fishstat* online database from FAO, covering world fisheries and aquaculture up to 2010. The review describes the evolution of aquaculture in Asia and the Pacific region from 2000 to 2010.

### ***General trends in aquaculture in the APFIC region***

The Asia-Pacific region continues to be the dominant aquaculture-producing region of the world. In 2010, the region produced 53.1 million tonnes of aquaculture products (excluding aquatic plants), representing 89 percent of the global aquaculture production of 59.9 million tonnes. This production had a rate of growth of 6.5 percent/year between 2000 and 2010.

In terms of value, the region's share amounted to some US\$95.2 billion (growing at 10.5 percent/year between 2000 and 2010). This value equated to 80 percent of the total value of global aquaculture, which reached US\$119.6 billion in 2010. When aquatic plants are included (the vast majority of which is cultivated in the Asia-Pacific region), the region becomes even more dominant, producing 71.9 million tonnes, worth US\$100.8 billion (out of 78.9 million tonnes, worth US\$125.2 billion worldwide). This represents 91 percent of global aquaculture production by quantity and 81 percent by value in 2010. Compared with 2000, the shares of both production (90 percent) and value (80 percent) remain almost unchanged.

The growth rate of aquaculture production in the region has continued to be very strong, with a yearly growth rate in terms of quantity of 6.7 percent between 2000 and 2010 (almost identical to the worldwide trend, as this region is the major driving force). The growth rate in aquaculture production in the APFIC region used to result primarily from the high growth rates in China, but growth in the APFIC region excluding China overtook that of China between 2000 and 2010 at 9.3 percent/year, compared to 5.5 percent/year for China alone.

Of the top ten aquaculture-producing countries in the world in 2010 (excluding aquatic plants), eight (including the top three) are from the Asia-Pacific region. The biggest producer by far is China (producing 37.1 million tonnes worth US\$60.3 billion), followed by India (4.6 million tonnes worth US\$9.1 billion) and Viet Nam (2.7 million tonnes worth US\$5.2 billion). Other major producers in the region are Indonesia, Bangladesh, Thailand, Myanmar, the Philippines and Japan.

The countries with the fastest growing aquaculture productions in the past decade in the region are Myanmar (24 percent/year), Viet Nam (18 percent/year), Indonesia (12 percent/year) and India (9 percent/year), with Bangladesh, the Philippines and Thailand also recording growth rates of 6 to 7 percent/year, excluding aquatic plants between 2000 and 2010.

Within the Asia-Pacific region, both inland culture and marine/brackish water culture (excluding aquatic plants) have shown steady growth, but inland aquaculture for the region excluding China grew especially rapidly at 11 percent/year (equating to a tripling of production from 3.8 to 11.0 million tonnes), compared to 6 percent/year for the marine sector (a doubling of production from 2.8 to 5.0 million tonnes) between 2000 and 2010. Over this same time period in China, the inland sector grew at 6 percent/year, whereas the marine sector grew at 5 percent/year. By contrast, Japan has shown a contraction in aquaculture production of 0.6 percent/year over the same time period because of continuing economic problems and declining population and demand in the country.

China reported a total aquaculture production (including aquatic plants) of 48.1 million tonnes in 2010, worth US\$62.5 billion, representing 61 percent of world aquaculture production in terms of volume and 50 percent in terms of value. This continues China's consistent domination of global

aquaculture production, although there is a slight decrease of 1.2 percent/year since 2000 in terms of quantity as the rest of the world (and particularly the APFIC region) is expanding aquaculture production more rapidly than China. However, China's contribution in terms of value has increased by 0.9 percent/year from 2000 to 2010 from 46 to 50 percent as China begins to culture more valuable species and demand higher prices for them in its growing domestic market.

There has been considerable change in the top twenty cultured species (excluding aquatic plants and molluscs) in the region between 2000 and 2010. There are six new members (whiteleg shrimp, pangas catfishes *nei*, red swamp crawfish, cyprinids *nei*, snakeheads *nei* and Amur catfish) in the top 20 species compared with 2000, although inland waters species (mainly Chinese and Indian carps) still hold the top seven positions. The biggest mover amongst these species is the Catla, which has been increasing at 20 percent/year between 2000 and 2010. In addition, there have also been significant changes in the order of the top 20. Whiteleg shrimp (increasing at 99 percent/year) and pangas catfishes *nei* (increasing at 29 percent/year) between 2000 and 2010 are among the top ten species now.

It is worth noting that the number and quantity of high-value species that are carnivorous or dependent on high (animal) protein feed have increased during the past ten years. Those freshwater species with current production exceeding 100 000 tonnes include Asian swamp eel, Japanese eel, largemouth black bass, mandarin fish and snakeheads (all increasing at 11 to 18 percent/year between 2000 and 2010), whereas those marine/brackish water species with production exceeding 50 000 tonnes include whiteleg shrimp, giant tiger prawn, Chinese mitten crab, red swamp crawfish, oriental river prawn, giant river prawn, Indo-Pacific swamp crab, Japanese amberjack, Japanese seabass, large yellow croaker, red drum, silver seabream, barramundi, groupers *nei* and turbot.

In marine waters, the production is generally dominated by high-value carnivorous/high protein feed-dependent species such as penaeid shrimp, jacks, seabass, seabream, croakers, groupers, turbot, halibut and cobia. However, some of the top species cultured in marine and brackish environments are also herbivorous/omnivorous, including milkfish, with new entrants including sea cucumbers and jellyfish. Production of crabs (especially Indo-Pacific swamp crab and swimming crabs) as well as the whiteleg shrimp have made significant advances in recent years, with whiteleg shrimp now the most produced marine species in the region at 2.2 million tonnes, with 1.6 million tonnes coming from marine/brackish environments and 0.6 million tonnes from freshwaters.

### ***Freshwater carnivorous marine finfish species***

The culture of this group of high value freshwater finfish has been growing very rapidly over the past decade in the Asia-Pacific region, reaching a rate of growth of 14 percent/year between 2000 and 2010, compared to only 6 percent/year for omnivorous/herbivorous freshwater species. This is in response to the growing affluence of the populations in the region and their demand for higher value species. It also reflects the higher profitability of farming these higher value species. However, the total production of these higher value species amounted to just 1.5 million tonnes in 2010, compared to 30 million tonnes for freshwater omnivorous and herbivorous species in the APFIC region. These higher trophic level species thus comprised just 5 percent of freshwater fish production in the region in 2010.

China dominated production of these higher value freshwater species, with a total production of 1.4 million tonnes or 92 percent of the total production of this group in 2010 from the APFIC region. Although China cultured 14 species of carnivorous freshwater fish in 2010, most of this production comprised snakeheads, Asian swamp eels, mandarin fish, Japanese eel and largemouth black bass. Other major producing states include Indonesia, Japan, the Republic of Korea, Thailand and Bangladesh.

In terms of overall value, these carnivorous/high production input species were valued at US\$5.7 billion in 2010 (with US\$4.8 billion or 85 percent produced by China), a 13 percent annual increase between 2000 and 2010.

### ***Marine and brackish water finfish species***

Total production of cultured marine/brackish water fish species in the APFIC region has increased considerably over the past ten years and reached some 2.5 million tonnes worth US\$7.9 billion at a unit value of US\$3.22/kg in 2010, an increase in production and value of 7 percent/year over that in 2000. In terms of the number and trophic level of species cultured, the vast majority of these species are carnivorous with a high unit value. However, the species with the highest production of all is milkfish, which is herbivorous/omnivorous.

In terms of herbivorous and omnivorous marine/brackish water fish species, total production in the APFIC region has increased significantly to 0.8 million tonnes worth US\$1.3 billion at a relatively low unit value of US\$1.53/kg in 2010, an increase in production and value of 6 percent/year between 2000 and 2010. Herbivorous/omnivorous fish species make up 34 percent of the volume and 16 percent of the value of marine finfish produced.

In terms of purely carnivorous marine/brackish water fish species, the total production in the APFIC region has increased even more rapidly to 1.6 million tonnes worth US\$6.7 billion at a relatively high unit value of US\$4.09/kg in 2010, an increase in production and value of 8 percent/year between 2000 and 2010. Carnivorous fish species currently make up 66 percent of the volume and 84 percent of the value of marine fish produced, and the culture of this group of fish is growing rapidly.

The major producing countries of marine and brackish water finfish are China, Indonesia, Philippines, Japan, Viet Nam, the Republic of Korea and Bangladesh. The major species produced are milkfish, Japanese seabass, barramundi, jacks (especially amberjack), large yellow croaker, red drum, seabreams and flatfish including turbot and bastard halibut.

### ***Freshwater finfish requiring lower quality feed inputs***

In general, the culture of this group of low-value herbivorous and omnivorous freshwater fish in the Asia-Pacific region has been growing more slowly than carnivorous freshwater finfish over the past decade, reaching a rate of growth of 6 percent/year between 2000 and 2010. However, the production of these species is very high (30 million tonnes in 2010), accounting for 95 percent of the freshwater fish production in the region. Thus any increase represents a huge output of fish (nearly 14 million tonnes more of these fish produced in 2010 than in 2000).

China dominated production of these lower value herbivorous/omnivorous freshwater species, with a total production of 19.4 million tonnes or 64 percent of the total production of this group in 2010 from the APFIC region. In second place was India, producing 4.5 million tonnes or 15 percent of the total production in 2010. Viet Nam is the third ranked country, producing 1.9 million tonnes or 6 percent of the total production in 2010. The production of this group of fish grew just 4 percent in terms of volume and 9 percent in terms of value in China between 2000 and 2010, whereas in India, the production of these species grew 10 percent in terms of volume and 18 percent in terms of value between 2000 and 2010. For Viet Nam, production of these species grew at an impressive 18 percent in terms of volume and 19 percent in terms of value between 2000 and 2010. Hence it has been India and Viet Nam that have been increasing the production of these types of finfish most rapidly in recent years.

In terms of overall value, the omnivorous and herbivorous freshwater fish production was valued at US\$42.5 billion in 2010 (with US\$24.9 billion being produced by China, US\$8.2 billion by India and

US\$2.8 billion by Viet Nam), an 11 percent annual increase between 2000 and 2010. This equates to a unit value of US\$1.41/kg, almost one third of the value of the carnivorous species. However, the unit value of this group increased by 4 percent/year between 2000 and 2010.

The species composition of finfish aquaculture production from the APFIC region has long been dominated by carps and barbs, a situation that is very unlikely to change in the foreseeable future. This is because of the massive volume of production, which is almost entirely consumed domestically. Total production of carps and barbs from APFIC countries in 2010 exceeded 23 million tonnes worth US\$32.4 billion at a unit value of US\$1.39/kg, which is a steady 44 percent of the total aquaculture production of the region (excluding aquatic plants). The top six cultured finfish species in the Asia-Pacific region are carps from freshwater production. These are, in order, grass carp, silver carp, catla, common carp, bighead carp, and crucian carp with a further five rohu, wuchang bream, Cyprinids nei, black carp and mrigal in the top 20. The other most important finfish groups cultured in freshwaters in the Asia-Pacific region include catfish and tilapia.

### ***Catfish species***

The catfish group includes the pangas catfish (*Pangasius* spp.), *Clarias* spp., *Mystus* spp., *Silurid* spp., *Pelteobagrus* spp. and some introduced species e.g. channel catfish from USA. The top five producing countries are Viet Nam (42 percent), China (29 percent), Indonesia (14 percent), Bangladesh (5 percent), Thailand (5 percent) and Malaysia (4 percent). Total production in Asia and the Pacific region in 2010 was 2.8 million tonnes, up from only 0.2 million tonnes in 2000, thus showing a rapid increase of 28 percent/year between 2000 and 2010. This production in 2010 was worth US\$3.9 billion at an average unit value of US\$1.42/kg. The biggest producer of catfish is in Viet Nam, which has seen a dramatic increase in the production of Tra catfish (*Pangasianodon hypenthalamus*) and Basa catfish (*Pangasius bocourti*) over the past 14 years. The production has increased from 0.1 million tonnes in 2000 to 1.14 million tonnes in 2010, valued at US\$1.7 billion, at a unit value of US\$1.50/kg.

### ***Tilapia***

Tilapia production in the Asia-Pacific region has increased steadily over the past two decades. Freshwater tilapia production reached 2.4 million tonnes worth US\$3.7 billion at a unit value of US\$1.49/kg in 2010, with an increase of 11 percent/year in terms of volume and 14 percent/year in terms of value between 2000 and 2010. In terms of total production of tilapia (from all environments) in the Asia-Pacific region, there was a production of 2.5 million tonnes worth US\$3.7 billion at a unit value of US\$1.49/kg in 2010. Thus freshwater tilapia culture made up nearly 98 percent of total tilapia production in the region. Most production is of the Nile tilapia (*Oreochromis niloticus*). In terms of country of production, China dominated with 57 percent of the production, with Indonesia producing 17 percent, Philippines producing 10 percent and Thailand producing 7 percent.

### ***Crustaceans***

Crustaceans are the aquaculture species group of highest unit value in the region. Production of crustaceans has been increasing since the mid-1990s despite problems with a number of diseases. Cultured crustacean production reached 5.1 million tonnes in 2010, worth US\$24.2 billion at a unit value of US\$4.71/kg, an increase of 13 percent/year by volume and 11 percent/year by value between 2000 and 2010. World crustacean culture produced 5.7 million tonnes worth US\$26.9 billion in 2010, thus production from the Asia-Pacific region accounted for 90 percent by both volume and value of total global crustacean production.

Of all aquaculture species produced in the region (excluding aquatic plants and molluscs), the whiteleg shrimp (*Penaeus vannamei*) was the species with the sixth highest production in terms of volume (2 221 818 tonnes), but was the most valuable single species cultured in the region, with a value of US\$9.2 billion at a unit value of US\$4.12/kg in 2010. Other crustacean species in the top 20 species by volume and value of culture were the giant tiger prawn (*Penaeus monodon*), the Chinese mitten crab (*Eriocheir sinensis*) and the red swamp crawfish (*Procambarus clarkii*).

In terms of country of production, China again dominated crustacean production, producing 3.2 million tonnes or 63 percent of the total production of crustaceans in the Asia-Pacific region. Next was Thailand producing 0.6 million tonnes (12 percent), Viet Nam at 0.5 million tonnes (10 percent) and Indonesia at 0.4 million tonnes (8 percent). Other important producing states included India, Bangladesh, Malaysia, Philippines and Myanmar.

### ***Molluscs***

Mollusc culture is split into low-value species produced in extensive cultured systems (e.g. seeded blood cockle mudflats, mussel and oyster stake culture) and high-value species produced in intensive systems (fed systems, and possibly recirculation). Total production of all molluscs in the Asia-Pacific region amounted to 13.1 million tonnes worth US\$11.7 billion at a unit value of US\$0.90/kg in 2010. This accounted for 92 percent of the total world mollusc production of 14.2 million tonnes worth US\$14.4 billion at a unit value of US\$1.01/kg in 2010.

For high value mollusc species production in the Asia-Pacific region, there was a total production of 6.1 million tonnes worth US\$6.2 billion at a unit value of US\$1.01/kg in 2010. This production grew at a rate of just 3 percent/year in terms of volume and 2 percent/year in terms of value between 2000 and 2010. With respect to low-value mollusc species production in the Asia-Pacific region, there was a total production of 7.0 million tonnes worth US\$5.6 billion at a unit value of US\$0.80/kg in 2010. This production grew at a rate of 5 percent/year in terms of volume and 6 percent/year in terms of value between 2000 and 2010.

### ***Aquatic plants***

The total production of aquatic plants in the Asia-Pacific region reached 18.9 million tonnes worth US\$5.6 billion at a unit value of just US\$0.30/kg in 2010 (99 percent from marine waters). Production has been growing steadily by 7 percent/year between 2000 and 2010. This production from the region accounts for over 99 percent of the total world production of 19 million tonnes in 2010, indicating the importance of the region for the production of this group.

Aquatic plant production can be divided into two distinct groups. The first group consists of seaweeds of temperate waters that are traditionally used for food purposes and are mainly produced in East Asia. The second group consists of tropical species mainly processed as a source of commercially valuable biopolymers (carrageenan, agar) that are used for various food and non-food purposes and are produced in Southeast Asia.

### ***Reptiles and amphibians***

Reported species produced in the region from this group are freshwater frogs and turtles. Total production was 0.4 million tonnes worth almost US\$2 billion at a high unit value of US\$5.22/kg in 2010, and growing at 9 percent/year between 2003 and 2010. Production from the Asia-Pacific region amounts to 99.8 percent of the world total, again indicating the importance of this region in the culture of these species.

### *Niche aquaculture species*

Total production of these reported niche species was 0.4 million tonnes worth US\$1.1 billion at a relatively high unit value of US\$2.46/kg in 2010. The growth rate of this group was a rapid 22 percent/year in terms of volume and 20 percent/year in terms of value between 2003 (when China first started recording many of them individually) and 2010. This comprised 99.9 percent of the total world production of these species.

### *Trends by subregions*

#### *South Asia*

South Asia's total aquaculture production amounted to 6.1 million tonnes worth US\$12.2 billion at a unit value of US\$1.99/kg in 2010, equating to just under 8 percent of the total world aquaculture production. Growth rate in production was at 9 percent/year in terms of volume and 13 percent/year in terms of value between 2000 and 2010. South Asia's production has been dominated by the production of freshwater and diadromous fish throughout the past decade, such that freshwater fish account for 94 percent of total aquaculture production in this subregion, and 16 percent of total world production of freshwater fish. The South Asian subregion also produces small amounts of crustaceans, marine fish, molluscs and aquatic plants.

#### *Southeast Asia*

Aquaculture production in Southeast Asia is highly diversified and in 2010 production of 101 different species (the majority of which were freshwater/diadromous finfish species) was reported, with the production of 17 species exceeding 100 000 tonnes each. The number of cultured species and the details of reporting have increased rapidly in the last years, increasing from 70 in 1996 and 80 in 2003. Total production from the Southeast Asian subregion was 14.4 million tonnes worth US\$18.1 billion at a unit value of US\$1.25/kg, equating to just over 18 percent of the total world aquaculture production in 2010. Overall growth rate was a rapid 15 percent/year in terms of volume and 9 percent/year in terms of value (because of a trend for declining unit price at 5 percent/year) between 2000 and 2010. Production from freshwaters (principally freshwater/diadromous finfish) has been a constant 35 percent (and growing at 14 percent/year) of total production from Southeast Asia since records began in 1950, whereas 65 percent (and growing at 15 percent/year) of production (mostly aquatic plants and crustaceans) has come from marine and brackish waters.

#### *China*

Chinese aquaculture has dominated world aquaculture production since records began in 1950 and for many years before that, as China has been considered as one of the originators of aquaculture. Production is not only higher than any other country in the world, it is also more diverse, with China reporting the culture of 112 species in 2010. The species diversification has been oriented towards high-value species and both indigenous and exotic species newly developed for aquaculture.

Aquaculture production growth from China has been maintained at a steady 5 percent/year in terms of volume between 2000 and 2010. China's aquaculture in 2000 was 29 million tonnes worth US\$24 billion at a unit value of just US\$0.81/kg. However, by 2010, this has increased by nearly 20 million tonnes to 48 million tonnes worth US\$63 billion at a higher unit value of US\$1.30/kg in 2010. This production comprised 61 percent by volume and 50 percent by value of the total world aquaculture production of 79 million tonnes worth US\$125 billion in 2010 (including aquatic plants).

Aquaculture production by volume in China was split almost evenly between marine and brackish water (51 percent) and freshwater (49 percent) in 2010. However, largely because of the high production of low-value aquatic plants in the marine environment, total value was higher for

freshwater culture (US\$44 billion at a unit value of US\$1.84 in 2010), compared to marine and brackish water culture (US\$19 billion at a unit value of US\$0.78/kg in 2010). Furthermore, the unit value of freshwater species produced in China increased by 6 percent/year, compared to an increase of just 2 percent/year for marine and brackish water species between 2000 and 2010. This rapid growth in the value of inland culture has occurred mainly because of the increased production of high value finfish and crustacean species. These increases are being achieved through the intensification of existing systems rather than any significant increase in production area.

#### *Other Asia*

Other Asia's total aquaculture production amounted to 3.0 million tonnes worth US\$6.6 billion at a unit value of US\$2.17/kg in 2010, equating to just under 4 percent of the total world aquaculture production. The aquaculture production in this region has been quite stable. Average growth has been only 2 percent/year in terms of volume and 1 percent/year in terms of value between 2000 and 2010.

The Republic of Korea had the biggest production (45 percent in 2010) in the Other Asia subregion of 1.4 million tonnes worth US\$1.8 billion at a unit value of US\$1.31/kg in 2010. Production grew at 7 percent/year between 2000 and 2010. Japan produced 1.2 million tonnes worth US\$4.7 billion at a high unit value of US\$4.06/kg in 2010. However, production in Japan contracted by 1 percent/year between 2000 and 2010. The third major player in the subregion is the Democratic People's Republic of Korea which produced 0.5 million tonnes worth US\$116 million at a very low unit value of just US\$0.23/kg in 2010. This was because of the majority of production (87 percent in 2010) being low-value Japanese kelp. Production in the Democratic People's Republic of Korea showed a growth rate of just 1 percent/year between 2000 and 2010. These three countries made up 99.8 percent of the production in the Other Asia subregion in 2010.

#### *Oceania*

Aquaculture production in Oceania is relatively limited. Oceania's total aquaculture production amounted to 0.2 million tonnes worth US\$1.1 billion at an overall high unit value of US\$5.50/kg in 2010, equating to just 0.25 percent of the total world aquaculture production. The growth rate in production was slow at 4 percent/year in terms of volume and 9 percent/year in terms of value between 2000 and 2010.

Oceania's production is dominated by the production of high-value molluscs and freshwater and diadromous fish. The Oceania subregion also produces small amounts of aquatic plants, marine fish, crustaceans and aquatic animals nei, with each accounting for just 1 to 7 percent of total production from the region. This production comes almost exclusively from New Zealand (110 592 tonnes or 56 percent in 2010) and Australia (69 581 tonnes or 35 percent in 2010), with only 9 percent coming from the Pacific Islands.

## **THEME 2: REGIONAL INITIATIVES PROMOTING IMPROVED ASSESSMENTS FOR STRENGTHENING MANAGEMENT**

### **The Bay of Bengal Large Marine Ecosystem – Regional Fisheries Management Advisory Committee (RFMAC)**

*Chris O'Brien, Bay of Bengal Large Marine Ecosystem Project*

At its 31<sup>st</sup> Session, APFIC was informed that the Bay of Bengal Large Marine Ecosystem Project (BOBLME) would form a Regional Fisheries Management Advisory Committee (RFMAC). This committee would provide ecosystem-based advice to the BOBLME Project countries. This committee was also requested to provide information on the Bay of Bengal region and its activities at the APFIC 32<sup>nd</sup> Session. The BOBLME Project is supporting countries to implement an ecosystem approach to fisheries management (EAFM) of shared fishstocks in the Bay of Bengal.

The EAFM framework has three tiers:

- Working groups to provide technical information
- A Regional Fisheries Management Advisory Committee (RFMAC), to interpret the information and deliver ecosystem based fisheries management advice
- A Regional Fisheries Management Forum (RFMF) to deliberate on the advice and make decisions for national actions. The RFMAC comprises members from the eight BOBLME countries, SEAFDEC, FAO, BOBP-IGO and IUCN

The working groups have been meeting since 2010; and the BOBLME Regional Fisheries Management Advisory Committee (RFMAC) convened its first meeting in Bangkok, 25-26 June 2012. The RFMAC meeting comprised government representatives for fisheries and environment from the BOBLME countries, and observers from SEAFDEC, FAO, BOBP-IGO and IUCN. The decision making forum is yet to meet.

The RFMAC reviewed ecosystem related information on the status of two key species that form significant fisheries in the BOBLME region: hilsa (*Tenualosa ilisha*) and the Indian Mackerel (*Rastrelliger kanagurta*).

The principal conclusions and recommendations from two advisory notes for Hilsa and Indian Mackerel developed out of the first RFMAC is the first ever regional management advisory on the shared fisheries for hilsa and Indian Mackerel. This advisory covered ecosystem status; socio-economic issues; governance issues; and various management options and their consequences.

In the ecosystem status section, the advisories addressed the biological status of hilsa (regional stock); what impact the fishery is having on the environment; what impact the fishery is having on endangered, threatened and protected species; what impact the fishery is having on other species; and what external factors threaten the fishery.

In the socio-economic section, the advisories covered employment and income; the value of the catch and the importance of the fishery to coastal communities. In the governance section, current management; implementation of an EAFM; data and information; legal tools and compliance; MPAs; and institutional structure.

#### *Indian Mackerel (Rastrelliger kanagurta)*

Indian Mackerel is a relatively cheap nutritious fish that is important in food security in the Bay of Bengal countries. The stock status is uncertain. Annual catches have been relatively stable over the period 2003–2007 at between 100 000 and 120 000 tonnes. However, catch statistics are not up to date and figures for the last 5 years are not available.

There is an urgent need to better understand the stock structure and improve catch statistics for Indian Mackerel.

RFMAC principal recommendations for management of Indian mackerel
Improve the catch statistics for Indian mackerel.
Through the BOBLME Project, complete the genetics study to determine the stock structure of Indian mackerel in the Bay of Bengal
Establish in-country multi-agency committees to monitor the implementation of the national Indian mackerel management plans.
Through the BOBLME Project, countries convene a regional Indian mackerel management forum to consider the advice of the RFMAC and monitor the implementation of a Regional Indian Mackerel Management Plan.



## *Hilsa (Tenualosa ilisha)*

Hilsa generates employment and income for millions of people in Bangladesh, India and Myanmar and the fishery is worth over US\$2 billion. Despite this, hilsa remains a subsistence food item for many poor coastal communities. It is the national fish in Bangladesh. The regional hilsa stock is overfished; and pollution and loss of essential riverine habitats through siltation and water diversion is further reducing fish numbers.

### *Follow up processes*

The BOBLME countries have made a range of key decisions relating to the development of the BOBLME Strategic Action Programme which will address the major issues relating to over-exploitation of marine living resources. The above recommended actions are specific to the hilsa and Indian Mackerel fisheries and should be implemented in conjunction with

the wider ranging actions that are intended to address the (i) decline in overall availability of fish resources; (ii) changes in species composition of catches; (iii) high proportion of juvenile fish in the catch; and (iv) changes in marine biodiversity.

### **RFMAC principal recommendations for management of hilsa in Bangladesh, India and Myanmar**

Reduce the numbers of fishing vessels targeting hilsa to increase stock numbers.

Protect spawning and nursery areas to rebuild the stock by introducing seasonal closures and hilsa sanctuaries.

Reduce the catches of juvenile hilsa by introducing regulations to make 110 mm mesh nets the legal minimum mesh size to be used by hilsa fishers.

Increase compliance with hilsa fishery regulations through awareness programmes and strengthening monitoring and enforcement capacity.

Establish dialogue and collaboration with the water management and land use authorities to create a better understanding of fisheries requirements and increase the amount of riverine habitat, water flow and improve water quality.

Establish in-country multi-agency committees to monitor the implementation of the national hilsa management plans. Management options and consequences.

Through the BOBLME Project, Bangladesh, India and Myanmar convene a trilateral regional hilsa management forum to consider the advice of the RFMAC and monitor the implementation of the Regional Hilsa Management Plan.

## **Managing complex fisheries using risk-based assessments – some ideas to facilitate the adoption of management regimes in Southeast Asia**

*Duncan Leadbitter, Sustainable Fisheries Partnership*

### **Introduction**

Multispecies fisheries present some major challenges for fishery managers wherever they occur in the world. They are especially problematic in countries where species diversity is very high (such as in the tropics), where management capacity is low and where fisheries policy and law continues to be focused on development rather than long-term sustainable use.

Catches continue to grow in many parts of Asia despite widespread evidence of resource depletion and overfishing.<sup>1</sup> There is evidence of serial depletion in geographic and species terms as well as on

<sup>1</sup> Lymer, D., Funge-Smith, S. & Miao, W. 2010. *Status and potential of fisheries and aquaculture in Asia and the Pacific 2010*. FAO Regional Office for Asia and the Pacific. RAP Publication 2010/17.85.

Stobutzki, I.C., Silvestre, G.T., Abu Talib, A., Krongprom, A., Supongpan, M., Khemakorn, P., Armada, N. & Garces, L.R. 2006. Decline of demersal coastal fisheries resources in three developing Asian countries. *Fisheries Research* 78: 130–142.

Ahmed, A.T. 2011. *Risk assessment for decision-making: case study, mixed species fisheries*. Asia-Pacific Fishery Commission Meeting, Yangon, Myanmar.

Ye, Y., Cochrane, K. & Qiu, Y. 2011. Using ecological indicators in the context of an ecosystem approach to fisheries for data-limited fisheries. *Fisheries Research* 112 (3): 108–116.

a trophic basis.<sup>2</sup> Depending on the country being considered, management has commonly failed to lock in the benefits of fishery development, resulting in transient and inequitably distributed benefits, and missed opportunities for long-term poverty alleviation.

The need for an enhanced approach to management in the region has been highlighted in a number of regionally significant forums such as the Asia-Pacific Fishery Commission (APFIC) and the Association of Southeast Asian Nations (ASEAN).

The APFIC regional consultative workshop<sup>3</sup> held in Myanmar in 2011 clearly spelled out the challenges facing those seeking to improve the management of multispecies fisheries in tropical countries, and ASEAN has adopted resolutions pertaining to the need for improved fisheries management at a number of meetings over the past decades. In 2001 it adopted the following recommendations:

*The effective management of fisheries should be encouraged through delegation of selected management functions to the local level.*

*The need to progressively replace “open access” to fisheries resources with “limited access regimes” should be recognized through the introduction of rights-based fisheries, which may also facilitate the management of fishing capacity and promote the use of responsible fishing gears and practices.*

At the joint SEAFDEC-ASEAN Conference on Sustainable Fisheries for Food Security for the ASEAN Region Towards 2020,<sup>4</sup> ASEAN ministers adopted the following resolutions:

*To implement effective management of fisheries through an ecosystem approach to fisheries that integrates habitat and fishery resource management aimed at increasing the social and economic benefits to all stakeholders, especially through delegating selected management functions to the local level and promoting co-management as a partnership between government and relevant stakeholders.*

*To promote better management of fishing capacity and use of responsible fishing technologies and practices, recognizing the movement towards replacing the “open access” to fisheries resources with “limited access” through rights-based fisheries, and at the same time secure the rights and well-being of inland and coastal fisheries communities.*

The particular case of the need to manage and control the activities of trawl fisheries in the region has been the subject of major research projects for several decades including TrawlBase,<sup>5</sup> which

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<sup>2</sup> Lymer *et al. op. cit.*

Chen, Z., Yongsong Qiu, Y., Xiaoping Jia, X. & Xu, S. 2008. Simulating fisheries management options for the Beibu Gulf by means of an ecological modelling optimization routine. *Fisheries Research* 89: 257–265.

Chen, Z., Qiu, Y. & Xu, S. 2011. Changes in trophic flows and ecosystem properties of the Beibu Gulf ecosystem before and after the collapse of fish stocks. *Ocean & Coastal Management* 54: 601–611.

Christensen, V. 1998. Fishery-induced changes in a marine ecosystem: insight from models of the Gulf of Thailand. *Journal of Fish Biology* 53 (Supplement A), 128–142.

Ainsworth, C.H., Varkey, D.A. & Pitcher, T.J. 2008. Ecosystem simulations supporting ecosystem-based fisheries management in the Coral Triangle, Indonesia. *Ecological Modelling* 214: 361–374.

<sup>3</sup> FAO. 2012. APFIC/FAO Regional consultative workshop: strengthening assessment of fisheries and aquaculture in the Asia-Pacific region for policy development, Yangon, Myanmar, 4–6 October 2011. FAO Regional Office for Asia and the Pacific, Bangkok, Thailand. RAP Publication 2012/12.

<sup>4</sup> SEAFDEC, 2011. Resolution and plan of action on sustainable fisheries for food security for the ASEAN region towards 2020. Southeast Asian Fisheries Development Center.

<sup>5</sup> Silvestre, G.T., Garces, L.R., Stobutzki, I., Ahmed, M., Santos, R.A.V., Luna, C.Z. & Zhou, W. 2003. South and Southeast Asian coastal fisheries: their status and directions for improved management. Conference synopsis and recommendations, pp. 1–40. In G. Silvestre, L. Garces, I. Stobutzki, M. Ahmed, R.A. Valmonte-Santos, C. Luna, L. Lachica-Aliño, P. Munro, V. Christensen & D. Pauly (eds.) Assessment, management and future directions for coastal fisheries in Asian countries. WorldFish Center Conference Proceedings 67.

examined the status of trawl resources across the region, the Regional Bycatch I (REBYC- I) project which evaluated mechanisms for reducing bycatch and the recently commenced REBYC-II project. This latter project aims to explore management options as opposed to relying on the development and implementation of technical measures.

More recently the Southeast Asian Fisheries Development Center<sup>6</sup> highlighted the need to improve fisheries management in the face of increasing demands for food security and increasing evidence of some fish resources being fished beyond sustainable limits.

The aim of this report is to postulate whether a risk-based management framework is both desirable and achievable as a mechanism for driving the adoption of management plans for these complex fisheries. The report puts forward the view that a risk-based approach assists managers and stakeholders to engage in the management process in a productive way that takes heed of the data poor nature of the fisheries. It helps implement a precautionary approach to fisheries in that justifiable decisions can be made in the absence of complete information. The risk-based approach proposed raises a large number of questions that need to be explored via trials and discussions with both experts and stakeholder groups.

### **Problem statement**

The SEAFDEC Regional Guidelines for Responsible Fishing Operations In Southeast Asia<sup>7</sup> set out the rationale for the need to take a different approach to managing fisheries in Southeast Asia based on cultural, ecosystem and fisheries structural considerations. Some of the practical implications for management in each of these categories include:

- The concept of bycatch is not well recognized as most, if not all, species taken in most fisheries have a use. As a result, discarding is not as pronounced as it is in many temperate water countries although it is recognized that discarding can often be a result of management requirements.
- The high diversity of species that comprise the majority of the catch in a fishing operation means that the cost of conducting formal stock assessments for all species is prohibitive.<sup>8</sup> Catches commonly comprise species with a diversity of life history strategies (r and k selected) with some high turnover species (e.g. squids and shrimps) difficult to evaluate using quantitative stock assessments and the benefits of attempting to do so are probably questionable.
- Although industrial-scale fisheries have developed in the region, the vast majority of fishers are small-scale and this makes enforcement, reporting and catch assessments very challenging.

For a variety of reasons, such as the large number of species, financial capacity, a large number of fisheries are data poor with formal assessments either not being undertaken, being undertaken at long time intervals (e.g. decades) and not being coordinated across international boundaries because of lack of formal fishery agreements. This is not to say that formal assessments are not undertaken and some fisheries agencies (e.g. Malaysia, India) have evaluated the status of some key species and made the results publicly available.

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<sup>6</sup> SEAFDEC. 2012. The Southeast Asian state of fisheries and aquaculture 2012. Southeast Asian Fisheries Development Center, Bangkok, Thailand.

<sup>7</sup> SEAFDEC. 2003. Regional guidelines for responsible fishing operations in Southeast Asia. Southeast Asian Fisheries Development Center. MFRDMD/SP/3 APRIL 2003.

<sup>8</sup> Stobutzki *et al. op. cit.*

Patrick, W.S., Lawson, P., Spencer, P., Gedamke, T., Link, J., Cortás, E., Cope, J., Ormseth, O., Field, J., Bigelow, K., Kobayashi, D., & Overholtz, W. 2010. Using productivity and susceptibility indices to assess the vulnerability of United States fish stocks to overfishing. *Fish. Bull.* 108: 305–322.

The situation has been made more complicated by the adoption of the ecosystem approach to fisheries (EAF), which has been interpreted by some as meaning that there is a need to have quantitative understandings of the relationships between species in order to manage in accordance with this new paradigm. Understanding in a quantitative way all the relationships between ecosystem components is challenging enough in ecosystems with a relatively small number of species but simply unworkable in the tropics.

Management implementation varies across the region but there is a general focus on technical measures such as gear type restrictions (ranging from bans on certain gear such as push nets to specifications on mesh sizes), time and area closures and zoning whereby certain areas are allocated to certain user groups. In some countries licensing schemes have been established and enforced and restricted entry regimes implemented whereas in others open access remains the norm either officially or unofficially via poor enforcement.

Very few countries have management plans for their fisheries. There is generally no explicit link between clear management objectives and management measures beyond allocation and, in some cases, the protection of juvenile fish (via mesh size limits). As such there does not appear to be any mechanisms in place for responding to clear evidence that resources are in trouble. Gathering multispecies data, identifying the cause of the problem (if it is fishing then the fleet responsible may be located in a neighbouring state) and building support for change may take years.

The need for timely decision-making has been highlighted on many occasions by those with an interest in fisheries sustainability – including government, industry and NGOs. This has created a demand for tools that can provide defensible information for decision-makers even in the absence of rigorous scientific data. In recent years there has been a growing focus on the needs of data poor fisheries as there are many examples where data poor situations create a decision-making vacuum that results in overexploitation (amongst other impacts).

### **Risk-based assessments as one solution**

Although there are a number of approaches to dealing with data poor situations,<sup>9</sup> the development of risk-based approaches parallels the rise in risk-based decision-making in data rich fisheries where tools such as Management Strategy Evaluation<sup>10</sup> are used and situations whereby scientific advice on, for example, total allowable catch (TAC) setting is worded in terms of probabilities of biomass increasing or decreasing under a range of catch scenarios.

It can be considered that risk has three components,<sup>11</sup> namely the variable state of the world, imperfect knowledge of the state of the world, including the future, and a desired state of the world. Most fisheries operate in a variable world of less than optimum knowledge but this is particularly the case for multispecies fisheries for the reasons outlined above. The third component implies the establishment of management objectives that will be addressed below.

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<sup>9</sup> Ames, T. 2010. Multispecies coastal shelf recovery plan: a collaborative, ecosystem-based approach. *Marine and Coastal Fisheries: Dynamics, Management, and Ecosystem Science* 2: 217–231.

Cope, J.M. & Punt, A.E. 2009. Length-based reference points for data-limited situations: applications and restrictions. *Marine and Coastal Fisheries: Dynamics, Management, and Ecosystem Science* 1:169–186.

Starr, R.M., Carr, M., Malone, D., Greenley, A. & Mcmillan, S. 2010. Complementary sampling methods to inform ecosystem-based management of nearshore fisheries. *Marine and Coastal Fisheries: Dynamics, Management, and Ecosystem Science* 2:159–179.

<sup>10</sup> Holland, D.S. 2010. Management strategy evaluation and management procedures: tools for rebuilding and sustaining fisheries. *OECD Food, Agriculture and Fisheries Working Papers*, No. 25, OECD Publishing. And Rademeyer, R.A., Plaganyi, E.E. & Butterworth, D.S. 2007. Tips and tricks in designing management procedures. *ICES Journal of Marine Science*, 64: 618–625.

<sup>11</sup> Sethi, S.A. 2010. Risk management for fisheries. *Fish and Fisheries* 11: 341–365.

An early approach proposing risk assessment as a mechanism for evaluating the sustainability of bycatch species and addressing management priorities for use in a complex tropical trawl fishery was used for the Northern Prawn Fishery in the Gulf of Carpentaria, Australia.<sup>12</sup> In this fishery there are over 400 recorded species taken and for the vast majority there is little available information beyond basic biological parameters. The costs of conducting stock assessments for each and every species to ensure sustainability are simply prohibitive and it was postulated that some species are less vulnerable to trawling than others. Identifying which species were more vulnerable than others would help managers, scientists and industry focus their research and management efforts.

A key component of the risk-based approach that has been developed<sup>13</sup> is Productivity Susceptibility Analysis (PSA), which generates an index of the vulnerability of a species to overfishing. Vulnerability can be defined<sup>14</sup> as a measurement of a stock's productivity and its susceptibility to a fishery. Productivity refers to the capacity of the stock to recover rapidly when depleted, whereas susceptibility is the potential for the stock to be impacted by the fishery. These definitions assume that there is knowledge about the stock. However, for most data-poor fisheries this is not available and often species distribution is substituted as a surrogate.

PSA has been applied in a number of cases such as Malaysia,<sup>15</sup> Australia,<sup>16</sup> the Philippines,<sup>17</sup> India,<sup>18</sup> New Zealand tuna fisheries,<sup>19</sup> the United States,<sup>20</sup> Argentina<sup>21</sup> and a number of fisheries that have been certified as meeting to the Marine Stewardship Council Standard for Sustainable Fisheries (see [www.msc.org](http://www.msc.org)).

The productivity axis comprises attributes that are inherent to the species involved and although changes in some of these parameters may be driven by fishing (e.g. age at first maturity may be affected by heavy fishing pressure) these attributes are generally less amenable to management intervention than attributes that comprise the susceptibility axis. Thus, opportunities to reduce risk would be driven more by changes in susceptibility than by changes in productivity.

Risk management can be considered<sup>22</sup> as a loose term for “*the general process of identifying, characterizing and reacting to risk.*” A more straightforward definition<sup>23</sup> is “*the logical development and implementation of a plan to deal with potential losses.*” From a fisheries perspective the question of potential losses covers a variety of potential outcomes, such as:

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<sup>12</sup> Stobutzki *et al. op. cit.*

<sup>13</sup> See not only Stobutzki *et al. op. cit.*, but also Hobday, A.J., Smith, A.D.M., Stobutzki, I., Bulman, C., Daley, R., Dambacher, J., Deng, R., *et al.* Ecological Risk Assessment for the effects of fishing. *Fisheries Research* 2011; 108: 372–384.

<sup>14</sup> Patrick *et al.* 2010. *op. cit.*

<sup>15</sup> Ahmed. *op. cit.*

<sup>16</sup> Griffiths, S., Kenyon, G., Bulman, C., Dowdney, J., Williams, A., Sporic, M. & Fuller, M. 2007. Ecological risk assessment for effects of fishing – report for the northern prawn fishery. Report No. R04/1072 1 29/06/2007. Australian Fisheries Management Authority, Canberra.

<sup>17</sup> Leadbitter, D. & Banks, R. 2010. Sustainability Audit Report for groupers and snappers taken in selected municipal and city waters of Zamboanga del Norte province, Republic of the Philippines. Report for the Regional Fisheries Livelihoods Programme ([www.rflp.org](http://www.rflp.org)) by Poseidon Aquatic Resource Management, Australia.

<sup>18</sup> Vivekanandan, E., Mohamed, K.S., Kuriakose, S., Sathianandan, T.V., Ganga, U., Lakshmi Pillai, S., & Nair, R.J. 2009. Status of marine fish stock assessment in India and development of a sustainability index. The 2<sup>nd</sup> workshop on the assessment of fishery stock status in South and Southeast Asia 5–9 October 2009, Bangkok, Thailand.

<sup>19</sup> Waugh, S., D. Filippi, Walker, N., & Kirby, D. 2008. Preliminary results of an ecological risk assessment for New Zealand fisheries interactions with seabirds and marine mammals. WCPFC-SC4-2008/EB-WP-2, Western and Central Pacific Fisheries Commission Scientific Committee Fourth Regular Session, 11–22 August 2008, Port Moresby, Papua New Guinea.

<sup>20</sup> Patrick *et al. op. cit.*

<sup>21</sup> Morales-Yokoboria, M.L., Prenska, L.B., & Blancob, G. 2011. A sight on the Marine Stewardship Council semi-quantitative analysis applied to an Argentinean fishery. *Procedia Environmental Sciences* 7: 122–127.

<sup>22</sup> Sethi *op. cit.*

<sup>23</sup> Dorfman, M.S. 2008. *Introduction to risk management and insurance*. Prentice Hall, Upper Saddle River.

- The loss of economically valuable species – an example is the loss of high-value species that are more vulnerable to fishing pressure than low-value species. Snappers and groupers have been more heavily affected by unmanaged fisheries than ponyfish, for example.<sup>24</sup>
- The loss of future development and profit opportunities – an example would be the loss of currently underutilized species for which there was potential in the future. Some species, if better handled, could become valuable in the future. This was the case for surimi species which were once sent to fishmeal plants as trash fish but improved handling has increased economic opportunities.
- Differential economic/social impacts on communities dependent on vulnerable species – an example being fishing communities dependent (possibly via their dependence on certain gear types or boat sizes) on particular fish species such as small-scale handliners being dependent on groupers.
- The retention of a relatively small number of vulnerable species (e.g. sharks and rays) brings benefits as they support a diversity of income sources, and it may be a sustainable practice if a “balanced harvest” approach is taken (see section titled ‘Harvest Strategy’ on page 41 for more detailed information).

There are, of course non-economic reasons to manage losses that may relate to biodiversity conservation. The PSA approach is best developed for species of fish, but can also be applied to animals of potential conservation concern such as reptiles, birds and mammals.<sup>25</sup> Other ecosystem system components such as benthic impacts have recently been subject to the development of ecological risk assessment tools.<sup>26</sup> However, there is a need<sup>27</sup> to ensure that non-fishery influences on the PSA are accounted for in some way as changes in susceptibility may well be driven by environmental factors that change availability, for example, and not be related to management intervention.

### **The susceptibility parameters**

As described above the various PSA models created have some common parameters but also some significant differences. A list of the parameters which each of the models under consideration utilizes to describe the susceptibility coordinate is provided below (Table 1).

Some of these may not be amenable to management decisions or may not be useful in the context of Asia trawl such as:

1. Price/value/desirability – unless the aim is to manipulate market prices then these parameters are not valuable from a management perspective.
2. Post-capture release/survival – a better aim is to use management to prevent capture. It should be noted though that for trawl gear in particular, some attention needs to be paid to post-gear contact mortality.
3. Biomass, abundance and mortality – although valuable parameters, many of the fisheries under consideration will be data poor and biomass estimates and estimates of M may not be available.

<sup>24</sup> See references above on ecosystem modelling such as Christensen *op. cit.*

<sup>25</sup> Kiszka, J. 2012. An ecological risk assessment of fishing for marine mammals, sea turtles and elasmobranchs in artisanal fisheries of the SW Indian Ocean from interview survey data. Report to the Working Party on Ecosystems and Bycatch, Indian Ocean Tuna Commission, Cape Town, South Africa, 15–17 September 2012.

<sup>26</sup> Williams, A., Dowdney, J., Smith, A.D.M., Hobday, A.J. & Fuller, M. 2011. Evaluating impacts of fishing on benthic habitats: a risk assessment framework applied to Australian fisheries. *Fisheries Research* 112(3): 154–167.

<sup>27</sup> Morales-Yokobori *et al. op. cit.*

**Table 1** Susceptibility parameters in three PSA approaches

Author	Hobday <i>et al.</i> (2011)	Patrick <i>et al.</i> (2010)	Vivekanandan <i>et al.</i> (2009)
Susceptibility parameters	<ul style="list-style-type: none"> <li>– Areal overlap</li> <li>– Vertical overlap</li> <li>– Selectivity</li> <li>– Post-capture mortality</li> </ul>	<ul style="list-style-type: none"> <li>– Areal overlap</li> <li>– Vertical overlap</li> <li>– Geographic concentration</li> <li>– Seasonal migration</li> <li>– School, aggregation, behavioural responses</li> <li>– Morphology affecting capture</li> <li>– Value/desirability of fish</li> <li>– Management strategy</li> <li>– F in relation to M</li> <li>– Biomass of spawners</li> <li>– Survival after release</li> <li>– Fishery impact on habitat</li> </ul>	<ul style="list-style-type: none"> <li>– Exploitation ratio</li> <li>– Susceptibility to fishing gear</li> <li>– Price index</li> <li>– Distribution on shelf</li> <li>– <math>L_r/L_{inf}</math></li> <li>– Coastal productivity index</li> </ul>

4. Environmental interactions – changes to oceanographic conditions do not lend themselves to management although pollution impacts and habitat destruction (non-fishery related) are obviously amenable to management.

There are three categories that are amenable to management intervention:

1. Spatial overlap – variously described as areal overlap, vertical overlap, geographic concentration, aggregation and distribution on shelf. In short, if the fish are in the same area as the fishing gear then there is a potential for them to be caught and thus the option of using time/area closures or other separation techniques can be utilized.
2. Fish attributes affecting capture – variously described as morphology, susceptibility, selectivity and the  $L_r/L_{inf}$  ratio. These can be addressed via technical measures such as mesh size, mesh orientation (e.g. square versus diamond), bycatch reduction devices.
3. Management – including strategy, exploitation ratio. This might primarily<sup>28</sup> focus on the existence of catch limits and “accountability mechanisms”. However, there are probably other elements that could be included. There is a need to address the reality that the absence of management is a risk and that some fisheries are better placed than others.

There is a need for care to ensure that parameters chosen are not correlated in some way and that larger numbers of parameters are not necessarily better.<sup>29</sup> The system used by Patrick *et al.* (2010) originally identified 75 potential parameters,<sup>30</sup> but these were reduced in number for a variety of reasons, including the possibility of duplication and lack of significant gains in information for the costs of collecting data.

Each of the PSA-based systems have algorithms that enable an index of vulnerability to be created and this combines not only the judgement made about each parameter into a score for each of the productivity and susceptibility axes but then creates an aggregate PSA score. The algorithms and weightings used are obviously influential in determining the final outcomes with the approach used by Hobday *et al.* (2011) being additive whereas that of Patrick *et al.* (2010) being multiplicative. There needs to be a balance struck between ensuring sufficient coverage of parameters and not

<sup>28</sup> As in the approach of Patrick *et al.* *op. cit.*

<sup>29</sup> Hobday *et al.* (2011).

<sup>30</sup> Patrick *et al.* *op. cit.*

diluting the influence of any given one to the extent that sensitivity to change is hampered.<sup>31</sup> There would be little value in adopting a system designed to evaluate management that was not responsive to management intervention.

### **Evaluating management using a risk-based method**

Although there is a growing number of species/fishery assessments available and these are used to highlight species that may require further investigation and/or management attention, examples of the use of the PSA to evaluate the efficacy of management could not be found in the public domain. PSA has been used in Malaysia to evaluate the potential impact of different fishing methods<sup>32</sup> that could then provide the basis for advice on exploitation strategy, but mechanisms for ameliorating vulnerability by manipulating the factors constituting the susceptibility axis were not explored.

It should be noted that fisheries undergoing an evaluation against the MSC standard can make use of the risk-based framework (RBF)<sup>33</sup> and that a certification body can rerun the RBF in order to evaluate proposals by the fishery for addressing a poor score. However, the MSC system only allows the RBF to be used for one certification cycle, thus pushing the fishery towards collecting adequate data and therefore the RBF is not used as a management tool.

In this report, the potential for using the PSA to evaluate management options is explored using various hypothetical management scenarios for a number of species found in tropical trawl fisheries from Viet Nam, Thailand, Indonesia and Australia. However, only one approach to the Productivity Susceptibility Analysis is explored<sup>34</sup> as an existing Excel workbook is downloadable from the Web site of the MSC.

The same technique could also be applied using other methods published by Patrick *et al.* (2010) and Vivekanandan *et al.* (2009). Twelve scenarios involving various degrees of management designed to alter the degree of susceptibility to capture and response to discarding are presented in Table 2.

The susceptibility parameters were manipulated to represent measures taken to either increase or decrease each of availability, encounterability, selectivity and post-capture mortality.

Although it is true that few species are discarded and thus questions of post-harvest survival are generally not applicable in many fisheries in Asia, it was decided that it is better not to discard any parameters at this stage, as this affects the relative weightings. This may be an option if the system is further developed.

Availability and encounterability could be varied by time and area closures or net design (e.g. high-opening designs) and selectivity by varying mesh size or use of various bycatch reduction devices. Post-harvest mortality could be varied by adopting onboard handling techniques such as swim tanks and hoppers.<sup>35</sup> There are undoubtedly many alternatives that could be explored and the options chosen are simply to illustrate how the system could operate.

The basis for the percentages used in Table 2 is set out in the matrix in Table 3. So, for example, no closed area maps to >30 percent overlap with fishing gear and medium closed areas to 10 to 30 percent overlap. It should be noted that other types of management responses that affect susceptibility to capture could be tested within this framework.

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<sup>31</sup> Alistair Hobday, pers. comm.

<sup>32</sup> Ahmed *op. cit.*

<sup>33</sup> Based on Hobday *et al.* (2011).

<sup>34</sup> The method of Hobday *et al.* (2011).

<sup>35</sup> See, for example, Leadbitter, D. (1999). Bycatch Solutions. Ocean Watch Australia, Sydney.



**Table 2** Management measures used as the basis for risk scenarios

Scenario number	Availability and encounterability (spatial)	Availability and encounterability (temporal and gear)	Selectivity	Post-capture mortality
Scenario 1	Closed areas reduce access by fishery to less than 10 percent of species range	Time of fishing occurs when species is not on the seabed	Mesh size selective for adult fish	Discards have high natural survival rate
Scenario 2	Closed areas reduce access by fishery to less than 10 percent of species range	Time of fishing occurs when species is not on the seabed	Mesh size selective for adult fish	Discards have low natural survival rate but hoppers used on board to keep fish alive prior to being returned to water
Scenario 3	Closed areas reduce access by fishery to less than 10 percent of species range	Time of fishing occurs when species is not on the seabed	Mesh size selective for adult fish and sub-adult fish	Discards have low natural survival rate but hoppers used on board to keep fish alive prior to being returned to the water
Scenario 4	Closed areas reduce access by fishery to less than 10 percent of species range	Time of fishing occurs when species is not on the seabed	Mesh size selective for adult fish	Discards have low natural survival rate
Scenario 5	Closed areas reduce access by fishery to less than 10 percent of species range	Wide opening net takes fish both on the seabed and slightly above it	Mesh size selective for adult fish and sub-adult fish	Discards have low natural survival rate but hoppers used on board to keep fish alive prior to being returned to the water
Scenario 6	Closed areas reduce access by fishery to between 10 and 30 percent of species range	Wide opening net takes fish both on the seabed and slightly above it	Mesh size selective for adult fish and sub-adult fish	Discards have low natural survival rate but hoppers used on board to keep fish alive prior to being returned to the water
Scenario 7	Fishery has access to the majority of the range of the species	Fish are benthic in habit and easily captured by a trawl	Mesh size only takes adults	Discards have a high natural survival rate
Scenario 8	Closed areas reduce access by fishery to between 10 and 30 percent of species range	Wide opening net takes fish both on the seabed and slightly above it	Mesh size selective for adult fish and sub-adult fish	Discards have low natural survival rate
Scenario 9	Fishery has access to the majority of the range of the species	Fish are benthic in habit and easily captured by a trawl	Mesh size takes adults and sub-adults	Discards have a low natural survival rate but hoppers used on board to increase survival rate
Scenario 10	Fishery has access to the majority of the range of the species	Fish are benthic in habit and easily captured by a trawl	Mesh size takes all life history stages	Discards have a high natural survival rate
Scenario 11	Closed areas reduce access by the fishery to between 10 and 30 percent of the range of the species	Fish are benthic in habit and easily captured by a trawl	Mesh size takes all life history stages	Discards have a high natural survival rate
Scenario 12	Fishery has access to the majority of the range of the species	Fish are benthic in habit and easily captured by a trawl	Mesh size takes all life history stages	Discards have a low natural survival rate

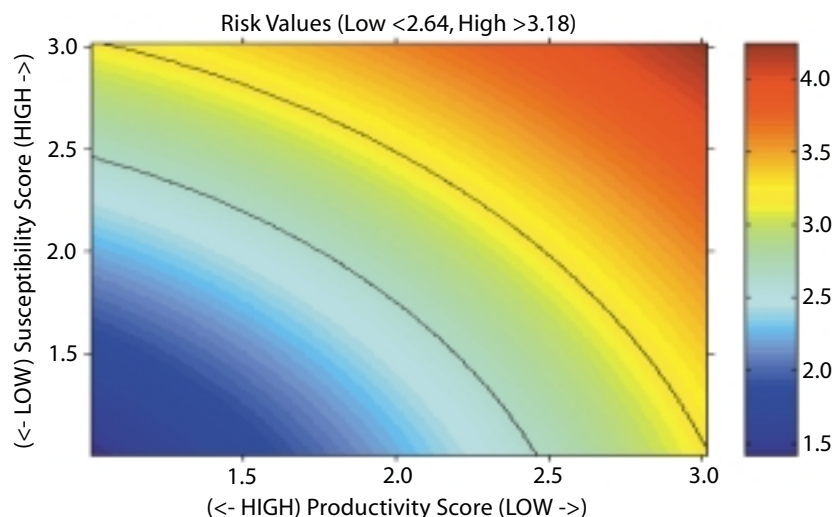
**Table 3** The cutoffs used for basis of the percentages in Table 2 (Source: Hobday *et al.*, 2011)

Susceptibility cutoff scores for species attributes for the ERAEF Level 2 PSA method. These example cutoffs have been determined from analysis of the distribution of attribute values for species in the ERAEF database, and are intended to divide the attribute values into low, medium and high susceptibility categories. A choice of attributes exists for some susceptibility aspects, such as availability: where if data are availability 1 is preferred over availability 2, while for encounterability, the maximum score of the two attribute choices (encounterability 1 and encounterability 2) is used.

Attribute	Low susceptibility (low risk, score = 1)	Medium susceptibility (medium risk, score = 2)	High susceptibility (high risk, score = 3)
Availability 1. Overlap of species range with fishery	<10% overlap	10–30% overlap	>30% overlap
Availability 2. Global distribution. Also need to consider stock proxies	Globally distributed	Restricted to same hemisphere/ocean basin as fishery	Restricted to same country as fishery
Encounterability 1 – Habitat (scores vary by fishery)	Low overlap with fishing gear	Medium overlap with fishing gear	High overlap with fishing gear
Encounterability 2 – depth check (scores vary by fishery)	Low overlap with fishing gear	Medium overlap with fishing gear	High overlap with fishing gear
Selectivity (Scores vary by gear type, this example is for set gillnets)	Species <mesh size, or >5 m in length	Species 1-2 times mesh size, 4-5 m in length	Species >2 times mesh size, to say, 4 m in length
Post-capture mortality (scores vary by fishery)	Evidence of post-capture release and survival	Released alive	Retained species, or majority dead when released

Risk categories used for the PSA are based on the division of the PSA plot (Figure 1) into three equal areas. Two scores may be separated by a very narrow margin and the species move from one category to another. The creation of more categories may assist the graphical demonstration of the results.

The full range of productivity parameters for one species of grouper (*Epinephelus malabaricus*)<sup>36</sup> is displayed in Table 4 for each of the scenarios described in Table 2. Although the risk categories do not demonstrate major responses to changes in susceptibility the Productivity Susceptibility Analysis score does respond to management intervention with scores ranging from a low of 2.11 when all parameters are favourable to survival through to 3.53 when the reverse is the case.



**Figure 1** Productivity-susceptibility plot indicating risk categories (Source: Hobday *et al.* 2011)

<sup>36</sup> Leadbitter and Banks *op. cit.*

**Table 4** Example of the response of one species to the various scenarios in Table 2

			Productivity scores [13]								Susceptibility scores [13]					Productivity Susceptibility Analysis (PSA) scores (automatic)	
Gear	Species	Scenario	Average age at maturity	Average max age	Fecundity	Average max size	Average size at maturity	Reproductive strategy	Trophic level (fishbase)	Total productivity (average)	Availability	Encounterability	Selectivity	Post-capture mortality	Total (multiplicative)	PSA score	Risk category
Trawl	grouper	Scenario 1	2	2	1	2	2	1	3	1.86	1	1	1	1	1.00	2.11	Low
Trawl	grouper	Scenario 2	2	2	1	2	2	1	3	1.86	1	1	1	2	1.03	2.12	Low
Trawl	grouper	Scenario 3	2	2	1	2	2	1	3	1.86	1	1	2	2	1.08	2.15	Low
Trawl	grouper	Scenario 4	2	2	1	2	2	1	3	1.86	1	1	1	3	1.05	2.13	Low
Trawl	grouper	Scenario 5	2	2	1	2	2	1	3	1.86	1	2	2	2	1.18	2.20	Low
Trawl	grouper	Scenario 6	2	2	1	2	2	1	3	1.86	2	2	2	2	1.38	2.31	Low
Trawl	grouper	Scenario 7	2	2	1	2	2	1	3	1.86	3	3	1	1	1.20	2.21	Low
Trawl	grouper	Scenario 8	2	2	1	2	2	1	3	1.86	2	2	2	3	1.58	2.44	Low
Trawl	grouper	Scenario 9	2	2	1	2	2	1	3	1.86	3	3	2	2	1.88	2.64	Low
Trawl	grouper	Scenario 10	2	2	1	2	2	1	3	1.86	3	3	3	1	1.65	2.48	Low
Trawl	grouper	Scenario 11	2	2	1	2	2	1	3	1.86	2	3	3	3	2.33	2.98	Med
Trawl	grouper	Scenario 12	2	2	1	2	2	1	3	1.86	3	3	3	3	3.00	3.53	High

The PSA scores for nine species found in trawl fisheries in Viet Nam, Thailand, Indonesia and Australia are used against the scenarios listed in Table 2 and are presented in Table 5. The productivity attributes are removed for clarity. Productivity Susceptibility Analysis scores are derived from:

- Malabar grouper (Leadbitter and Banks, 2010 as per Table 2)
- Bigeye snapper (*Priacanthus macracanthus*) – Fishbase and Liu *et al.* (2001)
- Remaining species from Griffith *et al.* (2007).

The species were chosen to demonstrate a range of PSA scores based on life history attributes that are highly productive (e.g. *Penaeus monodon*) to low productivity (*Pristis zijsron*).

Trawl fisheries that have access to a large proportion of a species range, use unselective mesh sizes and have high post-harvest mortalities (by retaining all the catch, for example) pose high risks to even those species that under relatively simple management regimes would otherwise be quite tolerant of fishing pressure (Table 5). This has important implications for species commonly used for surimi (goatfish, threadfins, barracudas etc.) and fishmeal (wide variety of species known as trash fish).

Table 5 further demonstrates how it would be possible to generate a comparison of the consequences of agreed management options for a large number of species taken in a fishery so as to adopt measures that are generally risk averse. This would help focus management attention on those species that stand out as being at risk under a variety of management scenarios.

**Table 5** Species of varying productivity (P) scores versus management scenario (susceptibility)

Species	P	1	2	3	4	5	6	7	8	9	10	11	12
Monodon	1.00	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Med
Goatfish	1.14	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	High
Bigeye snapper	1.29	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Med	High
Coioides	1.43	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Med	High
Lutjanus	1.71	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Med	High
Grouper	1.86	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Med	High
Loligo	2.29	Low	Low	Low	Low	Low	Med	Low	Med	Med	Med	High	High
Shark	2.43	Low	Low	Med	Med	Med	Med	Med	Med	Med	Med	High	High
Sawfish	2.86	Med	Med	Med	Med	Med	Med	Med	High	High	High	High	High

**Where:** Monodon = *Penaeus monodon*, Goatfish = *Upeneus sulphunurus*, Bigeye snapper = *Priacanthus macracanthus*, Coioides = *Epinephelus coioides*, Lutjanus = *Lutjanus malabaricus*, Grouper = *Epinephelus malabaricus*, Loligo = *Loligo chinensis*, Shark = *Glyphis glyphis* and Sawfish = *Pristis zijsron*

Some caution needs to be noted when considering the results from these tables, such as:

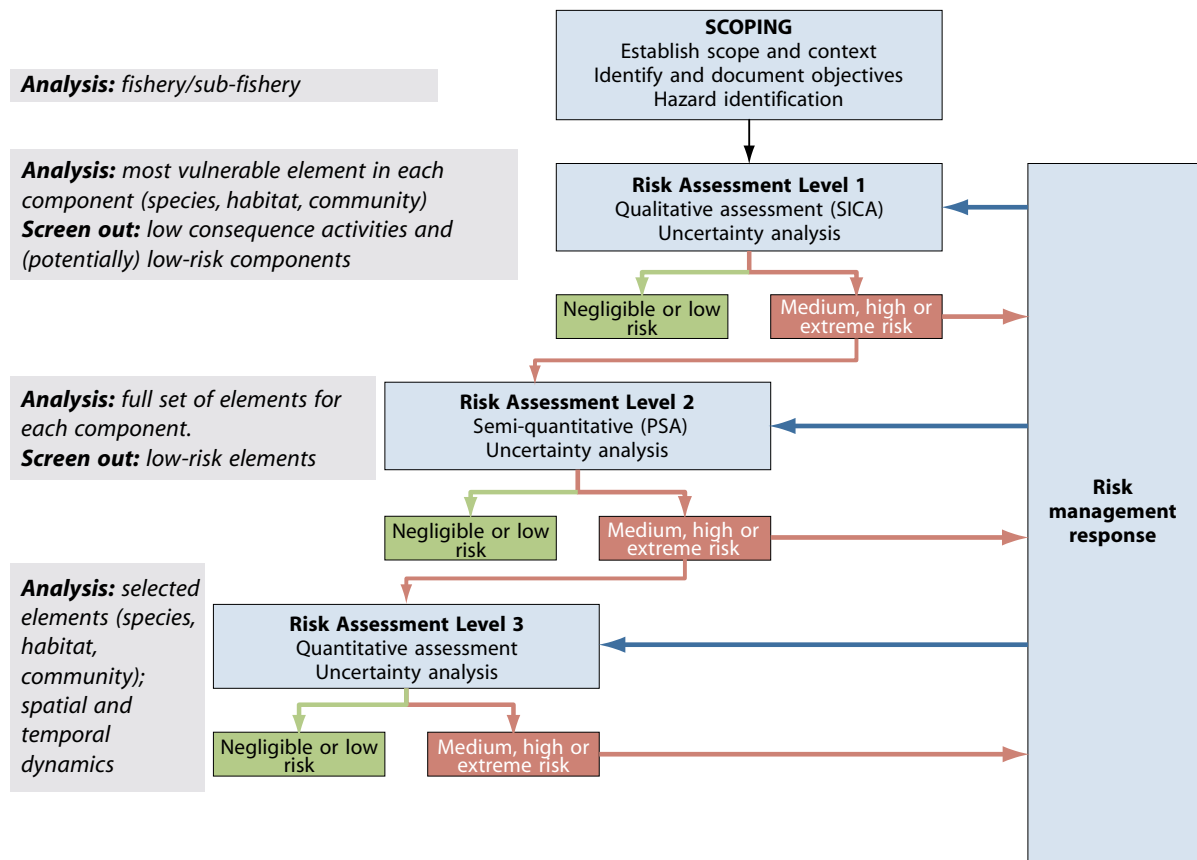
1. The PSA approach is designed to be used in data poor situations and, in line with the precautionary principle, is conservative in that it overestimates risk.
2. Managing risk is but one fisheries management objective. A species can persist at population levels that are well below those needed to support an economically viable fishery. For example, even though many groupers may persist in spite of heavy and poorly regulated fishing pressure they would not be reaching a size and a population level that would support an economically viable fishery.
3. The judgments made about the interactions with the fishing gear are based on informed judgment. In any fishery the degree of interaction with a particular species would differ, possibly in quite subtle ways.

### Designing a management framework around the PSA

To date the PSA has been used as an input to existing management systems that are primarily dependent on the availability of quantitative data or, in the case of Malaysia,<sup>37</sup> as a source of advice on preferred exploitation strategies. For example, in the Australian Commonwealth fisheries management system the Productivity Susceptibility Analysis is one tier in a multi-tiered risk assessment system that is used to identify species that should be the focus of some form of further investigation and action based on formal assessments. It has not been directly used as the basis for management decisions (except decisions aimed at facilitating research) in data poor fisheries.

In Figure 2, when managers (and fishery stakeholders) are confronted by species and/or circumstances that are associated with a high risk, the management response could conceivably take a number of forms. However, the most common course of action is to invest funds to generate more data so as to better characterize the risk and thus make management decisions based on better information. As argued earlier, the allocation of such funds may not be an option and an alternative is to take management action to reduce the risk.

<sup>37</sup> Ahmed *op. cit.*



**Figure 2** Model of the risk assessment process for a fishery (Source: Hobday *et al.*, 2011)

A key question is can a risk-based system such as the PSA can be used to directly inform management decisions that control fish catches and thus reduce risk? Other questions that follow from this are:

- Can (and should) a management system be based on moving species into a low risk category?
- What would be the positives and negatives of such a system?
- Should it be an end point in itself or a transitional arrangement to a more quantitative system?
- How could such a system meet the expectations of modern approaches to fisheries management including the setting of trigger points, harvest control rules, and ecosystem approach to fisheries and the precautionary approach?

Globally, there is a diversity of management approaches and systems that rely on informed judgment, often with stakeholder input, are common. Although formal and quantitative approaches are often proposed the fact is costs and complexity commonly make such approaches unworkable.

### Management objectives

The multispecies trawl fisheries in Asia have different objectives to those that operate in many other countries such as Australia. Although high value products such as shrimp and fish (such as groupers and snappers) are of importance, as they are elsewhere in tropical fisheries, the diversity of uses to which fish can be directed has resulted in a demand for all components of the catch. As a result, there is little or no discarding. For tropical trawl fisheries in countries such as Australia where the main product of interest may be shrimp, the management arrangements can be focused on delivering the maximum sustainable yield (or similar) of shrimp. In the Australian northern prawn fishery, for example, the research efforts have focused on (not exclusively) developing a thorough understanding of the dynamics of the key shrimp species and how they respond to various management options.

For many fisheries in Southeast Asia the management objectives (if stated) are broader, as not only is the range of utilized species far greater, but the number of potential beneficiaries is greater. This creates a huge demand for information if a quantitative approach is adopted, but the market demands for different catch components may well be in competition. For example, the mesh size needed to catch the small fish utilized for fishmeal is unsuitable for the large species (e.g. snappers and groupers), because it leads to excessive catches of juvenile fish. Conversely, the adoption of bycatch reduction devices (BRDs) aimed at reducing the catch of juvenile fish may substantially reduce the catch of small fish destined for the fishmeal plant, a factor which has probably impeded previous attempts to introduce BRDs into the region.

Although competing objectives are common in fisheries, the complexity of a tropical trawl makes it difficult to generate the sort of detailed information often needed to fully inform stakeholders and gain their support for solutions. This is especially the case when a solution that may not be optimal for one or more individual groups may well be the best solution overall. Creating a system that enables options to be explored rapidly may help facilitate the development of management plans that can provide a framework for further measures to be adopted in the future.

### **Harvest strategy**

Current harvest strategies in tropical trawl fisheries in Southeast Asia are unclear but appear to be derived from the fisheries development objectives that have underpinned the expansion of effort and catches in the region for several decades. Maximizing the biomass removed may be maximizing neither the economic return, nor even the social benefits and there is abundant evidence that this approach is depleting some species to the benefit of others, with unacceptable social and economic consequences.

Although there may well be a need to maximize the flow of benefits to as wide a group of people as possible this should not be pursued at the expense of fish resources. If objectives based on maximizing the yield from small groups of species (e.g. shrimps, snappers) are undesirable then a new approach is needed that spreads benefits across a wide range of users without endangering resources.

Recently the concept of “balanced harvest” was advanced by Garcia *et al.*<sup>38</sup> to provide a framework for managing fisheries that is an alternative to the current push towards increasing selectivity. The balanced harvest concept builds on the premise put forward by several authors<sup>39</sup> who argued that selective fishing may hinder rather than help an ecosystem approach to fisheries, and cited a number of cases where the disproportionate removal of target species has caused undesirable ecosystem changes. There is modelling to support a view that spreading modest fishing mortality across a wider range of species (and sizes) results in lower risks of problematic ecosystem outcomes.<sup>40</sup>

In the past, the focus on high-value species (i.e. selectivity based on economics) in Southeast Asia caused serial depletion and ecosystem changes.<sup>41</sup> As markets for other species have been developed fishing pressure increased on these species causing further ecosystem distortions. A key premise of this report – that the removal of all components needs to be managed, but this cannot be done using data intensive methods – suggests that a risk-based approach could be the cornerstone of a harvest strategy based on the balanced harvest concept.

<sup>38</sup> Garcia, S.M., J. Kolding, J., J. Rice, J., Rochet, M., J., Zhou, S., Arimoto, T., Beyer, J.E., Borges, L., Bundy, A., Dunn, D., Fulton, E.A., Hall, M., Heino, M., Law, R., Makino, M., Rijnsdorp, A.D., Simard, F. & Smith, A.D.M. 2012. Reconsidering the consequences of selective fisheries. *Science* Vol. 335, 2 March.

<sup>39</sup> Including Zhou, S., Smith, T. & Fuller, M. 2007. *Rapid quantitative risk assessment for fish species in selected Commonwealth fisheries*. Australian Fisheries Management Authority, Canberra, December.

<sup>40</sup> Garcia *et al. op. cit.*

<sup>41</sup> Christensen (1998).

If a low risk ranking is applied to all species in a fishery does this achieve the modest level of fishing mortality put forward by Garcia *et al.* or can this be achieved by a medium risk ranking? Further work is needed to explore these questions, which are also important for the establishment of trigger points and management objectives.

## Trigger points

Trigger points such as sustainability reference points are an integral part of modern fisheries management. A wide variety of parameters are used to define trigger points such as biomass, egg production, catch per unit effort, total catch (e.g. for threatened species) and encounterability (e.g. move-on rules linked to catches of deepwater corals).

Clear harvest control rules for bycatch species of low economic value have not been developed.<sup>42</sup> In the absence of stock data managers have proposed fishing mortality based reference points but this depends on more quantitative data rising from Level 3 of the decision-making process outlined in Figure 2. This report proposes that, in most circumstances, management decisions be taken at Level 2.

Approaches that can be employed in situations where data are limited and uncertainty high have been described.<sup>43</sup> It has been claimed that an original aim of reference points was to identify areas of agreement between stakeholders such that action would be taken when agreed conditions in the fishery were reached.<sup>44</sup> Such conditions could include a wide variety of indicators including those specifically relevant to data poor fisheries. The shift to quantitative reference points, shifted the emphasis away from an intent to have a more co-management style.

The most suitable trigger points are those that signal some change in the environmental parameter of interest, e.g. the catch. The system put forward in this report does not enable this sort of feedback as currently designed. Although it would be feasible to establish trigger points based on risk categories such as having a limit reference point defined by the number of high risk species and a target based on the number of low-risk species, the challenge would be to link this to any change in the fishery that would trigger a change in the risk rating and potentially a management response.

At the moment the PSA is species based and so a significant change, such as new species being discovered in the catches, would need to be evaluated and may trigger one of the reference points. The disappearance of a species from catches would also need to be evaluated and interpreted.

The challenge is to find attributes that could be monitored in a cost-effective and timely manner.

## Conclusions

Better ways of managing tropical multispecies fisheries (especially trawl) have been sought for some time in Southeast Asia<sup>45</sup> and although the differences between the ecologies, cultures and products of the region have been highlighted, workable management measures that suit the needs and are cost effective remain uncommon.

Risk-based approaches may offer a way forward and PSA may be a suitable tool that requires further investigation. There is little doubt that it has proven useful for informing managers and stakeholders about priorities, whether it can be used in an effective way to set objectives and trigger points, and guide harvest strategies remains to be seen. Nevertheless, further investigation seems warranted.

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<sup>42</sup> Zhou *et al. op. cit.*

<sup>43</sup> Seijo, J.C. & Caddy, J.F. 2000. Uncertainty in bio-economic reference points and indicators of marine fisheries *Mar. Freshwater Research*, 51: 477–83.

<sup>44</sup> Caddy, J. 2002. Limit reference points, traffic lights, and holistic approaches to fisheries management with minimal stock assessment input. *Fisheries Research* 56: 133–137.

<sup>45</sup> Silvestre *et al. op. cit.*

Some of the arguments in favour include:

1. It is a cost-effective approach that may help some agencies make a start when otherwise progress could remain stalled or be too slow to make a difference.
2. Depending on the system used, precaution is built in and the results of a PSA for any given species are more likely to yield a false problem than miss a species at risk.
3. It explicitly covers all the known species rather than simply focusing on a small number, even if the level of treatment is relatively scant.
4. Some aspects will require stakeholder engagement and this provides an opportunity to further the co-management approach.
5. New tools are being developed which will expand the utility of the system such as Habitat risk assessments and protected/endangered/threatened species risk assessments.
6. Computer programmes or simple spreadsheet templates could be written to speed up the assessment process.
7. A lot of the parameters are publicly available and easily accessible via sites such as FishBase.

Counter arguments include:

1. It is always better to have data and to strive for a system that is anchored in good data and information. Risk models are always subjective and this could lead to interpretations of available information that are either too lenient or too strict.
2. There is a need to ensure that interactions with other fisheries are taken into account and this could increase the risk rating. For example, if trawls take adult fish but the juveniles are taken in estuarine fyke nets then individual assessments may miss significant risks. This is also a common problem for more quantitative assessments. Tools to enable integrated assessments are available.
3. Risk is but one of several parameters of interest to fishery managers and stakeholders. For example, a commercial fishery is interested in yields and the fact that a species of interest is not at high risk may not be of much interest if economic returns are being adversely affected.
4. A mechanism to take into account non-fishery influences (e.g. environmental changes) on vulnerability needs to be developed.
5. Some investment in making the system responsive to changes in the environment is needed and this may be complex or require the sort of investment in data that the system is seeking to avoid.

The special needs and attributes of Asian fisheries have been described in numerous forums and publications. These needs create opportunities for new and innovative approaches to management and the risk-based approach combines an ability to work with data deficient fisheries and involve stakeholders in a co-management approach. The suggested approach detailed above can help stakeholders work through options that help protect resources for the long term while still providing a flow of benefits to a diversity of groups. The approach proposed needs to be established within a framework that sets clear objectives for the fisheries, implements workable reference points and harvest strategies and addresses economic and social needs. Given the declining state of many fish resources in the region, timely attention to the resolutions of SEAFDEC/ASEAN will prevent further decline and help rebuild resources where needed.



## Responsible supply of fishmeal to Asian aquaculture

Maggie Xu, International Fishmeal and Fish Oil Organisation

The fishmeal output of the Asian region (excluding China) during the past ten years has been stable at close to 1 million tonnes. Fishmeal consumption has been stable too but has been shifting gradually from agriculture to aquaculture. In 2010, 86 percent of the fishmeal used in the region went to aquaculture. Ten years ago the percentage was less than 60 percent. Although the fed aquaculture of the region grew by 130 percent, aquaculture fishmeal use increased only by 40 percent and all fishmeal use decreased by 10 percent.

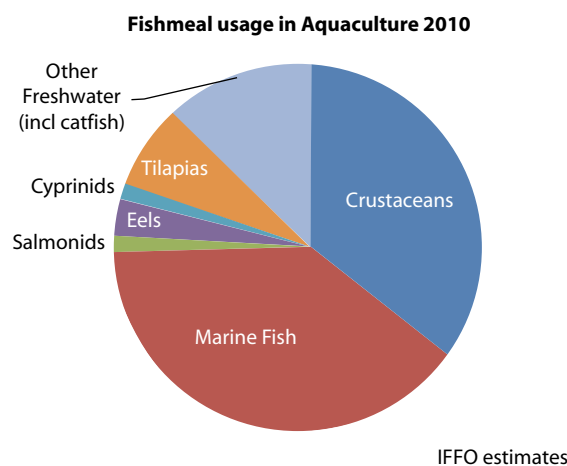
The growth of fed aquaculture is not being held back by shortages in the supply of fishmeal. What is important is not the amount of fishmeal but its responsible production. In order to respond to this demand, IFFO put forward its Global Standards for Responsible Supply (IFFO RS), which is a business-to-business initiative following ISO 65.

It was developed by a multistakeholder joint-committee composed of producers, traders, feed manufactures, fish farmers, leading retailers, international standard setters and NGOs. An independent third party certification body was appointed to conduct an audit of each application and currently IFFO RS is undergoing accreditation to ISO 65 to ensure full compliance.

IFFO RS addresses the concerns in two critical areas along the value chain. In order to comply with the IFFO RS standards, a factory must ensure that raw material whole fish is sourced from fisheries managed following the UN Code of Conduct for Responsible Fisheries and no IUU fish is used. As to the fishery byproduct used to produce fishmeal, it should not come from IUU fish either or IUCN red-listed species. At the same time, the manufacturing process in the factory should be carried out under a well-recognized quality control system to ensure product safety, purity and traceability. Once the fishmeal leaves the production site, the Chain of Custody programme ensures product identity and full traceability, which was developed as a means to demonstrate the fishmeal comes from a certified production plant on the value chain.

Up to now, 100 sites have been certified by IFFO RS with six more under assessment. Collectively they come from nine countries and represent 15 target fisheries as well as 62 byproduct species. Meanwhile the accreditation to ISO 65 is almost completed. IFFO RS is accepted as the secondary approved standard by the Global Aquaculture Alliance Best Aquacultural Practices (GAA BAP) standard and considered by the Aquaculture Stewardship Council (ASC) as the interim option. Although over 30 percent of global output of fishmeal and fish oil is already certified by IFFO RS, there is no Asian production plant on the list yet.

IFFO is encouraging fishery improvement and factory improvement so with the help of others, particularly UN FAO and Sustainable Fisheries Partnership, IFFO introduced its Improvers



***Crustacean and marine fish dominate fishmeal usage in Asian aquaculture***

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**Many fishmeal factories cannot currently achieve the RS standard – particularly in Asia. Often the reason is the lack of fisheries management data.**

**We need to encourage fisheries and factory improvement. A special approach is required for the mixed tropical trawl fisheries common in Asia.**

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Programme which should drive change for those who still cannot meet the RS standard. There is a growing demand to be able to demonstrate that the marine ingredients for aquaculture are sourced responsibly and IFFO RS is being accepted as a means for this demonstration.

Significant volumes are already available with more to come. Asia requires a special approach including consideration for mixed trawl fisheries and IFFO's Improvers Programme.

### **The way forward for trawl fisheries management in Southeast Asia and the Coral Triangle**

*Isara Chanrachkij, FAO/GEF project "Strategies for trawl fishery bycatch management" (REBYC-II CTI)*

The Coral Triangle subregion of Southeast Asia is one of the world's most biologically diverse, economically productive and potentially vulnerable marine zones.

As a result of increasing population and exploitation pressures, growing threats from pollution and major ecosystem change there is particular concern in the subregion, as in the global context more widely, about the untargeted capture of fish species and non-fish species, commonly termed bycatch and discards.

Problems associated with bycatch include the capture of juveniles of ecologically important and economically valuable species, non-reporting of retained catches and discarded catches. In some fisheries and regions, there is an increasing trend towards retention of bycatch for use as food for human consumption or for utilization as aquafeed and fertilizer. This is therefore a complex issue, requiring resource and biodiversity issues to be tackled alongside human needs and involving a mix of policy, technical and community support measures.

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**The goal is to achieve responsible trawl fisheries that result in sustainable fisheries resources and healthy marine ecosystems in the Coral Triangle and Southeast Asian waters by reduced bycatch, discards and fishing impact on biodiversity and the environment.**

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During 2002–2008, the FAO/UNEP/GEF project *Reduction of environmental impact from tropical shrimp trawling through the introduction of bycatch reduction technologies and change of management* (REBYC), had a relatively strong focus on technology and the development of selective gear. Although the project generated significant results, the experience showed that more was needed to successfully address the complex issues related to bycatch reduction in trawl fishing operations. Gear modifications are important but they are not always the most appropriate tool or they may need to be combined with other management measures. This is particularly the case in multispecies trawl fisheries of the type found in Southeast Asia and the Pacific region where overall management is weak and bycatch is largely utilized and considered part of the total catch.

Gear modification solutions also need to be supported by appropriate legal and incentive frameworks to become effective. Moreover, the socio-economic drivers behind bycatch and livelihoods and poverty context need to be understood and considered. Although initially this holistic approach may be more costly and require greater effort, it is cost-effective in the longer-term because of the sustainability of the results.

The follow up project *Strategies for trawl fisheries bycatch management* (REBYC-II CTI) is proposed to mitigate problems associated with bycatch in fisheries located within in the Coral Triangle region of Southeast Asia. This project will be based around multispecies trawling, where bycatch issues are amongst the most serious, with potentially significant effects on ecosystems and livelihoods. The project aims to address these challenges by promoting sustainable fishing, encouraging adoption of best fishing practices, and providing a rational approach to delivering

benefits from landed bycatch. Specific technological practices will be identified and management plans developed in partnership with the private sector at both national and regional levels, including the preparation of “best practice guidelines for fishing operations”.

The global environment objective of the project is to achieve responsible trawl fisheries that result in sustainable fisheries resources and healthy marine ecosystems in the Coral Triangle and Southeast Asian waters by reduced bycatch, discards and fishing impact on biodiversity and the environment. The project development objective is effective public and private sector partnership for improved trawl and bycatch management and practices that support fishery-dependent incomes and sustainable livelihoods.

The project is executed by the governments in the five participating countries, i.e. Indonesia, Papua New Guinea, Philippines, Thailand, Viet Nam and the Southeast Asian Fisheries Development Center (SEAFDEC), based in Bangkok, Thailand assumes the role as Regional Project Facilitator, in partnership with the private sectors and relevant national, regional and international organizations. The Food and Agriculture Organization of the United Nations (FAO) is the Global Environment Facility (GEF) agency for the project that will be funded jointly by GEF and the implementing and executing partners.

The project is structured around four interrelated components:

- 1) The policy, legal and institutional frameworks component will work towards the establishment of national or area-specific trawl fisheries bycatch management plans and building institutional capacity for their implementation.
- 2) The resource management and fishing operations component will lead to the adoption of more selective fishing gear and practices, provide a basis for implementing zoning of fishing areas and developing spatial-temporal closure management measures, and generate better data on number of vessels and recommendations for fishing effort and capacity management.
- 3) The information management and communication component will include bycatch data collection, mapping of fishing grounds, establishment of socio-economic monitoring procedures, and means for communicating bycatch data and information. Standardized methods for bycatch data collection will be promoted across project countries.
- 4) The awareness and knowledge component will address the awareness of and knowledge related to trawl fisheries bycatch management issues and how they relate to sustainability, and what measures that are available to make fishing more responsible. Private sector/fishers, policy-makers, fisheries managers, officials, extension officers and NGOs will be offered activities to enhance their knowledge on best management practices and responsible fisheries.

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**Multispecies fisheries resources found in Southeast Asia and the Pacific region have different types and scale of trawler.**

**Fisheries resource management is a challenge and bycatch is largely utilized and considered part of the total catch.**

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## **Fish and fisheries of the Lower Mekong River Basin – updated information**

*So Nam, Mekong River Commission*

The inland fisheries of the Mekong River Basin, which are among the largest in the world, are of enormous importance to more than 60 million people who live in the Lower Mekong Basin (LMB). In the river basin where 70 percent of communities are rural, rice farming and fishing are the main occupations for most people. Fisheries resources, including fish and other aquatic animals, make a vital contribution to regional food security and nutrition, cash income and employment, and have strong cultural and religious significance.

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**Per capita consumption of fish in the LMB does not vary much, the regional average is about 46 kg/person/year, with national figures varying by about 20 percent.**

**This LMB figure is similar to the Southeast Asian rate of 51 kg/person/year and significantly higher than the world rate of 24 kg per person.**

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In the lowland areas of the LMB, protein from fisheries resources ranges from 40 percent to more than 80 percent of the total animal protein intake.

There are about 850 freshwater fish species recorded from the Mekong River Basin (a total that includes some undescribed species of uncertain status), with a total estimate of about 1 100 species if the coastal or marine visitors are included. These can be grouped according their ecology and migration patterns and include: (1) black fish, with limited lateral migrations from the river onto floodplains and no longitudinal migrations upstream and downstream; (2) grey fish, not spending the dry season in floodplain pools nor undertaking long distance migrations; and (3) white fish, undertaking long distance migrations, in particular between the lower floodplains and the Mekong mainstream. A large proportion of the total fish catch in LMB is dependent on highly migratory fish species (i.e. the white fish).

The current total catches and production from Mekong fisheries (including aquaculture) amounted to about 3.9 million tonnes, of which about 2 million tonnes were from capture fisheries in 2010. Total first-sale value is of the order of US\$3.9 to 7.0 billion per year, but most of the catches and production are consumed directly by households, so are part of the informal or subsistence economy that does not appear in national accounts. Inland fisheries do however make significant contributions to the monetized economies of all four downstream riparian countries. Fisheries accounts for nearly 12 percent of Cambodia's GDP, and fisheries value in Lao PDR is equivalent to 7 percent of the country's GDP. Although proportionally less important, the Mekong fishery sectors in Thailand and Viet Nam add well over US\$750 million to the economies of each country annually.

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**The Lower Mekong Basin fisheries production represents about 20 percent of the world's inland capture fish production.**

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Although the importance of the Mekong fisheries is increasingly recognized, management information should be improved by systematic basin-wide research on aspects such as biodiversity, productivity, attributes of flood pulse, sediments and nutrients, the size and value of fisheries, the contribution of aquaculture, the possibilities for managing, conserving or increasing production, and the ways to mitigate the impacts of water resources developments. The actual management systems and processes to be applied also require a great deal more trial and refinement for local conditions, and should be the subject of basin-wide appraisal to document the key factors in success and failure.

## **The adoption of aquaculture assessment tools (AATs) for sustainability in the Asia-Pacific region**

*C.V. Mohan, Network of Aquaculture Centres in Asia-Pacific*

The importance of promoting responsible and sustainable aquaculture practices at national and local levels is widely recognized. Planners, policy-makers and manager are expected to consider environmental, social, animal health and welfare and food safety issues among others while developing national programmes and activities to promote responsible and sustainable aquaculture to support rural development and empower small-scale farmers. Broadly speaking, aquaculture assessment tools could include methods, guidelines and processes that are used for planning, development, management and decision-making. However, appropriate use of these tools by relevant stakeholders has been rather limited in the Asia-Pacific region for various reasons. As a follow up to the recommendations of the APFIC regional consultative workshop on “Strengthening assessments of fisheries and aquaculture in the Asia-Pacific region for policy development and management” (4–6 October 2011, Yangon, Myanmar), FAO, NACA and APFIC came together to initiate a regional study of aquaculture assessment tools in the Asia-Pacific region.

The objectives of the FAO/NACA/APFIC *Regional evaluation study/workshop on the application of aquaculture assessment tools for sustainability in the Asia-Pacific region* (Dec 2011–Nov 2012) were to:

- undertake a regional evaluation study on adoption of existing aquaculture assessment tools in ten Asia-Pacific countries and document them as country papers;
- produce a regional synthesis document on adoption and constraints to adoption of aquaculture assessment tools in Asia;
- convene a regional workshop to discuss implementation issues in the adoption of aquaculture assessment tools and develop a regional strategy/action plan to promote wider application of aquaculture assessment tools in the Asia-Pacific; and
- produce an FAO/NACA/APFIC publication on the regional study.

### *Country review study and documentation paper*

Experts from nine countries (Bangladesh, China, India, Indonesia, Malaysia, Philippines, Republic of Korea, Thailand and Viet Nam) contracted under the project undertook national level evaluation studies and documented the outcomes as country papers. The project team provided templates for the evaluation study and the country papers.

### *Regional synthesis*

NACA and FAO thoroughly reviewed the country outputs and used them to develop a regional synthesis paper. The regional synthesis covered issues of regional importance, common issues and concerns across countries, extent of adoption of tools in the region, constraints to adoption, capacity building and awareness raising needs, suggested actions and recommendations.

### *Regional workshop and regional action plan*

FAORAP, NACA and APFIC convened a regional workshop from 3 to 5 July 2012 in Pattaya, Thailand. The purpose of the regional workshop was to present the ten country case studies, discuss the findings, present draft regional synthesis, agree on a final structure for the regional synthesis document, and through facilitated discussions develop a regional strategy and action plan for promoting wider adoption of AATs in the Asia-Pacific region. Experts from nine countries (Australia, China, India, Indonesia, Malaysia, Philippines, Republic of Korea, Thailand and Viet Nam), representatives from SEAFDEC’s Aquaculture Department, the World Organisation for Animal Health Tokyo, the Sustainable Ethical Aquaculture Trade project, private sector and project team members from FAO and NACA participated in the three-day workshop.

The workshop noted that aquaculture is a major supplier of fish for food and it is expecting aquaculture to become increasingly important in the future. This is particularly the case in Asia, where population increase, economic development and limited increases in capture fish supply will require aquaculture production to fill the demand. The expectation is that aquaculture must achieve this against a background of increased competition for land and water from other sectors and increasing constraints on resource inputs such as marine feeds. The general trend is towards increasing intensification of aquaculture within existing areas. The workshop identified a number of key risks and concerns that face the sustainability and stability of the aquaculture sector as it consolidates and intensifies into the future. These include loss of production, loss of market access and poor economic viability of farms, economic impacts, and social impacts.

#### *Key risks and tools*

The workshop suggested that the application of the following assessment tools could suitably address many of the identified risks.

Risks	Tools
<b>Disease</b>	Pathogen risk assessment (RA), HC, Q, surveillance, record keeping, early warning and contingency planning, performance of veterinary services (PVS) evaluation tool
<b>Food safety</b>	Residue testing, record keeping, traceability, movement documents, HACCP, GAP/BMP, public/private certification, import/export regulation and control
<b>Environment</b>	EIA, CCRF, BMP/GAP, certification, effluent discharge control, carrying capacity, zoning/spatial planning, social impact assessment
<b>Genetic and biodiversity</b>	BMP/GAP, standard operating procedure (SOP)s for hatchery, ecological RA, input quality assessment and monitoring
<b>Market access</b>	Production process, public/private certification
<b>Climate change</b>	Early warning systems, life cycle analysis, carbon foot print, greenhouse gas emissions, zoning and planning,
<b>Consumer perception</b>	Certification, branding
<b>Policies</b>	Political tools

#### *Constraints on adoption of tools*

The workshop was informed of the wide range of tools being applied in the region through nine country paper presentations and noted that the manner of their application is highly context specific. The workshop considered the application of the tools and particularly what action was required at the national and regional level to promote wider adoption. The workshop noted that constraints on the effective use of these of the tools were because of:

- limited incentives and awareness e.g. long term benefits are not immediately apparent to industry/producers;
- lack of supporting legislation, institutional mainstreaming;
- financial constraints, cost recovery mechanisms not clear;
- lack of capacity and technical skill to apply tools;
- lack of basic methodology or regional minimum requirements (e.g. carrying capacity, genetic risk analysis);
- constraints on access to technical information (e.g. language barrier);
- ineffective integration between different agencies with responsibilities linked to planning and management; and
- lack of buy-in by producers wary of regulatory controls and potential increased costs.

Action	National level recommendations
Scoping of the national aquaculture sector using an EAA approach	To prioritize key areas where tools are required or priority issues that need to be addressed through the use of specific planning and management tools
Improve inter-agency coordination	Undertake a review of how the competent national agencies could coordinate more effectively in the key areas of food safety, environmental management and biosecurity Strengthen integration and coordination such that this supports sectoral management while minimizing negative impacts
Review legislation and regulatory implications	Consider upgrading relevant national legislation/policy accordingly
Develop opportunities presented by effective public-private partnerships	For providing services to the planning and management of the sector e.g. private testing systems, quarantine, EIA, certification quality testing
Awareness raising of benefit and value of using assessment tools	The competent agency or agencies for aquaculture to undertake awareness raising and communication strategies to sensitize policy-makers, regulatory agencies, farmers regarding appropriate application of tools and their benefits to the sector Look into how national competent agencies could more appropriately benefit from the effective use of services and the oversight mechanisms that ensure effective support to the aquaculture sector
Capacity building	Provide relevant training in the use of specific tools at the national level

### *Regional level recommendations*

**Develop an aquaculture planning and management toolbox for the region.** This should:

- build on existing source materials as well as case material from the increasing variety of country specific applications;
- be available as an online resource in an easy to use format to best meet the needs of a wide variety of users;
- use the opportunities to learn lessons from development of animal health systems in the region as well as EIA or other tools from other sectors; and
- initiate a regional process to harmonize minimum requirements for such tools.

Once tools are identified and available, suggested follow up includes the development of a comprehensive series of course modules on tools for aquaculture planning, assessment and management. There would be a need for further refinement and testing of these course modules through the development a regional training course that could be used by training institutions for in-country and regional training.

**Promote/encourage networking for information sharing.** Document success stories/best practices in the application of tools relevant to the context of the region. Undertake a specific review of how tools for planning and management may benefit (or marginalize) small-scale producers.

**Develop a regional support programme.** This could be done within the framework of NACA, noting that these capacity development and information sharing needs crosscut three of NACA's core themes (health, food safety, sustainable farming systems).

As a priority seek regional support for such a programme (including a request to FAO for regional TCP support). Bring this general capacity building need to the attention of the coming NACA Governing Council and APFIC Thirty-second Session. Encourage member countries to consider raising this regional need at the FAO Sub-Committee on Aquaculture and the FAO Committee on Fisheries.

## **Implementing an ecosystem approach to fisheries (EAF) in small-scale fisheries in the Philippines**

*Len Garces, WorldFish Center*

The importance of fisheries, especially small-scale fisheries (SSF), as a source of nutrition, employment and income for many of the world's coastal and rural poor can hardly be exaggerated (FAO – WorldFish Big Numbers Project, 2010). In addition, small-scale fishing is a key livelihood strategy for millions of households in coastal and rural communities in developing countries and plays an important part in food security and poverty alleviation. In the Philippines, the importance of SSF, or municipal fisheries as they are commonly referred to in the Philippines, to the economy cannot be overemphasized. Annually, some 1.3 million metric tonnes of fish are harvested by the municipal fisheries. These supply the fish food needs of over 100 million Filipinos (who consume about 38 kg/capita/year) and provide direct employment to 1.4 million fishers (Pido *et al.*, in prep).<sup>46</sup>

The legal and policy framework to support SSF in the Philippines is quite comprehensive. At the top is the 1977 Philippine Constitution that stipulates preferential treatment for marginal fishers. The Local Government Code (LGC) of 1991 is a landmark legislation that promotes local autonomy and government decentralization of a number of basic services from national government agencies (NGAs) to the local government units (LGUs). As such, the LGUs have become the key managers of natural resources within their territorial boundaries. Specifically devolved responsibilities concerning the fisheries sector are the enforcement of fishery laws in municipal waters. The Philippine Fisheries Code of 1998 (RA 8550) also provides a comprehensive legal framework that governs the development, management and conservation of the country's fisheries and aquatic resources. It focuses on the sustainability of the fishery resources as well as the maintenance of ecological balance. Specifically for the SSF, the code espouses poverty alleviation and the provision of supplementary livelihoods among municipal fishers.

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**An ecosystem approach to fisheries (EAF) is a strategy for the integration of the activity within the wider ecosystem such that it promotes sustainable development, equity, and resilience of interlinked socio-ecological systems.**

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Despite several fisheries programmes and local initiatives, “failures” in governance of SSF are still manifested by (see Pido *et al.*, 2012):<sup>47</sup> (i) depleted fishery resources; (ii) degraded fishery habitats; (iii) intensified resource use competition and conflict; (iv) post-harvest losses; (v) limited institutional capabilities; (vi) inadequate/inconsistent fisheries policies; and (viii) weak institutional partnerships. If these issues are not properly addressed and inappropriate harvesting practices continue, fish food availability and food security in coastal rural areas will be severely affected.

The European Commission-funded project titled, *Implementing an ecosystem approach to fisheries (EAF) in small-scale tropical marine fisheries* aims to use an EAF framework to improve SSF management and enhance their contribution to poverty reduction.

The specific objectives are to:

1. assess existing institutional arrangements and understand how an EAF can overcome barriers to effective integrated SSF management;
2. develop EAF strategies and actions for SSF management; and
3. strengthen the capacity of local fishery stakeholders and government agencies to collaborate and work within an EAF.

<sup>46</sup> Pido, M.D., Perez, M.L., Garces, L.R. & Salayo, N.D. (in prep). Re-thinking sustainable development of small-scale fisheries in the Philippines: past initiatives, lessons learned and strategic directions.

<sup>47</sup> Pido, M.D., Perez, M.L., Garces, L.R. & Salayo, N.D. 2012. Towards sustainable development of small-scale fisheries in the Philippines: experiences and lessons learned from eight regional sites. The WorldFish Center, Penang, Malaysia. Policy Brief 2012–10.



The project, which covers four developing countries namely: the Philippines, Indonesia, Tanzania, and the Solomon Islands, aims to use the EAF framework to improve SSF management in these countries and enhance their contribution to poverty reduction. In the Philippines, the project is being implemented in the coastal communities of Misamis Occidental (Aloran, Jimenez, Oroquieta City, Panaon, Sinacaban, and Tudela), with possible expansion to the coastal communities in Misamis Oriental.

*Phase 1: Participatory research*

Involves identification and prioritization of management options for EAF in focal sites using the Participatory Diagnosis and Adaptive Management (PDAM) framework.

*Phase 2: Collaborative implementation of EAF in focal sites*

Pilot implementation of customized strategies in focal sites to enhance capacity of stakeholders for EAF implementation.

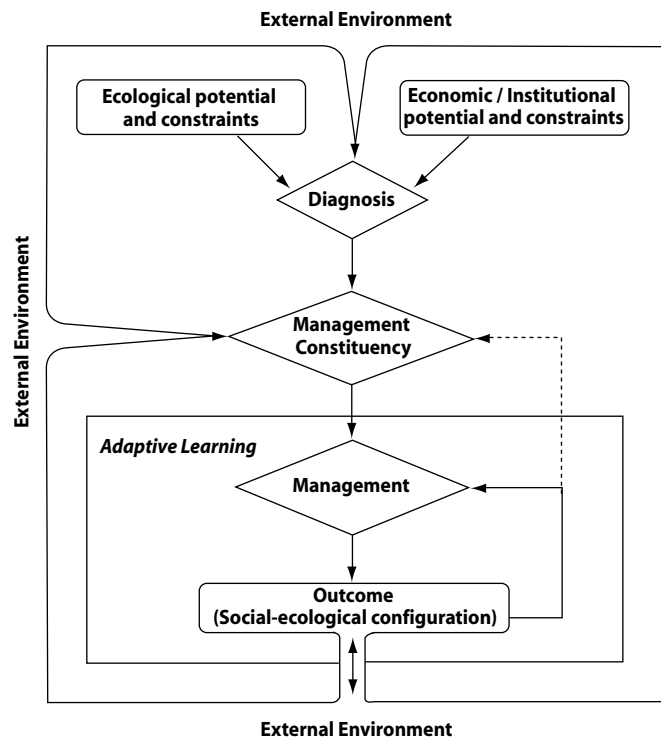
*Anticipated outputs:*

- increased commitment to implement an EAF in SSF management achieved through better understanding of its potential contributions to poverty reduction and environmental sustainability;
- better integration of EAF and existing institutional arrangements in focal sites;
- enhanced understanding of the roles of MPAs in the effective implementation of an EAF;
- active participation of final beneficiaries, including women, in participatory research and collaborative implementation of EAF strategies in focal sites;
- capacity development of target groups achieved through collaborative research and implementation of EAF strategies in project sites; and
- practical guidelines for EAF action programmes and policy recommendations for long-term planning produced and disseminated.

Moreover, six core strategies (sustain, protect, develop, capacitate, institutionalize and communicate) were recommended to help reverse the deteriorating conditions of the SSF and achieve the desired positive states and to reverse the deteriorating conditions (Perez *et al.*, 2012). A brief description of each strategy follows:

**Sustain** refers to the conservation and rational use of the fishery resources for the benefit of present and future generations. Wild stocks must be harvested within the natural regenerative capacity of the fisheries.

**Protect** refers to the preventive steps to be undertaken to manage the risks or threats to the fisheries and associated ecosystems. This includes preservation of certain elements of the coastal fisheries environments that should be maintained because of their intrinsic and economic values.



**Figure 1** PDAM (Andrew *et al.* 2007)

**Develop** relates to the development of SSF in geographical areas where it can still be pursued. It also pertains to developing sustainable livelihoods, as well as improving the fisheries products along the value chains, to uplift the standard of living of the fishers and their dependents.

**Capacitate** refers to the capacity-building endeavours that are needed to enhance the capacity of the municipal fishers and other relevant stakeholders. This strategy pertains to sectoral integration with other relevant economic sectors as well as the partnerships that need to be instituted or strengthened at the local and national levels.

**Institutionalize** relates to organizational integration. The efforts of various organizations involved in fisheries management need to be synchronized to achieve the maximum benefits.

**Communicate** refers to the generation of pertinent information and knowledge as well as exchanges of ideas and information among the coastal stakeholders that are required for effective fisheries governance. It also includes the use of scientific knowledge for adaptive management.

### **THEME 3: COUNTRY EXPERIENCES IMPROVING FISHERIES MANAGEMENT AND THE CCRF**

#### **Fisheries resources management in Bangladesh: A paradigm in natural resource conservation** *M.I. Golder, Department of Fisheries*

Bangladesh is rich in fisheries resources comprising both inland and marine fisheries. There are 260 species of freshwater fish and 12 species of freshwater prawn and 475 species of marine finfish and 36 species of marine shrimp. The fisheries sector has a high potential and has been playing a vital role in the socio-economic development of Bangladesh. The annual growth rate increased by 5.6 percent over the last ten years, and it is now contributing 4.4 percent of the national GDP and 22 percent of the agricultural GDP. It provides about 60 percent of the animal protein and about 10.5 percent of the total population of the country depends directly or indirectly on fisheries for their livelihoods. Community-based fisheries co-management was initiated in 1986 and the management of natural resources has proved to be more successful when women have an integral share in them.

<b>Contribution to national GDP</b>	4.4 percent (Agriculture: 22.2 percent)
<b>Total fish production</b>	3.06 million tonnes (2010-2011)
<b>Average growth rate</b>	5.82 percent last 10 years
<b>Consistent growth</b>	4.79 percent – 7.32 percent over the decade
<b>Animal protein supply</b>	60 percent = 51 g/day/person
<b>Livelihoods involvement (persons)</b>	15.6 million (10.5 percent)
<b>Foreign exchange earnings</b>	2.73 percent rank 2 <sup>nd</sup> position
<b>Export (fish and fish products)</b>	US\$567 million
<b>Export potential</b>	US\$1 billion by 2015

The National Fisheries Policy 1998 aims to: enhance fisheries production with a provision for poverty reduction; ensure the supply of animal protein; achieve economic growth by increased exports of fish/shrimp while conserving ecosystems and restoring biodiversity. The Department of Fisheries (DoF) has approved the National Fisheries Strategy with eight sub-strategies. During the early 1970s about 90 percent of the fish came from inland capture fisheries but this had changed by 2012 when more than 50 percent came from aquaculture.

To enhance production from open-water capture fisheries, the DoF has intervened with a number of projects and programmes, such as restoring fish habitats, conserving biodiversity, stocking

fry/fingerlings, establishing nurseries, fish sanctuaries, fish-friendly structures and passes. Bangladesh has succeeded in increasing the production of hilsa (Indian shad) by implementing the hilsa management plan. The programme has undertaken people-friendly management regimes, proper conservation measures, imposed a fishing ban during the peak spawning period, as well as a ban on juvenile (jatka) hilsa catch and protected hilsa sanctuaries. During the ban period the hilsa/jatka fishers are given food grains, cash incentives and input supports to engage them in alternative income generating activities as part of the social safety net coverage. As a result of these interventions an increment of 40 924 tonnes of hilsa was produced between 2008 and 2011 with the distribution of 56 000 tonnes of food grain to 186 264 fishers' families.

Training and awareness programmes are in place to implement the Code of Conduct for Responsible Fisheries (CCRF) involving fishers, fish farmers and other stakeholders. In the case of marine fisheries, licensing the activities of fishing crafts and fishing trawlers and their regular inspection is underway with assistance from the Bangladesh navy, the coastguard, the local administration and other related agencies. A major constraint on preparing an appropriate management plan is insufficient data. The Bangladesh Marine Fisheries Capacity Building Project with assistance from the Islamic Development Bank and the Malaysian Government has the provision to procure a modern survey and research vessel that will help improve research, monitoring, control and surveillance, and vessel traffic management activities. The small-scale fisheries of Bangladesh are comprised of about 43 000 mechanized and non-mechanized boats that do not possess fishing licenses. Fishing capacity and effort is being increased as a result of open access to the marine waters and this is leading to overfishing.

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**CCRF Article 6, Section 6.16**

**States should promote awareness of responsible fisheries through education and training.**

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The destructive gears that are used by the artisanal fishers need to be replaced by environmental-friendly selective gears. Bangladesh has already complied with the issuance of IUU-catch certificates for exporting marine fishes and shrimps to the European Union. The country is in the process of establishing a national plan of action to eliminate IUU-fishing in the coastal and marine ecosystem and strengthening monitoring, control and surveillance activities. A number of developing partners and international agencies like FAO, the Danish International Development Agency, WorldFish Center, World Bank, German Technical Cooperation Agency, European Council etc. are providing technical and financial assistance for harnessing the potential of fisheries from both inland fresh and marine waters.

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**IPOA, Article 4, Section 4.14**

**States should fully and effectively implement the Code of Conduct and its associated International Plans of Action.**

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### **Management of capture fisheries of China in the South China Sea**

*Yongsong Qiu, South China Sea Fisheries Research Institute*

Marine fishing by fishers from the southern Chinese provinces mostly takes place in the northern part of the South China Sea (NSCS). Fishery stocks in the coastal and shelf waters are depleted and overfished, respectively, because of rapid growth in fishing capacity from the 1980s to the 1990s.

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**Current fishing capacity is more than two times higher than the optimal level.**

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The management measures introduced by China in the NSCS include fishery zoning to limit trawl fishing in the inshore waters of <40 m depth and the establishment of closed fishing areas/seasons in the estuarine and coastal waters to protect breeding and nursery stocks. A fishing boat licensing

system and a policy of limiting fishing capacity have been in place since the late 1980s and fishing capacity has tended to level off since the late 1990s. A two-month (June/July) summer closed fishing season applying to trawl, purse seine and trammel gillnet in the NSCS has been implemented since 1999, and in 2009 the closed fishing season was extended to two and a half months (from 15 May to 1 August).

The major problems in the NSCS fishery include overcapacity and capture of undersize fishes. The summer closed fishing season was intended to reduce the capture of juveniles and to a certain extent reduce fishing pressure. The closed season has been successfully implemented. However, after the closed season, the catches were still dominated by juveniles and trash fish because of the non-selectivity of fishing gears. The use of small mesh size is also encouraged by demand for forage fish from aquaculture of high-value fishes. It is recommended that in addition to a closed fishing season covering all types of fishing, mesh regulation and/or size at first capture be enforced.

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**CCRF Article 6, Section 6.3**

**States should prevent over fishing and excess fishing capacity and should implement management measures...**

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To reduce fishing capacity, a programme of fishing boat decommissioning through buyback by the government was started in 2000. However, the buyback was on a voluntary basis and very few fishing boats were decommissioned. Expanding fishing for pelagic fishes and oceanic squid further offshore to the open SCS would be a way to reduce fishing pressure in the inshore waters. Assuming continuation of the current policy of strict limits on the number of fishing licenses and total fishing horsepower, promoting pelagic fishery in the open SCS would lead to partial relocation of fishing capacity away from the heavily fished waters and would correspond to a reduction in fishing pressure. It would also lead to the recovery and growth of the fishery in the shelf waters.

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**CCRF Article 7, Section 7.6.3**

**Where excess fishing capacity exists, mechanisms should be established to reduce capacity to levels commensurate with the sustainable use of fisheries resources...**

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### **Land rights certification programme for fishers of small-scale fishing businesses in Indonesia**

*Ir. A. Bambang Sutejo, Directorate of Fishing Business Development, Ministry of Marine Affairs and Fisheries*

Capture fisheries enterprises in Indonesia are characterized by the domination of small-scale fisheries. Indonesia's small-scale fishing businesses are considered to be inefficient and having low productivity as a result of a number of interrelated factors, such as: 1) lack of skills and limited access to technology; 2) poor access to capital; 3) limited monetary incentives; 4) adverse trading (a patron–client trading chain); 5) the fishers' limited assets; and 6) limited social protection.

With regards to poor access to capital, most fishers do not have assets that can be used as collateral in formal financial institutions and therefore cannot borrow money to develop their businesses. Consequently, fishers borrow money from moneylenders or take operational fishing support from fish dealers. The latter creates the fishers' dependency on the fish dealer which entails an adverse patron–client trading chain, whereas the moneylenders charge high interest rates leading to growing debts. These conditions weaken the fishers' business development capacity.

One form of structural poverty in Indonesia can be attributed to the lack of legal ownership of the land occupied by people in the coastal area. The macroeconomic policy adopted by the Indonesian government for the marine and fisheries sector is the Economic Empowerment of Coastal Communities Programme. Under this, there is a wide range of empowerment activities such as land rights certification, multipurpose fisher's identification card, assistance for small-scale fishing, aquaculture and fish processing businesses.

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**CCRF Article 6, Section 6.18**

**Recognizing the important contributions of artisanal and small-scale fisheries to employment, income and food security, States should appropriately protect the rights of fishers and fishworkers, particularly those engaged in subsistence, small-scale and artisanal fisheries, to a secure and just livelihood, as well as preferential access, where appropriate, to traditional fishing grounds and resources in the waters under their national jurisdiction.**

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In 2007, the Ministry of Marine Affairs and Fisheries and the National Land Agency signed a Memorandum of Understanding and Cooperation Agreement, on the Empowerment of Fishermen and Small-scale Fishing Businesses to Increase Capital Access through Land Rights Certification. The related programme was designed to protect the fishermen's rights over their land. It subsequently enhanced the social security of the fishers and their families. Usually, it also ensures that the fishers' living places and their fishing activities are in close proximity. It was also designed to improve fishers' access to credit from formal financial institutions such as banks, insurance agencies as well as the state pawnshop, thus enabling business diversification or expansion of their family enterprises.

During 2009–2011, 13 189 certificates were issued although the target was 13 500 certificates.

The impact of the programme can be seen from the number of land certificates utilized by fishermen to access bank credit. Up to 2011, in the five provinces, 628 land certificates were used by fishers to get credit from banks. Most of the credit was used for business diversification as well as to support operational/maintenance costs including fishing vessel and gear repairs. To assess the programme's usefulness, an assessment of successful business diversification or expansion triggered by land rights certification activity should be carried out in the future.

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**Implementation mechanism**

**Preparation year phase: pre-land certification; dissemination, identification and inventory**

**First year: certification phase: determination of participants and land certification.**

**Second year post-certification phase: guidance and facilitation of certificate recipients to access capital.**

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**Implementing the ecosystem approach to fisheries in Malaysia**

*Rohani Mohd. Rose, Department of Fisheries Malaysia*

Malaysia has undertaken various actions to improve the management of fisheries, including a review of the national plan of action on sharks. To strengthen the country's turtle protection and conservation projects turtle exclusion devices (TED) have been introduced on a voluntary basis and new guidelines have been introduced to coordinate and

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**Conservation of turtles**

**Protection of marine turtles, nesting beaches and egg collection.**

**Establishment of hatcheries and sanctuaries.**

**Implementation of TED on a voluntary basis.**

**Incentives to fishermen to encourage the use of TED.**

**Guidelines to coordinate and monitor related projects by government agencies and the private sector.**

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monitor relevant projects undertaken by government agencies and the private sector. In terms of adopting community-based fisheries management, action is being taken to identify a model village to implement this.

Considerable action has been taken to combat IUU-fishing in Malaysia's economic exclusion zone and the high seas, including conducting two workshops in mid-2011 under its capacity building and institutional development programmes.

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**CCRF Article 7, Section 7.6.4**

**"... measures [should be] taken to ensure that fishing gear, methods and practices which are not consistent with responsible fishing are phased out and replaced with more acceptable alternatives..."**

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### **Improving fisheries management and implementing the CCRF in Myanmar**

*Saw Lah Paw Wah, Department of Fisheries*

The country is endowed with rich and varied marine, coastal and inland fishery resources. It has 2 832 km of coastline and total marine fishery areas of 486 000 km<sup>2</sup>. Inshore fishing vessels and offshore fishing vessels are operating in Myanmar's waters with medium-size trawlers, purse seines and long liners important for marine fishing. Moreover, many traditional fishing gears and implements are operating in the open access fisheries of coastal and inland areas.

Total fish production in 2010-2011 was 4.14 million tonnes, of which 2.16 million tonnes were from marine fisheries and 1.98 million tonnes were from freshwater fisheries. The fisheries sector in Myanmar is of a great importance for food security and is a major source of animal protein in the diet of the people: in 2010-2011 per capita consumption of fish was 48 kg. According to the official statistics for 2010-2011, Myanmar had a population of 60.85 million and 70 percent of the total population was living in the rural areas. Fisheries contribute to rural people's livelihoods, their food security, their supply of nutrients and to their socio-economic development as well as to national revenues.

There is inadequate information on the actual marine resource situation, and this acts as a constraint on effective fishery management along with inadequate technology and capacity to add value to small-scale and medium-scale fishery products by processing them.

Myanmar's inland water bodies such as natural lakes, reservoirs, rivers and ponds cover an area of about 8.2 million hectares. To increase fish production "culture-based capture fisheries" is being practiced in some leasable waters. According to the regulations introduced, the lessee has to release fish fingerlings/juveniles into these fishery areas.

The objectives of the Ministry of Livestock and Fisheries are to:

- produce quality breeds of livestock and fish;
- promote all round development in the livestock and fishery sector;
- increase meat and fish production for domestic consumption and share the surplus with neighbouring countries;
- promote investment in the livestock and fishery sector;
- encourage the expansion of marine and freshwater aquaculture;
- maintain and conserve freshwater and marine resources;
- extend freshwater fisheries for local consumption and promote marine fisheries for export; and
- upgrade the socio-economic status of livestock and fisheries communities.

The Department of Fisheries has sole responsibility for management and sustainable development of the country's fisheries. Its goals are to:

- distribute quality seeds of fish and shrimp;
- conserve fisheries resources, the environment and biodiversity;
- conduct research and development on fisheries technology;
- enhance fish production for domestic consumption and export;
- replenish fisheries resources by implementing restocking programmes;
- educate and create public awareness in fisheries resources conservation;
- disseminate fisheries technology in fishing, aquaculture and fish processing; and
- improve capacity building of departmental personnel for human resources development.

In order to conduct proper fisheries management the State issues directives and regulations, in accordance with fisheries laws, on the conservation of fishery resources and fisheries management for sustainable fishery development such as closed season, closed areas, prohibited sizes and species and restriction of net mesh size. To ensure sustainable fishery development and food security, illegal fishing methods such as the use of explosives, poisons and electrical shocks (electro-fishing) are prohibited by law.

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**CCRF Article 8, Section 8.5.3**

**States and relevant institutions should collaborate in developing standard methodologies for research into fishing gear selectivity, fishing methods and strategies.**

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**Success story of community-based reservoir fisheries in Indrosarobar Kulekhani, Makawanpur District, Nepal**

*Rajendra Kumar K.C., Directorate of Fisheries Development, Department of Agriculture*

Nepal, although a landlocked country, is endowed with vast inland water bodies in the form of rivers, lakes, manmade ponds and reservoirs estimated at 0.82 million hectares. The economic wellbeing of Nepal is very closely related to its natural resources, available land, water and forests. The population is estimated at approximately 27 million and the fisheries sector contributes just over 0.94 percent to the national gross domestic product and 2.72 percent to agricultural gross domestic product. Annual fish production is 52 450 tonnes, 21 500 tonnes from capture fisheries and 30 950 tonnes from aquaculture (mainly fish). Nepal has a rich diversity of freshwater fish – recent studies have shown that more than 200 indigenous fish species are found in the freshwater systems of Nepal (fish and fisheries belonging to high altitude regions are least known). However, freshwater fisheries along with fish habitats are being threatened by environmental transformations and various development projects.

The Government of Nepal is planning to construct a number of hydropower dams (it has been a national priority for some time) and it is essential that their potential effects on fish populations and the rural communities that depend on them be investigated and appropriate mitigation measures where necessary be applied. Environmental concerns and the food insecurity of the local people should not be overlooked. Some mitigation measures such as establishing a small hatchery to breed and restock native species, placing fish cages in reservoirs to support local livelihoods can be a small part of a hydropower project and is already being practiced in some areas along with some awareness raising programmes. Thus, to conserve and promote native fisheries more attention by the government is needed.

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**Cage fish culture activities have been expanded, providing an alternative livelihood option for the communities displaced by the impoundment.**

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Conservation of aquatic life is addressed by the Aquatic Animal Protection Act 1961, which prohibits the use of explosives or poisonous substances in any waterbodies where the intention is to catch or kill aquatic life. This Act was revised in 1999; it regulates fishing gears, size of fish and fishing season. Studies on the effects of development projects on fishery resources and implementation of mitigation measures where necessary have been made mandatory under this regulation. Along with the Aquatic Animal Protection Act 2069 there are laws designed to protect wetland biodiversity and ensure ecosystem conservation in Nepal such as the Forest Act, the Environmental Protection Act, the National Parks and Wildlife Protection Act, the Soil and Watershed Conservation Acts and various regulations.

**CCRF Article 8, Section 8.4.2**

**States should prohibit dynamiting, poisoning and other comparable destructive fishing practices.**

Fisheries and aquaculture are largely untapped resources in Nepal and there is ample scope and opportunity for increased production using improved technology and better management practices.

**Improving management and governance of fisheries and aquaculture in Pakistan**

*Ghulam Mujtaba Wadahar, Livestock and Fisheries Department, Government of Sindh*

Fishery plays an important role in Pakistan’s economy and is considered to be an important source of livelihood for the coastal inhabitants. Apart from marine fisheries, inland fisheries (comprising an extensive riverine irrigation system that provides a wide network of lakes, ponds, marshes, waterlogged areas, natural depressions, dams etc.) is also a very important source of animal protein.

Contribution of fisheries	
GDP	1 percent
Contribution to agricultural GDP	4 percent
Contribution to labour force	1 percent
<b>Sources of livelihood:</b>	
Direct fishers	400 000
Ancillary industries	600 000
Per capita consumption lowest in the world	1.8 Kg

Fisheries’ share in GDP is small, however it contributes substantially to the national income through export earnings. It is a significant source of foreign exchange earnings and provides employment to about 400 000 fishers directly.

Freshwater resources comprise both public and private waters. For public waters (in Sindh province), the present government has abolished the contracts (lease) system to eliminate the middleman and increase the incomes of fishers, so the fishers are directly fishing and marketing their catch.

The fisheries sector is a nation building sector and as such urgently requires careful planning, thoughtful investment and better management. The areas needing improvement are as follows:

**The inadequate organizational setup:** The fisheries departments in the provinces, especially in Sindh province which has a high potential for fisheries development, lack adequate manpower and an effective organizational structure and these need to be addressed.

**Research and development:** The R&D wings in the provincial fisheries departments are not commensurate with the needs of the sector and therefore need prompt attention for human resource development in real terms.

**Infrastructure development:** Infrastructure facilities such as hatcheries, nurseries, soil testing and disease diagnostic laboratories, extension and support centres, general transportation vehicles, jetties, cold storage, fish carrying boxes, insulated transportation vehicles, and processing plants all need to be established to strengthen the sector.



**Capacity building:** Overseas training is an important means of personnel development in any sector. As this type of training provides trainees with a broader vision and new ways of thinking it can help to rejuvenate the life of any economic sector. There is need to train human resources in the provinces as follows:

- Long-term training i.e. M.Sc, M.Phil and Ph.D (three to five persons each year, each province).
- Short-term training (five to eight training events each year, each province).

Inland water capture fisheries comprise the Indus River, lakes, canals, waterlogged areas, flood compartments and the marine and coastal belt. To develop the fisheries sector to strengthen the economy requires a number of well-designed measures:

*Measures to take for inland fisheries development*

- Water area surveys.
- Improvements in post-harvest technology and availability of soil/water analysis and disease control laboratories, processing and hygienic fish landing facilities.
- Research laboratories and other infrastructure development as well as quality control measures.
- Improvements in socio-economic conditions of fishers and incentives for them during fishing holidays.
- Soft/easy small-medium loans with easy accessibility to aquaculturists and fishers.
- Effective extension services and quality assurance.

*Measures to take for marine fisheries development*

- Regular stock assessment surveys and restocking where necessary.
- Strict conservation measures and fishing moratoriums with regard to species and areas/zones and strict vigilance for fishing as per rules.
- Incentives for fishers during fishing moratoriums.
- Use of special nets for fishing to save juvenile and unwanted biota.
- Zonation (species wise) and designation of fish reserves and parks.

Cooperation is still to be sought from the international community to help develop aquaculture in Pakistan in a sustainable way. Assistance is required to tap into the brackish water resources that are still unexploited because of the non-availability of infrastructure, technology, consultancy and training facilities.

**Improving fisheries management and implementation of the CCRF in the Philippines**

*Jessica C. Munoz, Bureau of Fisheries and Aquatic Resources, Department of Agriculture*

The Philippines is an archipelagic country comprising about 7 100 islands. Its coastline is more than 17 000 km long. The territorial water is about 2.2 million sq km and an exclusive economic zone (EEZ) over seven times its land area. The continental shelf area covers about 185 000 sq km. The Philippines is one of the world's most important producers of fish with a total fish production of about 5.2 million tonnes in 2010. The Philippines major export commodities are tuna, seaweeds and shrimp/prawn. The fisheries sector contributes about 20.6 percent to the agriculture sector. The fisheries sector provides direct and indirect employment to over 1.6 million people, or about 5 percent of the national labour force. Fish continues to be the principal source of protein for the country's population, accounting for 70 percent of the total animal protein intake and 30 percent of the total protein intake.

The government has made serious efforts to address the pressing issues of the coastal areas, the fisheries and impacts to the coastal communities. The Fisheries Code and the Local Government Code are the major policies that have enabled the national government and the local government units, in partnership with other stakeholders, to shift the fisheries sector focus from increasing capture fisheries production to fisheries resource protection, conservation and sustainable management.

The Philippines adheres to the ecosystem approach to fisheries management (EAFM) framework, which considers the interrelationships and interdependencies of the fisheries, the environment and the population. In the Philippines context of EAFM, fisheries management aims to promote the sustainable management of coastal and fisheries resources and alleviate the poverty of fishers through the provision of viable livelihood activities. The major activities under EAFM include the following:

**Promotion of habitat enhancement and rehabilitation.**

A number of MPAs have been established by local government units as well as management groups to protect and rehabilitate damaged coral reefs, depleted mangrove forests and overfished fishing grounds. Resource enhancement will be implemented in the regions, which, depending on the local situation, may include establishment and/or maintenance of fish sanctuaries, mangrove reforestation and riverbank rehabilitation.

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**CCRF Article 6, Section 6.9**

**States should ensure that their fisheries interests, including the need for conservation of the resources, are taken into account in the multiple uses of the coastal zone and are integrated into coastal area management, planning and development.**

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**Improvement of the capacity of municipal fishers and other stakeholders at the local level for fisheries resource management.** Fisheries resource management planning and onsite coaching entails regular consultations and meetings with the implementers to address immediately issues that may arise during the course of project implementation. Local government units have integrated fisheries into the planning and development of coastal zones and inland waters. They have developed coastal/fishery resource management plans and integrated these plans into the local development plan with appropriate budget allocation for fishery-related activities.

**Expansion and enhancement of new and existing livelihood projects** and identification and implementation of other viable livelihood projects to increase household incomes. Livelihood projects are packaged with corresponding training. The training is focused on people's organizations, fishers associations and cooperatives that will undertake livelihood projects. The stakeholders can also suggest subject matters/topics that will promote better fisheries co-management. The two-tiered approach aims to train and develop good decision-making and problem-solving skills.

**Coastal resource management (CRM) planning and implementation, capacity-building of implementers through training** and onsite coaching is an important part of EAFM. The development of fisheries management plans led to a number of specific fisheries plans. The Sardine Management Plan brought about the closure of the sardines fishery in Zamboanga Peninsula from December 2011 to February 2012. Monitoring is ongoing to determine the extent of the impact of the closure. Initial reports indicated the improvement of catch volume as well as the increased size of sardines. The Tuna Management Plan is also the basis for a number of fisheries administrative orders aimed to manage and protect tuna fisheries. Genetic studies are being done at the National Fisheries Research and Development Institute to determine stock structure and validate species.

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**CCRF Article 6, Section 6.3**

**States should prevent over fishing and excess fishing capacity and should implement management measures to ensure that fishing effort is commensurate with the productive capacity of the fishery resources and their sustainable utilization. States should take measures to rehabilitate populations as far as possible and when appropriate.**

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**Research-based decision-making is important in EAFM.** The Philippines has the National Stock Assessment Programme that started in 1998. Enumerators are engaged to conduct landed catch and effort monitoring. The data related to commercial and municipal landings are collected and an inventory of boats and gears is made. Detailed studies of species are also carried out. A National Stock Assessment Programme database is in place and is being maintained.

**Measures are in place to control/prevent IUU-fishing.** The National Plan of Action on IUU Fishing is slowly gaining results in terms of strengthening law enforcement. The creation of quick response teams to address fishery violations, among others, is progressing. Fishing vessel monitoring is being carried with the cooperation of the private sector. An observer programme is also being implemented.

**The promotion of fishers groups, recognizing local/traditional management systems** is one of the most important principles in the EAFM framework. In the Philippines, indigenous peoples in Palawan have rights of tenure over their area where they live. On the other hand, the fisheries and aquatic resource management councils are involved and participate in the decision-making for the management and regulation of the fisheries sector. NGOs, PO and other fishermen’s organizations are also part of the decision-making process. Capacity building through training of fishers, processors and traders is being accomplished by the national government. Gender and child labour considerations are also incorporated into the EAFM.

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**Gender and child labour issues are dealt with through: gender analysis on women in fisheries; prioritization of women in fisheries development; participation of women in management bodies; a law that penalizes child labour (below 15 years old) in fishing activities.**

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**Information, education and communication (IEC) campaigns** are carried out to elicit active participation of stakeholders in coastal resource management. IEC campaigns are continuously undertaken in EAFM.

Technical assistance may be required in the implementation of the EAFM strategies. The national and the regional governments as well as academe provide assistance to the local government units and the coastal communities in undertaking EAFM-based fisheries management activities.

**Biodegradable fishing gear in the Republic of Korea**

*Bong Jin Cha, Fisheries System Engineering Division, National Fisheries Research and Development Institute*

The National Fisheries Research and Development Institute (NFRDI) and the Ministry of Food, Agriculture, Forest and Fisheries in the Republic of Korea has been developing and publicizing biodegradable fishing gears since 2003. This activity is closely linked to many articles of the CCRF, in particular article 7.6.9 which refers to ghost fishing (caused by nets lost at sea) and requests states to take action to reduce it.

Loss of fishing gear in the Republic of Korea	
Gill net fishery fishing boats	21 000
Average net length of one fishing boat	35 km
Loss per year	10 percent
Trap fishery fishing boats	8 800
Average number of traps per boat	2 500
Loss per year	20 percent

A number of nets are lost at sea around the world and they inadvertently “catch” fish for a long time. According to several studies, biodegradable fishing gear would be changed completely into water and carbon dioxide by bacteria and fungi, and would not therefore result in these ghost catches.

Poly butylene succinate is recommended as a raw material for biodegradable gears because the gear made from this material can resist biodegradation by bacteria and fungi for two years and so can initially be used normally. NFRDI are now testing this type of net in several fisheries. Catch efficiency has reached 70 percent of catch efficiency compared with traditional gears of the same type in initial tests. The catch efficiency of some biodegradable gillnets and traps reached that of traditional gear after modification as a result of field test. In 2011, 340 fishing boats used the biodegradable gear. The Republic of Korea established the Fisheries Resource Management Act in 2009 to support fishers who want to use the biodegradable gear.

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**CCRF Article 7, Section 7.6.9**

**States should take appropriate measures to minimize ...catch by lost or abandoned gear...**

**States ...should promote, to the extent practicable, the development and use of selective, environmentally safe and cost effective gear and techniques.**

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### **Improving fisheries co-management in Negombo lagoon under the Regional Fisheries Livelihoods Programme (RFLP) in Sri Lanka**

*Anura Jayasekara, Department of Fisheries and Aquatic Resources*

In 1998, Negombo lagoon became the first site where community-based fisheries management was implemented under the newly introduced Fisheries and Aquatic Resources Act No. 2 of 1996. Under the legal provisions in the act, the lagoon was declared a fishery management area. Ten fisheries committees and a fisheries management authority (all comprising fishers) were established and a few management regulations were introduced such as banning the use of certain gears and restricting the area of operation of some gears. Over the years, with little outside support, the fisheries committees and the management authority failed to drive the management process forward and by 2010 were more or less defunct. Fisheries problems – use of illegal/harmful gears, decline in catches and income, increased fishing effort, etc. – continued to increase. These institutions were also frustrated by their inability to address other issues such as pollution of the lagoon, illegal encroachment, mangrove destruction.

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**Legal amendments to integrate fisheries management with ecosystem conservation is a major success and it will apply to all future co-management initiatives in Sri Lanka.**

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With the help of the Spanish funded FAO-RFLP, the Department of Fisheries and Aquatic Resources (DFAR) adopted a two pronged approach in re-establishing fisheries co-management in Negombo lagoon. The Fisheries Act is being amended to accommodate wider stakeholder participation in order to provide for integration of fisheries management with environmental conservation.

The fisheries committees in Negombo lagoon have been revived and made functional again. A Fisheries Management Coordinating Committee comprising of all relevant stakeholder agencies has been established to assist the fisheries committees in managing fisheries and minimizing environmental issues. Awareness raising training on fisheries co-management, ecosystem-based fisheries management, etc. has been provided to fishers and other relevant stakeholder agency representatives.

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**CCRF Article 7 Section 7.1.9**

**“States ...should ensure transparency in the mechanisms for fisheries management and in the related decision-making process.**

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A fisheries development and management plan has been formulated with active stakeholder participation. The plan identifies actions required for sustainable management of fisheries to ensure fisher livelihoods and minimize threats to the lagoon ecosystem. DFAR has already initiated implementation of some important activities identified in the plan, with support from RFLP.

Negombo lagoon boundary will be established after a survey to arrest further illegal encroachments. A plan for the conservation and management of mangrove associated with the lagoon will be integrated and implemented with the fishery management plan. Monitoring, control and surveillance capabilities of the district fisheries office have been strengthened by the provision of a new boat and an engine.

Fisheries management and environmental conservation are processes that need to be nurtured continuously among the fishing community. Towards this end, a series of seminars on coastal environment conservation were held targeting the next generation, namely school children in schools located around the lagoon. Training is ongoing for a street drama to be staged in all 36 villages around the lagoon, to inculcate the importance of protecting the lagoon and its associated ecosystems.

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**CCRF Article 7 Section 7.1.10**

**States... should give due publicity to conservation and management measures and ensure that laws, regulations and other legal rules governing their implementation are effectively disseminated. The bases and purposes of such measures should be explained to users of the resource in order to facilitate their application and thus gain increased support in the implementation of such measures.**

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**Improving fisheries management and implementing the CCRF in Thailand**

*Smith Thummachua, Department of Fisheries*

Because of its geographical location, Thailand has access to fisheries in the Gulf of Thailand and in the Andaman Sea, both of which are endowed with rich fishery resources. Thai marine fisheries have been developing since 1960, and apart from fishing in the EEZ, Thai fishing vessels are operating in foreign waters and in the high seas in the Indian Ocean.

Licensing of vessels in Thai and foreign waters
Three-month closed areas – mainly purse seine and gillnet (15 February – 15 May in Gulf of Thailand; April – June in the Andaman Sea)
3 km conservation zone (trawl and pushnet free zone)
Fishing gear restrictions
Participation of local community, fishery association in management.

The development of marine fisheries has encountered various challenges, and currently faces overfishing, excess fishing capacity, conflict among fishers employing incompatible gears, and trade-related measures. To tackle these problems, various management measures have been implemented with the aim being to sustain fisheries resources, to ensure food security, and to implement the FAO CCRF.

Thailand adopted the Master Plan of Marine Fisheries Management of Thailand. It is valid for ten years starting in 2009 and has the following objectives:

1. To manage responsible and sustainable marine fisheries.
2. To facilitate rapid recovery of depleted fish stocks and to safeguard the marine ecosystem from any destructive practices.
3. To support fishery institutional strengthening and co-management, including networking at all levels to enable their active participation in marine fisheries management.
4. To promote capacity building of fishing enterprises at all levels to enable their effective operation under changing fisheries situations around the globe, and increasingly stringent governance.
5. To enhance fishers' quality of life.
6. To ensure seafood safety and confidence of consumers of fish and fish products.

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**CCRF Article 7 Section 7.1.1**

**States ...should, through an appropriate policy, legal and institutional framework, adopt measures for the long-term conservation and sustainable use of fisheries resources.**

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The master plan is composed of five strategies having 88 action programmes highlighting the necessity to manage people, which is the core of the plan.

To highlight a few actions to improve fisheries management, in particular those to combat IUU fishing, Thailand is working on catch certification, a regional MCS network under the RPOA-IUU fishing and vessel monitoring system.

### **Timor-Leste’s experiences in improving management of capture fisheries**

*Acacio Guterres, National Directorate of Fisheries and Aquaculture*

During the last three years, Timor-Leste has taken important steps in the development of fisheries management systems. After a first phase of development of the legal and policy frameworks after the 1999 conflict and the consolidation of the state institutions in the aftermath of the 2006 crisis, the National Directorate of Fisheries and Aquaculture has developed mechanisms with the support of the donor community and international partner agencies that constitute the basis for efficient resource management.

Fisheries have an important contribution to make in addressing the main challenges the country faces with regard to food security, poverty and unemployment. Currently the sector is in a phase of transition as Timorese fishers are introducing new fishing techniques, old consumption patterns are being questioned and changed and infrastructure development will facilitate the rapid development of the fisheries sector.

For these reasons, it is now the appropriate time to promote the best pattern of development for the present and future generations.

The National Directorate of Fisheries and Aquaculture has had some notable successes, e.g. with regards to the establishment of appropriate resource management systems, ranging from the development of a data management system (National Fisheries Statistical System) to the operation of a National Licensing Service which has registered and licensed most of the fishing boats in the country, the establishment of a community-based IUU reporting system using simple and inexpensive technologies and the gathering of information on traditional rules and arrangements and assistance to the communities in their codification.

All these recent achievements show that the best approach to resource management in Timor-Leste, given the limited resources and capacity in the NDFA, necessarily involves building positive partnerships between the state institutions and the local communities. Many of the achievements shown have been made possible with external support, which we still need to continue if we are to make progress.

#### **Timor-Leste linkages with the CCRF**

- 6.1 States and users should conserve aquatic ecosystems
- 6.2 Maintenance of the quality, diversity and availability of fishery resources
- 6.3 States should prevent overfishing and excess fishing capacity
- 6.4 Decisions should be based on the best scientific evidence available and take into account traditional knowledge
- 6.5 Apply a precautionary approach
- 6.8 All critical fisheries habitats should be protected and rehabilitated
- 6.10 States should ensure monitoring and control of the activities of fishing vessels and fishing support vessels
- 6.13 Ensure that decision-making processes are transparent
- 6.16 States should promote awareness of responsible fisheries through education and training
- 6.18 States should appropriately protect the rights of fishers and fishworkers.

## **USA National Marine Fisheries Services: stewardship of living marine resources for the twenty-first century**

*Michael Abbey, National Marine Fisheries Service, National Oceanic and Atmospheric Administration*

A new and controversial management plan being implemented in the United States covers multiple species management in one plan. The plan, whose implementation started in 2010, is called the Northeast Multispecies Fishery Management Plan and includes 13 species, managed at 20 separate stocks. These are all bottom-dwelling species and are generally all harvested with the same gears. Note that the United States fisheries management law requires NOAA to manage all fisheries for sustainability, which includes applying management actions to ensure that United States' fisheries reach that level.

“Catch shares” is a general term used in several fisheries management strategies, which include Limited Access Privilege Programs and individual fishing quotas that dedicate a secure share of fish to individual fishermen, cooperatives or fishing communities for their exclusive use. The New England Program falls under this strategy. Access to the New England groundfish fishery was limited in 1994. Subsequent actions dramatically reduced the amount of fishing effort permitted as a proxy to reduce groundfish mortality. This included allocating days-at-sea to vessels, trip limits, and daily possession limits. A version of those input controls is used still to manage the common pool fishery.

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### **CCRF Article 6, Section 6.1**

**States and users of living aquatic resources should conserve aquatic ecosystems. The right to fish carries with it the obligation to do so in a responsible manner so as to ensure effective conservation and management of the living aquatic resources.**

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NOAA found that that management at this level was too difficult and created a hostile relationship with fishers. The goal of the NOAA management effort in New England was to give fishers more freedom to fish but also more responsibility for the overall health of the fishery. NOAA believes that this program will lead to higher incomes for fishers and a reduction of bycatch and overall fishing mortality as the fishermen will fish more prudently. This leads to improvements in the sustainability of the fisheries.

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**Fishers now have more freedom to decide how they want to fish, but more responsibility to fish without threatening the health of the fisheries.**

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## **THEME 4: ADAPTATION TO AND MITIGATION OF CLIMATE CHANGE, LIVELIHOODS AND SUPPORT TO SMALL-SCALE FISHERIES**

### **Implications of climate change for fisheries and aquaculture: challenges for adaptation and mitigation in the Asia-Pacific region**

*Angela Lentisco, APFIC Secretariat*

APFIC has emphasized the importance of adaptation to and mitigation of the impacts of climate change related to fisheries and aquaculture in the region. It was recommended in the previous Session that APFIC should review the effects of climate change on fisheries and aquaculture in the region and provide advice to member countries on strategic planning for adaptation to climate change and mitigation measures for the sector. In response to this recommendation the APFIC Secretariat prepared a regional review on “The potential impact of climate change on fisheries and aquaculture in the Asian region” and organized

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**Climate change will not have uniform impacts across the globe. Certain trends and impacts may be more pronounced in Asia.**

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a regional consultative workshop on “Implications of climate change for fisheries and aquaculture: challenges for adaptation and mitigation in the Asia-Pacific region”.

This workshop was hosted by the Directorate of Fisheries Development, Ministry of Agriculture and Cooperatives of Nepal and was convened in Kathmandu, Nepal during 24–26 May 2011. There were 50 participants from member countries and competent regional organizations. The objective of the workshop was to share best available information and knowledge, discuss and analyze specific potential impacts, raise awareness of the threats of climate change on the fisheries and aquaculture sector and obtain recommendations for action.

The workshop noted that climate change is expected to contribute to increasing disruptions to aquatic and coastal systems upon which many millions of Asian people depend and it is vital that governments in the region understand the risks, identify vulnerable systems and develop adaptive strategies.

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**Don't blame climate change for problems mainly caused by bad management such as impacts of overfishing and the impacts of overcrowding aquaculture.**

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The main recommendations of the workshop were:

- advocate for increased policy emphasis and financial resourcing to climate change adaptation and mitigation in the sector;
- strengthen governance and integrate climate change adaptation into decision-making;
- improve monitoring, tracking and assessment;
- strengthen management of fisheries and aquaculture to improve adaptation and resilience to climate change;
- involve communities and local institutions in climate change adaptation as this is critical for success;
- recognize the different gender-related impacts of climate change;
- develop accessible information for decision-makers (in other sectors); and
- build capacity.

There were also specific recommendations for targeted research and development and for knowledge development.

There were also specific recommendations directed to regional organizations to support member countries, which were:

- create a regional climate change stakeholder’s forum;
- coordinate responses for transboundary issues using EAF/EAA;
- conduct regionwide monitoring of key climate change-related indicators and data/information sharing;
- engage regional cooperation to address climate change;
- develop a series of connected regional marine protected areas;
- establish an integrated cyclone prediction system; and
- represent the sector in non-fishery forums and other national and regional bodies.

Finally, there were a number of specific recommendations directed to FAO, APFIC and regional organizations to support improved integration of the sector in climate change planning. These were:

- integrate fisheries and aquaculture into disaster risk management plans and strategies and national adaptation programmes of action;



- support the development of an adaptation and mitigation strategy for the sector;
- integrate climate change into fisheries and aquaculture management;
- coordinate partnerships;
- investigate impacts; and
- use international fora to follow up impacts.

## **How to get fisheries and aquaculture onto the climate change agenda**

*Robert Lee, APFIC Secretariat*

This presentation on climate change urges APFIC members to urgently take stock of their fisheries and aquaculture situation related to climate change and proposes some steps and actions that can be taken to address the fact that in many of the international platforms that deal with or provide funding fisheries and aquaculture is inadequately addressed.

The presentation first shows that the Asia-Pacific region is highly vulnerable to climate change and natural disasters. Prominent increases in intensity and frequency of extreme events is evidenced in the region such as cyclones, heat waves, flooding and thunderstorms. Other studies have shown the likelihood of more intense El Niño events.

Climate change is an additional threat to the region on top of the already heavy tolls unleashed by natural disasters. Climate models indicate increases of 0.5 to 2 degrees by 2030 with more rapid increases in arid areas, greater rainfall during summer monsoons. Sea levels are also predicted to rise by 3 to 16 cm by 2030. The region is doubly vulnerable from natural disasters and slower onset climate change impacts. The Economic and Social Commission for Asia and the Pacific reported that in 2008 there were more than 223 000 disaster-related deaths and 101 million people were affected by disasters, which caused more than US\$103 billion worth of damage. According to the Stern report and the IPCC Assessment Report, it is the poorest people living in the poorest countries that are likely to suffer the most from the effects of climate change. Developing countries are likely to see the degradation or reversal of many of their socio-economic advances.

The presentation then went on to question the status of national plans with regards to vulnerability assessments, risk mapping, identification of priority areas, inclusion of pro poor and gender policies into climate change adaptation strategies, the integration of fisheries and aquaculture in the national communications to the United Nations Framework Convention on Climate Change (UNFCCC) and to the International Strategy for Disaster Reduction (ISDR). The presentation appealed to the audience to take climate change as a matter of urgency and integrate, in addition to adaptation measures, actions to remove greenhouse gases from the fisheries sector and focus on the

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### **CCRF Article 12 Para 12.5**

**States should be able to monitor and assess the state of the stocks under their jurisdiction, including the impacts of ecosystem changes resulting from fishing pressure, pollution or habitat alteration. They should also establish the research capacity necessary to assess the effects of climate or environment change on fish stocks and aquatic ecosystems.**

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**Developing countries in Asia are very vulnerable to climate change and natural disasters. In 2008, there were >223 000 deaths and 101 million people affected, with damages amounting to USD 103 billion (ESCAP, IPCC).**

**If the temperature rises 0.5 to 2° by 2030, the sea level will rise 3–16 cm by 2030. The Asian Development Bank predicts climate-related migration will lead to increasing conflicts and social stress.**

**The poorest people in the poorest countries are expected to suffer first and foremost.**

**Poor water management, governance and other sectors' mitigation plans will affect fisheries and aquaculture.**

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fact that good resource management and an ecosystem approach is a good way to reduce vulnerability. In addition, an example of a regional disaster insurance mechanism (the Caribbean Catastrophe Risk Insurance Facility) was shown as a way to insure against catastrophes.

The presentation then outlined the process of moving forward from risk assessments to identification of funding. The UNFCCC and World Bank estimates of funding needs in adaptation to and mitigation of climate change were outlined and two funding mechanisms the Least Developed Country Fund (LDCF) and the Special Climate Change Fund (SCCF) were overviewed. Steps to be taken to get fisheries and aquaculture into the national communications to the UNFCCC and the ISDR were pointed out. A table showing how FAO was assisting various countries with respect to climate change through the LDCF and SCCF funding was presented and practical steps were proposed.

The key messages to the fisheries and aquaculture departments and ministries are: 1) be prepared; 2) if fisheries and aquaculture are not in the national communications to the UNFCCC and the ISDR it will be assumed by the international donors that fisheries and aquaculture are not important and therefore funding for the development of adaptation strategies in these sectors will not be forthcoming; and 3) there are critical information and scientific gaps related to fisheries, aquaculture and climate change.

### **The FAO guidelines on small-scale fisheries: getting it right – a civil society perspective**

*Nalini Nayak, International Collective in Support of Fishworkers*

Small-scale fisheries, both inland and marine, are an important source of livelihood and food security for millions of people in Asia. The subsector however continues to be constrained by many factors, including insecure rights to land and fishery resources, lack of infrastructure, vulnerability to natural disasters and climate change, poor access to basic services, social security, markets and decision-making processes.

The decision by the FAO Committee on Fisheries (COFI) to develop guidelines on small-scale fisheries provides an important opportunity to support the subsector, enabling it to fulfil its potential in contributing to food security, poverty alleviation, environmental sustainability, human development and to local and national economies.

The guidelines have been widely welcomed by governments, including Asian governments. The guidelines have also been welcomed by fishworkers and support organizations. Civil society has actively engaged with the process of developing the guidelines, and several national-level workshops have been organized in Asian countries to seek proposals from fishing communities on the content of the guidelines. The need for a human rights-based approach to fisheries and fishing communities has been consistently emphasized.

The challenge is to ensure that the guidelines adopted reflect the aspirations and perspectives of small-scale fishing communities, offer practical guidance on supporting small-scale fisheries, and lead to their socio-economic and political empowerment. To achieve this it is important that states dialogue with organizations in the small-scale sector to arrive at a common understanding on what the guidelines should contain. A specific focus on women fishworkers is critical. It is also important to agree on a common vision on what is sought for the small-scale sector in order to ensure the positive characteristics of the sector—social, environmental, economic and cultural—are not compromised.

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**Key highlighted issues and principles were the indivisibility of fishers rights and human rights and a “rights and responsibilities” approach.**

**Need to be clear: what are small-scale fisheries?**

**There must be full and effective participation in all aspects of governance and management of fisheries resources.**

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Implementation of the guidelines is equally critical. This is the role of states as well as other stakeholders, including organizations representing small-scale fishing communities. Strategies for implementation need to be jointly evolved, implemented and monitored. The guidelines present an important opportunity—it is an opportunity that must not be wasted.

## **Lessons learned for improving livelihoods and resilience in coastal communities**

*Steve Needham, FAO/AECID Regional Fisheries Livelihoods Programme*

The RFLP sets out to strengthen capacity among participating small-scale fishing communities and their supporting institutions in Cambodia, Indonesia, the Philippines, Sri Lanka, Timor-Leste and Viet Nam. The four-year RFLP (2009–2013) is funded by Spain and implemented by the Food and Agriculture Organization of the United Nations (FAO) working in close collaboration with national authorities for fisheries in participating countries.

Small-scale fishers are generally poor and have few other livelihoods options when their fishing income is reduced because of overfishing or the implementation of fishery management measures that restrict their fishing. As one of its key goals RFLP is therefore working to strengthen existing livelihoods while identifying and evaluating new alternative income activities.

### **Key lessons learned from RFLP at the mid-point of its operations**

*Livelihoods actions require considerable time and resources*

It is a lengthy process to consult, plan, prepare, and implement livelihoods activities. In Cambodia for example the process of planning, assessing opportunities and feasibility, group strengthening etc. took almost two years. This can have consequences for fixed-term projects which may simply find themselves without sufficient time to properly implement livelihoods actions. Working with existing groups is one method of speeding up the process but this can result in the most disadvantaged or vulnerable members of communities being excluded.

*The importance of interventions being community-driven*

Communities must be fully involved and supportive of livelihoods options because activities parachuted in from above are far less likely to work. In Cambodia for example a community-based approach to identify livelihoods options involved community fisheries, commune councils, provincial departments and the fisheries administration at all levels.

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#### **A principled approach**

**At its onset RFLP teams and counterparts identified a series of principles which would guide its livelihoods actions.**

**These can be summarized as: promoting empowerment; working in partnerships; leveraging the strengths and potential of people and institutions; putting people at the centre; promoting sustainable fisheries livelihoods in a holistic way; being flexible and adaptable; being sensitive to traditional cultures; and being transparent and accountable.**

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#### **RFLP fisheries related livelihood activities**

**Food products:** fish sauce, fermented fish, seaweed snacks, fish crackers, bottled sautéed shrimp paste, surimi tempura

**Services:** hybrid sailboat-making, fishing supply stores, dock operation, engine repair/net repair services

**Aquaculture:** home-based aquaculture, aquaculture development planning, seaweed growing, seaweed drying

**Better quality dried fish:** scad drying, fish drying

**Miscellaneous:** crab bank, mangrove environmental services

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It is important that any such findings are validated with communities to ensure that they meet real needs. It is equally important not to raise expectations to unrealistic levels.

### *The demand for non-fisheries livelihoods*

In RFLP areas of operation, strong demand and interest has been apparent in most countries for non-fisheries related actions that can contribute to reduction of vulnerability, reduced pressure on resources and enhanced fisher safety. It is therefore important not to view or perceive livelihoods for fisher communities through too narrow a lens. Alternative fisher livelihoods don't only mean aquaculture and in fact certain aquaculture actions may place increased fishing pressure back on the resources that RFLP was designed to protect if they involve the culture of predatory high-value species requiring wild seed for stocking and fish as feed. In the Philippines the income from a women's group supports the family during the monsoon season when the men cannot fish. In Viet Nam husbands are reported to be spending less time at sea to help with chicken raising, whereas in Sri Lanka home gardening income is reducing the pressure on fishers to catch more fish.

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**Non-fisheries related activities**

**Agriculture:** chicken raising, pig production/ biogas/organic fertilizer, rice bank, sand leek plantation, home gardening, coconut oil production, corn

**Products:** sewing/handicrafts, undergarments/ bags and caps, handicrafts /weaving

**Food products:** making *tinagaktak* (beef in coconut milk) or yema (egg yolk and milk dessert)

**Vocational training:** beauty skills, dress making, information technology, reinforced fibre glass skills, salt production , coir production

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### *New livelihoods need new expertise*

Non-fisheries related livelihoods activities may require skills outside the usual sphere of expertise of fisheries agencies. Communities undertaking some of these actions (e.g. chicken raising) would benefit from enhanced interaction with agricultural extension workers. For example, chicken-raising in Viet Nam and Cambodia is common but training has not been offered to fisher families. Other government agencies such as the Department of Labour or those concerned with the development of small and medium enterprises also have expertise in many livelihoods areas that would be highly useful to coastal communities and enhanced collaboration should be encouraged.

### *The significant role of women*

Women play a prominent role in RFLP livelihoods activities. These real "alternative" livelihoods offer additional income, help reduce pressure on marine resources (men have less need to fish) and also support safety goals (men are less pressured to fish during unsafe periods). Income generated by women is more likely to be used for food, education, children etc. These actions also help improve the community status of women and the use of their time. Women's groups are often better/already organized (e.g. Philippines Rural Improvers Clubs and Indonesian *ikat* weavers) and therefore it can be more efficient and effective to work with them.

### *The importance of integration*

Livelihoods actions cannot take place in isolation and must be holistic in nature. It is important to link relevant livelihoods actions to resource management activities. For example in the Philippines shrimp paste production may potentially have a negative impact on resources and therefore needs to be linked to stock assessment. Meanwhile, small non-fisheries livelihoods actions supported by RFLP in the Philippines (e.g. sewing group) are also contributing a small amount of profits to management of the local MPA. In addition, lack of access to capital has been identified as a major obstacle to small-scale fisher communities embarking on or strengthening livelihoods actions. RFLP is therefore helping

build links with microfinance institutions (e.g. Philippines' MFIs are invited to observe group strengthening training and to listen to the presentations of business plans).

### *Recommendations*

- Fishing families exhibit a strong interest in non-fishing livelihoods. Fisheries line agencies may not have the necessary expertise to help develop such livelihoods. Efforts should be made by fisheries agencies to enhance collaboration with other agencies (especially agricultural extension departments) and other agencies should be encouraged to make greater resources available for fisheries communities.
- To a large degree, alternative fisheries livelihoods are women's livelihoods. Increased emphasis should be placed on understanding the role of women in fishing communities and supporting their development as income generators. Government agencies should become more aware of gender issues so that they are better placed to develop initiatives or deliver support that helps women meet their full potential.
- Lack of access to capital remains a major obstacle to fisheries communities' livelihoods development. Increased emphasis needs to be placed on enhancing access to microfinance for fishing communities. Systematic efforts should be made to enhance fishers' financial literacy as well as to facilitate the formation, or improve the efficiency of, community-based savings organizations. Microfinance institutions and rural banks should also be helped to increase their awareness and improve their understanding of the needs of fishing communities.
- The potential livelihoods development of many small-scale fisher communities is undermined by a lack of access to basic services such as clean water and sanitation, electricity and markets. Enhancing access to these basic services would greatly benefit communities and potentially allow them to develop their own livelihoods improvements/initiatives.
- Fisheries agencies have in many cases placed considerable emphasis on increasing production of fisheries products and less on marketing them. As a result, agencies tend to lack marketing expertise and should seek to improve their capacity in this regard.

## **THEME 5: COUNTRY EXPERIENCES IMPROVING AQUACULTURE MANAGEMENT AND THE CCRF**

### **Steps towards improvement of aquaculture management: Bangladesh perspective**

*M.I. Golder, Department of Fisheries*

The fisheries sector in Bangladesh accounts for 60 percent of animal protein intake, and provides employment to about 15.6 million people (about 10.5 percent of the total population including 1 percent women). Overall, the fisheries sector has experienced an annual growth rate of 5.6 percent over the last ten years with inland culture fisheries registering an average annual growth of 8 percent, contributing nearly 50 percent of the total fish production. Inland enclosed waterbodies (ponds, ditches), semi-enclosed waterbodies and *baor* (a type of freshwater wetland of fluvial origin), shrimp and prawn farms etc. covering a total area of about 0.68 million ha (12 percent of total inland water) produced about 1.46 million tonnes of (48 percent of total yield) fish and shrimp in 2010/11. There are 260 freshwater fish and 24 prawn species in Bangladesh.

Polyculture of Indian and Chinese carps along with a few other exotic species is the most dominant system in Bangladesh. Other practices include pond monoculture of Thai pangasius, mixed culture of

tilapia and carps in seasonal ponds or ditches, and culture of common carp and silver barb in rice fields. Monoculture of genetically improved tilapia in ponds and cages is also becoming popular. In general, fish culture in Bangladesh is characterized by improved extensive to semi-intensive culture. On average, the yields for carp polyculture in ponds are about 3.3 tonnes/ha that can be increased to 1.5 to 2 times.

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**Aquaculture production is mostly improved extensive and semi-intensive type systems. The production area is 12 percent of total open water bodies (0.68 million ha).**

**Production in 2010/11 was 1.46 million tonnes of fish – about 48 percent of total national fish production.**

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Brackish water aquaculture was introduced as an important economic activity in the early 1980s with shrimp as the dominant species. To meet the extended export demand for shrimp, shrimp farm areas have increased remarkably during the last decades. Shrimp farming consists mainly of two shrimp species (*P. monodon* and *M. rosenbergii*) and these are cultured in various systems (e.g. extensive, improved extensive and semi-intensive) in the coastal area. The average yields for shrimp culture and prawn culture approaches 350 kg/ha and 600 kg/ha respectively, which could be increased to 750 and 1 000 kg/ha respectively. The national fisheries policy and strategies support the introduction of an ecosystem approach to aquaculture. The shrimp sector sub-strategy prioritizes zonation of coastal areas for shrimp farming to mitigate conflicts with rice farming; coordinated fish-rice or shrimp-rice culture; improved traditional, eco-friendly semi-intensive culture systems for increasing production but conserving the ecological balance and biodiversity.

To restore several indigenous fish species and maintain genetic diversity, a carp brood bank has been established to ensure quality brood of natural origin to government and private hatcheries and activities being implemented for the conservation of the Halda River in Chittagong, the only natural carp spawning ground in Bangladesh. To address the climate change impacts in the coastal region, necessary adaptive measures are under consideration, such as the introduction of saline-tolerant species (mainly Thai pangasius and tilapia) and the expansion of cage farming. Small-scale aquaculture in semi-closed floodplains, as a means of climate change adaptation, is also being practiced in other regions of the country.

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**CCRF Article 9, 9.3.5**

**States should... promote research and ... the development of culture techniques for endangered species to protect, rehabilitate and enhance their stocks...**

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Very recently the Government of Bangladesh enacted The Fish Hatchery Act 2010, The Fish Hatchery Regulations 2011, The Fish Feed and Animal Feed Act 2010 and the Fish Feed Regulations 2011 that are being enforced to ensure quality fish seed and fish feed. The Fish and Fish Product (Inspection and Quality Control) Ordinance (1983) prohibits the operation of a fish processing and packing plant without a license and fish and fishery products can't be exported without a health certificate from the testing laboratories of the DoF.

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**CCRF Article 9, Section 9.1.1**

**States should establish, maintain and develop an appropriate legal and administrative framework which facilitates the development of responsible aquaculture.**

**CCRF Article 11, Section 11.1.4**

**States should cooperate to achieve harmonization, or mutual recognition, or both, of national sanitary measures and certification programmes as appropriate and explore possibilities for the establishment of mutually recognized control and certification agencies.**

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The Ordinance is further implemented by the Fish and Fish Product (Inspection and Quality Control) Rules (1997), which include HACCP requirements for shrimp processing plants. In terms of food safety, fish farmers, extension workers, NGOs and other stakeholders are also being trained on GAP, traceability and HACCP practices and have started to put these into

practice. To ensure a traceability system in the shrimp sector, about 200 000 shrimp farms and 10 000 finfish farms has been registered and the registration of fish farms in other areas is proceeding. Community-based approaches for fish farmers are also practiced in aquaculture, e.g. aquaculture mainly in larger public ponds and flood plains, cages, formation of common interest group (CIG), fish farmer school (FFS) etc.

Aquaculture has been progressing with reasonable success, however there are some new and challenging issues that are arising in the process, and these need to be seriously addressed to keep up the current growth of the aquaculture industry. The emerging issues are quality brood and its stock management and quality seed production and its availability at affordable price; climate change impacts on aquaculture etc. There is ample opportunity for aquaculture to expand both vertically and horizontally. Bangladesh is likely to be one of the countries most adversely affected by climate change impacts and needs both technical and institutional support/cooperation from its development partners.

### **Aquaculture development in Cambodia**

*Pich Sereywath, Community Fisheries Development Department, Fisheries Administration*

The development of aquaculture in Cambodia is an effective way to ensure food security and employment and to contribute to the economy, both at the household and national level. Aquaculture is important in securing and sustaining fisheries resources and the ecosystem. Without this sector, the government and its development partners would face critical challenges in the long-term

with respect to responsible fisheries, food security, and poverty reduction. Because of its considerable importance, the Royal Government of Cambodia (RGC) sees it as a priority sector that needs to improve in line with sustainable environmental considerations nationally and regionally and in close cooperation with partners on the implementation of the CCFR as well as the ecosystem approach to aquaculture (EAA).

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**Most aquaculture production is from inland aquaculture, whereas coastal aquaculture production represents about 10 percent of the total aquaculture production.**

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Cambodia has produced a series of legal instruments and regulations and technical standards to support the development of aquaculture activities, notably for small-scale aquaculture generating income for rural poor communities and providing sufficient fish for the consumption of poor rural households, especially children and pregnant women who might be at risk of malnutrition. Aquaculture production has increased 20 percent each year and yielded 72 000 tonnes in 2011. However, the RGC plans to produce up to 200 000 tonnes by 2019. Along with this plan, in terms of ensuring safe aquaculture products, food security and poverty reduction, Cambodia is planning to develop a Master Plan for Aquaculture Development and establish a surveillance, monitoring and control system for aquaculture operations. In addition to this, Good Aquaculture Practice is being introduced to both officials and farmers. The introduction is gradual, however, because of limitations of knowledge/experience and budget. Along with these changes Cambodia is facing slow growth in aquaculture development activities and export markets.

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**CCRF Article 9 Section 9.1.1**

**States should establish, maintain and develop an appropriate legal and administrative framework which facilitates the development of responsible aquaculture.**

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## Recent improvements in aquaculture in Southern China and some constraints

Yongsong Qiu, South China Sea Fisheries Research Institute

China has been the world's largest aquaculture producer since the 1980s. The major types of aquaculture in Southern China include prawn culture (*P. vannamei* and *P. monodon*) using seashore and land-based ponds, tilapia culture in freshwater ponds mainly for the international market, polyculture of carps in freshwater ponds mainly using traditional methods for domestic consumption, marine cage culture of high-value fishes, as well as culture of molluscs and seaweed utilizing natural aquatic productivity.

Prawn production is the most important aquaculture industry in the coastal areas of Southern China. The application of probiotics (*Bacillus* spp.) has been expanding in recent years to reduce the use of chemicals and antibiotics. This helps to meet the strict export standards for antibiotics and chemical residues. The increased use of land-based intensive prawn culture ponds enhances the efficiency of production, avoids the reclamation of intertidal habitats, and reduces the impacts from natural disasters. The traditional cage

culture of high-value fish causes overloading of nutrients and sediments and can be impacted by low oxygen and fish diseases. Recent technical success in the manufacture of wave-resistant large cages provides potential for moving cage culture further offshore to avoid polluting and being polluted. Tilapia culture and processing is another export-orient industry. The major improvement in recent years has been the realization of "zero-waste" disposal and export certification.

The aquaculture industry of Southern China faces constraints related to seeds, feeds, and environments. Almost all kinds of seed production for marine species use wild genetic resources without any genetic improvements in terms of survival, growth, and disease-

resistance. Moreover, the absence of quality surveillance and control for aquaculture seeds also contributes to production instability. The Chinese feed industry heavily relies on fishmeal imports. This could be a factor limiting further growth in aquaculture. Encouraging molluscs and seaweed culture relying on natural aquatic productivity could be an option. Most of the high-value fish culture uses forage fish from capture fisheries. The demand for forage fish encourages the capture of trash fishes that comprise a large amount of juveniles of commercial species.

To mitigate the constraints related to feeds and the environment, wave-resistant large cages for offshore culture using pellet feeds should be promoted. Meanwhile, the number of traditional culture cages in the coastal bays and coves should be reduced according to the results of carrying capacity studies. At present the wastewater from aquaculture is discharged without any form of treatment and it is therefore recommended that standards be introduced for wastewater disposal from aquaculture farms. Moreover, environmental impact assessment should be introduced for the establishment and operation of intensive aquaculture systems.

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### CCRF Article 9, Section 9.4.4

**States should promote effective farm and fish health management practices favouring hygienic measures and vaccines. Safe, effective and minimal use of therapeutants, hormones and drugs, antibiotics and other disease control chemicals should be ensured.**

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**The Chinese feed industry uses 1.5 million tonnes/year of fishmeal and about 80 percent of this has to be imported.**

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## Aquaculture management and the CCRF implementation in Indonesia

Setiawan and Debora Prihatmajanti, Directorate General of Aquaculture, Ministry of Marine Affairs and Fisheries

Aquaculture production in Indonesia has shown strong growth in recent years, from 3.8 million tonnes in 2008 to 4.7 million tonnes and 6.3 million tonnes in 2009 and 2010, respectively. In 2011 the total aquaculture production was about 7.9 million tonnes. The aquaculture sector is thus set to play an increasingly important role in Indonesia's economy.

The main aquaculture species are shrimp (*Penaeus monodon* and *Letapenaeus vanamei*), seaweed, seabass (*Lates calcarifer*), grouper (*Chromileptes* spp.), milkfish (*Chanos chanos*), tilapia (*Tilapia niloticus*), pangasius (*Pangasianodon hypophthalmus*), African catfish (*Clarias geriepenus*), common carp (*Cyprinus carpio*), and giant gourami (*Osphronemus gourame*). Seaweed tops the list, followed by milkfish and shrimp.

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**GAP obliges fish farms to cultivate as well as harvest fish in a controlled environment by focusing on sanitation, the import control and registration of fish food, drugs and chemical and biological materials.**

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In line with the CCRF, the Directorate General of Aquaculture, Ministry of Marine Affairs and Fisheries has been conducting several programmes as follows:

### 1. Quality assurance and food safety of aquaculture production

- GAP certification to implement food safety requirements on farms.
- Hatchery certification: appropriate procedures for broodstock selection and the production of eggs, larvae and fry.
- Feed registration and feed importation control.
- Fish drug, biological and chemical substances registration.
- Residue monitoring: prohibited materials and contaminants (antibiotics, heavy metals etc.).
- FAO guidelines on aquaculture certification will be harmonized with ministerial decrees.

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**CCRF Article 9 Section 9.4.7**

**States should ensure the food safety of aquaculture products and promote efforts which maintain product quality and improve their value through particular care before and during harvesting and on-site processing and in storage and transport of the products.**

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### 2. Fish health and environment management

- Quarterly Aquatic Animal Diseases Reports to the World Organisation for Animal Health (OIE).
- Monitoring and control of fish health, water and soil quality.
- Laboratory accreditation and networking.
- Research and development for native species and important species technology.

### 3. Other responsible fisheries development

- Planting mangroves.
- CCRF training.
- Organic culture promotion and assistance.
- Human resources development.
- Small-scale fish farmers/group capacity building.

## **Implementing the ecosystem approach to aquaculture in Malaysia**

*Rohani Mohd. Rose, Department of Fisheries Malaysia*

To facilitate implementation of the EAA, Malaysia has reviewed its national agriculture policy and implemented the new National Agro-Food Policy (NAP) (2011–2020), which prioritizes food security and safety, increasing the agro-foods contribution to the GNP and encouraging public-sector driven businesses.

Under the NAP the focus is on high value commodities such as fish and shrimp, ornamental fish and seaweed.

Strategic action has been taken to boost R&D to support production of fry, new varieties of ornamental fish, new seaweed products, disease control as well as the establishment of biosecurity laboratories, collection and quarantine centres, fish disease free zones and seaweed industry zones.

Participation of farmers in the certification of fisheries and aquaculture through a farm accreditation scheme and the establishment of the code of conduct in support of best aquaculture practices (i.e. minimizing use of trash/low-value fish) has been encouraging.

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### **CCRF Article 9 Section 9.1.3**

**States should produce and regularly update aquaculture development strategies and plans, as required, to ensure that aquaculture development is ecologically sustainable and to allow the rational use of resources shared by aquaculture and other activities.**

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**Commercialization of seaweed farming in Sabah using the “longline” method.**

**Clustering farms under the mini estate farming concept to move the industry towards downstream product development. This will boost seaweed output to 900 000 tonnes in 2020.**

**Adopting international standards and best practices in terms of quality and sustainability and a liberalization programme will enable companies to compete globally.**

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## **Improving aquaculture management and implementing the CCRF in Myanmar**

*Saw Lah Paw Wah, Department of Fisheries*

Aquaculture has a major role in terms of food security and is one of the most important industries in the national economy of the country. Myanmar has a fish ponds area of 88 525 ha and a shrimp ponds area of 91 036 ha. The people of Myanmar prefer freshwater fish to marine fish, so the state has set a policy to target marine fish for export market. The pond culture of freshwater fish rohu (*Labeo rohita*) is well developed and significant production of cultured freshwater fish is used for domestic consumption with the surplus going to other countries.

Eighteen kinds of freshwater fish are being successfully cultured and nearly 800 million fish seeds are being produced by government and private fishery stations for the aquaculture development and restocking programme. However, the fishery sector in Myanmar has some constraints such as inadequate seeds supply in marine finfish aquaculture resulting from inadequate hatchery technologies.

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**Mud crab aquaculture has become a booming industry as domestic consumption and export demand are growing rapidly. Soft shell mud crab farming has become very popular as it commands a high price.**

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### **CCRF Article 9 Section 9.3.4**

**States should promote the use of appropriate procedures for the selection of broodstock and the production of eggs, larvae and fry.**

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The government has been conducting food security programmes for rural community livelihoods such as the rice-fish culture programme, restocking fish and prawn seeds into natural waters, training on fish seed production and grow-out culture techniques, distribution of fish seeds to farmers, providing loans to stakeholders, and establishing backyard hatcheries.

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**CCRF Article 9 Section 9.4.1**

**States should promote responsible aquaculture practices in support of rural communities, producer organizations and fish farmers.**

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### **Integrated aquaculture in Nepal**

*Rajendra Kumar K.C., Directorate of Fisheries Development, Department of Agriculture*

Aquaculture plays an important role in improving rural livelihoods. Many sustainable aquaculture development models suitable for rural livelihoods as well as commercial ventures exist in Asia. Carp polyculture in ponds, cage aquaculture, culture in tanks and raceways, small-scale pond aquaculture, integrated fish culture with livestock, horticulture, fish culture in rice fields etc. are practiced in Nepal.

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**CCRF Article 9, Section 9.4.5**

**States should regulate the use of chemical inputs in aquaculture which are hazardous to human health and the environment.**

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The management system adopted in Nepal for both natural water fisheries and aquaculture are environment friendly and most organic fish farms adopt integrated pest management with little use of chemicals with regard to implementing the CCRF and EAF.

*Success story of small-scale aquaculture in Western Nepal (public-private partnership model)*

The fisheries programme is supported by the United States Agency for International Development and the Government of Nepal and is focused on poverty alleviation of the rural people. The programme is based on a value-chain approach. It was launched in four districts (Banke, Bardia, Kailali, and Rupendehi).

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**The advantage of integrated farming is that the application of the waste products from one system can boost the other. The total output of the farm is increased with vegetable integration. This has supported the farmers to increase their income from NRs 15 000 to 20 000 annually (US\$238 to US\$317).**

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The project initially focused on farm households possessing a treadle pump to diversify their farming system through the introduction of vegetables on pond dikes, through the construction of a small fish pond adjacent to the treadle pump for fish culture and a small reservoir for irrigation and training activities.

### **Pakistan's work on aquaculture: implementing the CCRF**

*Ghulam Mujtaba Wadahaar, Livestock and Fisheries Department, Government of Sindh*

Aquaculture is a rapidly expanding sector and plays an important role in supplementing the protein requirements of the masses. It comprises fish farms, fish hatcheries, fish nurseries as well as pen and cage culture. Fish hatcheries are also established in the country and play a vital role in enhancing fisheries potential. The shrimp production unit at Karachi has opened new avenues for shrimp farming along the coastal belt of Sindh. Various development schemes have been launched to speed up the growth of aquaculture and new trends have been set for sustainable fisheries in the region. Aquaculture in Pakistan is a recent development and in many parts of the country the management of the sector is in the development phase with aquaculture practices varying across the different provinces. The Asian Development Bank assisted projects have helped to strengthen the institutional structure, along with infrastructure development such as the development of hatcheries and juvenile production, model farms, transfer of technology, capacity building, human resource development and the strengthening of extension services.

### *Aquaculture management and implementation in the past five years*

Various measures have been taken to strengthen aquaculture activities in a sustainable way to address the issues pertaining to food security, socio-economic development, alternative livelihood resources for the fishers, skills development and over-exploitation of fisheries resources through conservation and management. In this regard projects were launched during last five years under the annual development programme. The main achievements and constraints are presented below.

Achievements	Constraints
Introduction of new system and technologies	Inadequate training institutes
Introduction of polyculture/integrated farming system	Inadequate facilities in existing centres
Improvement in feed technology/proper fertilization and manuring	Inadequate qualified staff
Introduction of fast growing exotic species	Insufficient operational funds
Shift from extensive to semi-intensive farming	Non-availability of library
Water/soil analysis, disease control and fish health management	Inadequate laboratory material and equipment
Increase in per acre yield (500 kg to 1 200 kg/acre)	Lack of pure strain broodstock
Artificial propagation of fish species	Lack of trained manpower
Success in artificial breeding of threatened species i.e. Mahaseer and Kalbans	Inadequate supply of funds to public hatcheries
Breeding and culture of red tilapia, <i>Tilapia niloticus</i> and GIFT tilapia	Short supply/production of large size fish seed of species that can be cultured
Introduction of ornamental fish culture on a commercial scale	Non-availability of formulated feed
Rearing, breeding and culture of <i>Pangasius hypothalamus</i>	Inadequate number of public and private hatcheries, high demand of large size quality fish seed
Establishment of freshwater prawn hatchery	Lack of pure strain
Replenishment of fish seed stocks in public water bodies	Lack of credit facilities for private hatcheries operators/owners for development purposes
Introduction of backyard hatcheries	Seed certification programmes should be initiated for quality control of fish seed
Regulations be prepared for private hatcheries	

High priority areas of action were two major Asian Development Bank projects in the 1980s and the 1990s, which established infrastructure such as hatcheries, nurseries and model farms. Training centres were established too in all provinces. As a result carp and trout farming was promoted in Pakistan.

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#### **CCRF Article 9, Section 9.3.4**

**States should promote the use of appropriate procedures for the selection of broodstock and the production of eggs, larvae and fry.**

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Overall, more than 70 000 hectares have been brought under aquaculture and there is regular stocking in natural water bodies (rivers, canals, reservoirs and lakes). Now, fish farming is practiced in most natural waters.

### *Ecosystem approach to aquaculture*

Fish potentials of the lakes have been drastically reduced to about 1 000 tonnes annually (mainly comprising trash fish) compared to the past production of over 20 000 tonnes, particularly because of

non-recruitment of indigenous fish fry from the Indus River. This has resulted from supplying river water to the lake at the wrong time, i.e. when there is either very little or no fish seed in it. Moreover, the over-exploitation of fish has also tremendously multiplied the problem.

The ecosystem has become unbalanced/unstable for many reasons, including sediment degradation, excessive vegetation and proliferation of exotic fish species like tilapia. Moreover, the gene bank is becoming depleted.

Because of non-stocking of major carp species, non-commercial and unimportant opportunistic fish species have flourished and taken the place of fishes such as *Labeo rohita*, *Catla catla*, *Crihinus mrigala*.

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**Aquaculture is now one of the fastest growing food producing sectors, but it is being criticized for creating adverse environmental impacts.**

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There are nearly 400 000 fishers engaged in fishing activity using more than 45 000 boats and as a result of declining fish stocks and decreasing fish potential, the dependent fisher population are leading a hand-to-mouth existence, resulting in their displacement.

Measures have been taken to stabilize the ecosystem of the major public water bodies, through the salvage of fish stocks. With the assistance of the Environment Protection Agency, rules have been introduced to regulate the effluents discharged from the various industries affecting the ecosystem of the waterbodies.

### **Improving aquaculture management and implementing the CCRF in the Philippines**

*Rosario Segundina P. Gaerlan and Jessica Munoz, Bureau of Fisheries and Aquatic Resources*

The Philippines has been a traditional fisheries area because of its archipelagic state. However, as population has increased, the need for new sources of fish became a priority. Hence, the gradual shifting from capture fisheries to aquaculture. For the past ten years, aquaculture has overtaken capture fisheries as the main source of fish and as of 2010, aquaculture now comprises more than 50 percent of the total fish production. This includes fish and shellfish and seaweeds.

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#### **CCRF 9.1.1**

**States should establish, maintain and develop appropriate legal and administrative framework which facilitates the development of responsible aquaculture.**

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In support of the Code of Conduct for Responsible Fisheries, the Philippines promulgated the Fisheries Administrative Order 214, series of 2001 or the Code of Practice for Aquaculture. The Code generally outlines the general principles and guidelines for environmentally-sound design and operation of aquaculture for the sustainable development of the sector. Other environmental laws that support aquaculture include those related to the use of water, discharges and pollutants. Apart from the Code, Philippine national standards specifically for aquaculture feeds have been established.

Initially, areas for aquaculture zones are declared through zoning in the local fisheries ordinance. For large areas, an Environmental Compliance Certificate (ECC) is issued before any aquaculture activity is started. Before an ECC is issued however, several steps must be carried out to ensure the project conforms to all laws and standards pertaining to the establishment of an aquaculture project. However, small projects do not yet conform to the standards.

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#### **CCRF 9.1.5**

**States should establish effective procedures specific to aquaculture to undertake appropriate environmental assessment and monitoring...**

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For health and management, a fish health section has been established in all regional offices and they are continuously conducting disease control, monitoring and surveillance. An emergency response has been instituted to help fish farmers decide on the proper emergency action in cases where this is needed. However, many fish farmers still do not act immediately and wait to the last minute before doing anything. For the movement of animals, local transport permits are also issued and quarantine checkpoints have been established. For the management of genetic stocks, gene selection is being undertaken, use of local stocks is encouraged and risk analysis must be done prior to importation for aquaculture use. Food safety and quality is monitored through the inspection and certification programme. Traceability systems especially for export have been instituted. Certification systems ensure that the product has gone through all the necessary procedures prior to export. Several standards have been established as part of the Philippine National Standards System. Advocacy on local product certification is still ongoing.

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**Many small scale fishers are not members of fish-farmer groups.**

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On consultation and capacity building, almost all activities are consulted through the Fisheries and Aquatic Resource Management Councils and a public hearing or stakeholder consent is required prior to any project establishment. Fish farmer groups are given priority to be granted fishery rights as mandated by law. Several government agencies accredit/register fish farmer groups and in turn they can have access to funds and projects from donors. Training activities are continuously offered to upgrade the fish farmers' skills. Because of socio-economic considerations, it has been mandated that only 10 percent of the potential areas for aquaculture will be used and resource use is discussed in public hearings to resolve potential or actual conflicts. Gender considerations are being institutionalized and priority beneficiaries are small-scale fisherfolk and members of registered fish farmer groups in project implementation.

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**CCRF 9.1.4**

**States should ensure that livelihoods of local communities, and their access to fishing grounds, are not negatively affected by aquaculture developments.**

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Implementation of all these laws, regulations and programmes still depend on the cooperation of the local governments and the stakeholders. Consultation and advocacy is being continuously undertaken to promote the implementation of the Code.

### **Seaweed cultivation for green growth in the Republic of Korea**

*Eun Kyoung Hwang, Seaweed Research Center, National Fisheries Research and Development Institute*

The world seaweed production has been increasing over the past decade and reached 19 million tonnes in 2010. And the Republic of Korea produces 0.99 million tonne annually, which places it among the top four seaweed producing countries (FAO 2010). Total annual production of seaweeds was estimated to be 992 283 tonnes (wet weight) in 2011. Economically important genera are: *Porphyra*, *Undaria*, *Hizikia*, *Laminaria*, *Sargassum*, *Enteromorpha*, and *Codium* used for food, and *Gelidium*, *Pachymeniopsis*, and *Ecklonia* spp. used as raw material for phycocolloidal extraction. *Porphyra* is the most economically valuable seaweed species as it accounted for 57 percent of the production in value.

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**The seaweed gene bank has 148 seaweed strains, comprising 116 strains of *Porphyra* (*conchocelis*) from all over the world, 16 domestic strains of *Undaria* (free-living gametophytes) and 16 strains of other algae (*Laminaria*, *Ecklonia*).**

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Republic of Korea has the knowledge needed for mass seaweed cultivation of various species. Because of the environmentally friendly nature of seaweed, the technology of seaweed cultivation can

be applied to other aspects of biomass production for food, feed, extract industry and integrated multitrophic aquaculture.

Recent successive researches on seaweed cultivation and species improvement were mentioned in the presentation. Along with the green growth policy of the Korean government, seaweed cultivation is likely to play an increasingly important role as a bioremediation system to alleviate eutrophication problems resulting from fed aquaculture, and as a carbon dioxide absorbing system to prevent global warming.

### **Rehabilitation of shrimp aquaculture industry affected with white spot disease in the North Western Province of Sri Lanka through implementation of best management practices**

*J.M. Asoka, National Aquaculture Development Authority, Ministry of Fisheries and Aquatic Resources Development*

Shrimp farms are mainly located on the coastal belt of the North Western Province. The main water source for the shrimp farming is the Dutch Canal, which was constructed in the seventeenth century, connecting three lagoons called Chilaw, Mundal and Puttalam. *Peneaus monodon* (tiger prawn) were cultured in 1 320 shrimp farms covering an area of 4 500 ha. White spot disease first appeared in the shrimp aquaculture industry in 1996, but despite this, shrimp production was about 4 360 tonnes in 2000. The shrimp industry was severely affected with white spot disease and it affected the production leading to a drop in 2005 of up to 1 570 tonnes. In order to address the situation, a shrimp monitoring and extension unit was established in the North Western Province to monitor and reduce the disease.

As a management tool, best management practices (BMPs) were proposed to the shrimp industry with the aim of reducing white spot disease through the prevention of the spread of the disease and obtaining sustainable shrimp production while ensuring the minimum damage to the environment.

BMPs were formulated for shrimp farming, shrimp hatcheries, broodstock collectors, shrimp harvesting, feed and feed suppliers, feeds and feeding, chemical suppliers and importers in consultation with all the stakeholders of the shrimp industry. The shrimp farm extension and monitoring unit, with the co-participation of the farmer associations, strictly monitored the implementation of the BMPs and necessary action was taken to make improvements.

Farmers have to comply with applicable rules and regulations imposed by the government. After implementation of BMPs for pond preparation on the farm, a permit is issued for stocking postlarvae by the shrimp farm monitoring and extension unit.

With the implementation of the above BMPs, shrimp production has shown positive results and the occurrence of white spot disease has been brought under control on the farms in the North Western Province in Sri Lanka.

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#### **CCRF Article 9 Section 9.1.2**

**States should promote responsible development and management of aquaculture, including an advance evaluation of the effects of aquaculture development on genetic diversity and ecosystem integrity, based on the best available scientific information.**

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**Through the implementation of BMPs, shrimp production has been increased.**

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#### **CCRF Article 9 Section 9.4.2**

**States should promote active participation of fish farmers and their communities in the development of responsible aquaculture management practices.**

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## **Improving aquaculture management and implementing the CCRF in Thailand**

*Chuanpid Chantarawarathit, Department of Fisheries*

Aquaculture production in Thailand has increased continuously since 2003. Last year, the total aquaculture production in Thailand was 1 401 870 tonnes to which coastal aquaculture contributed 889 390 tonnes (63 percent) and freshwater aquaculture contributed 512 480 tonnes (37 percent). Although aquaculture growth has the potential to meet the growing demand for aquatic foods and to contribute to food security and poverty reduction, it is increasingly recognized that improved management is necessary to address a number of major issues in the sector. Therefore aquaculture is included in the national fisheries policy and master plan that complies with the CCRF under the vision of a “sustainable aquaculture with secured and safe production.”

A number of laws and regulations have been established gradually and adopted by the stakeholders to develop and promote aquaculture practices to meet international guidelines/standards related to aquaculture production. However, a number of constraints have been found in recent years such as disease outbreaks, adverse changes in water quality, lack of effective food safety and quality assurance measures and increasing demands by civil society and others to maintain environmental integrity. Food safety programmes and a full traceability system for aquaculture production, therefore, have been developed along with good aquaculture practices and certification schemes as well as a focus on organic marine shrimp farming.

Thai agricultural standards or GAP (TAS 7401-2009) have been established and used voluntarily. The standards refer to a common set of key topics including social responsibility, environmental assessment for marine shrimp farm impacts, animal health and welfare, food safety and quality, and traceability. To ensure aquaculture processes and products comply with the DOF standards, the Aquaculture Development and Certification Centre has been established since 2010 as a certification body adopting the ISO/IEC Guide 65:1996 and providing service and aquaculture certification for marine shrimp and tilapia farms.

The DOF promotes good farm management practices and attempts to increase the number of certified farms to reduce effluent pollution load and comply with relevant effluent standards through appropriate treatment. Wherever sustainable coastal zone management has been developed, EAA has been used to mitigate the negative impacts of shrimp farming on coastal ecosystems. To solve problems of transboundary pathogens or diseases in a systematic way, the *Thailand Economic Strategy for Control of Aquatic Animals Diseases*, includes a diseases surveillance, monitoring and control system, which has been developed in line with the OIE standards. Disease transfer is reduced by regulating the introduction and transfer of aquatic organisms and by controlling the transboundary movement of aquatic animal diseases using quarantine measures.

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**The Thai Aquatic Animal Genetic Research and Development Institute has a fish sperm bank. It undertakes genetic improvement of broodstock and selection.**

**There is a programme of rehabilitation and conservation of Thai endangered fish species.**

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### **CCRF Article 9, Section 9.2.1**

**States should protect transboundary aquatic ecosystems by supporting responsible aquaculture practices within their national jurisdiction and by cooperation in the promotion of sustainable aquaculture practices.**

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### **CCRF Article 9 Section 9.3.2**

**States should cooperate in the elaboration, adoption and implementation of international codes of practice and procedures for introductions and transfers of aquatic organisms.**

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The quality of the manufactured feed and feed ingredients is regulated under the Feed Quality Control Act. However, though a reduction of fishmeal utilization has not yet been achieved, research on the development of suitable alternative protein sources to reduce dependence on fishmeal and other fish-based products has been supported.

A major issue related to the social impacts of aquaculture, particularly shrimp farming, is labour/worker conditions. Relevant agencies currently are carrying out a social impact assessment of the shrimp production sector together with the development of guidelines for good labour practices in the shrimp farming industry.

### **Timor-Leste's experiences in aquaculture management**

*Acacio Guterres, National Directorate of Fisheries and Aquaculture*

The need to increase access to animal source foods – livestock and fish – is vital to improving the nutritional status of the people of Timor-Leste and addressing the country's problem of chronic malnutrition.

Aquaculture, or the farming of aquatic animals and plants, has been identified by the government as a means of improving the food and nutrition security situation of the country, and contributing to economic activity and household incomes in rural areas.

Despite the shortcomings of the country with respect to infrastructure development, the supply of inputs and the constraints of the NDFA in resources and human capacity, three successful aquaculture management actions taken place: one is the introduction, from 2004, of the mariculture of seaweed, the production of which has been increasing along with its export and its consumption in Timor-Leste.

Under the auspices of the National Strategic Development Plan (2011–2030) launched by the Prime Minister in 2011, the NDFA has undertaken a Study on the Potential for Aquaculture Development and developed a National Aquaculture Strategy (2012–2030) for Timor-Leste. The strategy, which is intended to guide future development of aquaculture in Timor-Leste, was prepared through a process of consultation and analysis, and is anchored in the principles required for poverty reduction, combating malnutrition, economic development and effective ecosystem management.

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#### **CCRF Article 9, Section 9.4.3**

**States should promote efforts which improve selection and use of appropriate feeds, feed additives and fertilizers, including manures.**

#### **CCRF Article 6 Section 6.17**

**States should ensure that fishing facilities and equipment as well as all fisheries activities allow for safe, healthy and fair working and living conditions and meet internationally agreed standards adopted by relevant international organizations.**

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#### **National Aquaculture Development Strategy**

##### **Vision**

**Aquaculture contributes to improved food and nutrition security, diversification of livelihoods of inland and coastal communities, and economic growth in Timor-Leste**

##### **Goals**

- 1) Significant and measurable increase in average per capita fish consumption**
  - 2) Aquaculture will provide a range of new livelihood options for coastal and inland communities**
  - 3) New infrastructure and technical capacity will be developed to support aquaculture enterprises**
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#### **CCRF Article 9 Section 9.4.1**

**States should promote responsible aquaculture practices in support of rural communities, producer organizations and fish farmers.**

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## **Aquaculture development in the United States**

*Michael Abbey, National Marine Fisheries Service, National Oceanic and Atmospheric Administration*

Marine aquaculture in the United States consists of a vibrant community that contributes to seafood supply, supports commercial fisheries, enhances habitat and at-risk species, and maintains economic activity in coastal communities and at working waterfronts.

However, direct United States marine aquaculture production is quite small relative to overall United States and world production. Only about 20 percent of United States aquaculture production is marine species. The US\$1 billion value of total United States aquaculture production (freshwater and marine) pales in comparison to the US\$100 billion value of world aquaculture production.

A compelling case can be made for producing more seafood in the United States. Right now, the United States is a major consumer of aquaculture and fisheries products – importing 86 percent of the seafood consumed there.

The United States is making progress towards encouraging greater aquaculture development of the United States Marine Aquaculture Policy. The purpose of this policy is to enable the development of sustainable marine aquaculture within the context of the NOAA's multiple stewardship missions and broader social and economic goals. Meeting this objective will require NOAA to integrate environmental, social, and economic considerations in management decisions concerning aquaculture.

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**Half of the fish the United States imports comes from aquaculture, yet only 5 percent of the seafood that Americans eat is from domestic freshwater and marine aquaculture. About 10 percent is from USA capture fisheries.**

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### **CCRF Article 6, Section 6.19**

**States should consider aquaculture, including culture-based fisheries, as a means to promote diversification of income and diet. In so doing, States should ensure that resources are used responsibly and adverse impacts on the environment and on local communities are minimized.**

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## **THEME 6: PRIORITIES AND CAPACITY BUILDING FOR IMPLEMENTING THE CCRF**

### **Priority areas for fishery management in South Asia**

*Md. Sharif Uddin, Bay of Bengal Programme Inter-Governmental Organisation*

The Bay of Bengal Programme Inter-Governmental Organisation (BOBP-IGO) works in South Asia covering the marine waters of Bangladesh, India, the Maldives and Sri Lanka. These nations are densely populated, low to middle income and with a medium level of human development. The region is home to 20 percent of the global population and 15 percent of the global fisheries population and account for about 9 percent of the global production of fish and fish products from all sources.

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**The Bay of Bengal is home to about 20 percent of global population and 15 percent of the world's fishers.**

**The Bay of Bengal has a multispecies-multigear fishery contributing 8 percent or 9 percent of the global fish supply.**

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The marine capture fishery offers an important livelihood, often the only opportunity in the coastal areas. The fishery operates in a multispecies environment, employing a range of fishing gears. Although, historically fishery in the region was restricted to coastal areas, the declining catch rates is now leading to expansion of the fishery to the offshore waters. Although fisheries production in the region seems to be tapering off, the dependence on fisheries is increasing.

Set against this backdrop, the following areas have emerged as priorities to ensure sustainability of marine capture fisheries in the region. Although initiatives to address these issues largely rest with the governments, a larger regional framework is needed to address them effectively.

**Establishing a well-defined MCS system:** Towards this end the necessity is to define the roles of the community and the government in fisheries management and to ensure a well-functioning monitoring, control and surveillance system.

**Stock management:** Falling catch rate and abundance of forage species indicate poor health of important commercial stocks in the region. Lack of qualitative data is limiting proper evaluation of the stocks and the setting of management norms to sustain the fishery.

**Occupational safety and livelihoods:** Fishing in the region is highly risky and there is a general laxity in following safety rules and regulations. There are few alternatives to fisheries as a livelihood so participation is more or less obligatory. There is a need to integrate safety at sea into fisheries management.

**Cross-sectoral impacts:** With increasing urbanization and industrialization, the threats from point and non-point sources of pollution are increasing. The sector is also facing sharp and often unequal intersectoral competition over the use of coastal and marine waters.

**Adapting to climate change:** The region is vulnerable to climate change for which precautionary measures are needed. Past experience shows that policies in the region are reactive rather than proactive. This needs to be changed.

### **ASEAN-SEAFDEC Resolution and Plan of Action Towards 2020: priority areas of the Southeast Asian region**

*Nualanong Tongdee, Southeast Asian Fisheries Development Center*

The Southeast Asian Fisheries Development Center (SEAFDEC) is an intergovernmental organization working towards the sustainable development of fisheries in the Southeast Asian region. In June 2011, SEAFDEC in collaboration with ASEAN, the ASEAN-SEAFDEC member countries, and several partner organizations organized the ASEAN-SEAFDEC conference *Fish for the people 2020: adaptation to a changing environment*. In addition to the conclusion and recommendations made during the conference technical session, the ASEAN-SEAFDEC ministers and senior officials also endorsed the Resolution and Plan of Action on Sustainable Fisheries for Food Security for the ASEAN Region Towards 2020 to serve as a policy framework and guide to setting priority actions for the ASEAN member countries with respect to sustainable fisheries, food security and the well-being of people in the ASEAN region.

To follow-up on the outputs of the 2011 conference, SEAFDEC organized in July 2011 the Inception Workshop on Follow-up Activities to the ASEAN-SEAFDEC Conference on Sustainable Fisheries for Food Security Towards 2020. The workshop was aimed at enhancing the awareness of ASEAN-SEAFDEC countries as well as relevant agencies,

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**CPUE in many fisheries is going down and there is a lack of information on state of fish stocks.**

**Entry to fisheries remains free as often this is the only livelihood option.**

**Fishers are going into deeper waters and occupational safety is becoming a serious issue.**

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**The Southeast Asian fishery sector production increased from 10.8 to 31.4 million tonnes over 20 years.**

**It is now 20 percent of global production and value increased from US\$5.2 to US\$39.2 billion over the same period.**

**There are about 15 million people employed in fishery-related activities. The majority are small-scale fishers/farmers.**

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institutions, organizations, and donor agencies on the 2011 conference's Resolutions and Plan of Action. In addition, the workshop was also meant to prioritize wide-ranging sets of issues and concerns elaborated in the Plan of Action in order to come up with feasible programmes and activities to attain the common objective of sustainable fisheries development for food security in the ASEAN region.

During the workshop, several priority areas of common concern among the ASEAN member countries were identified:

**Marine/coastal fisheries:** developing a national/regional database on fishing vessels and keeping record of the fishing activities to help combat IUU fishing; sharing of information and developing common/coordinated position on international fisheries-related issues; sharing of market information; and improving fish handling along the whole supply chain.

**Inland fisheries:** enhancing data collection and awareness of other sectors, the public and policy makers on the importance of inland fisheries; promoting co-management for sustainable utilization of inland fishery resources; and enhancing production from inland fisheries through development of appropriate fishing gears/methods, fish restocking programmes and application/enforcement of laws/regulations.

**Aquaculture:** enhancing the roles of aquaculture for rural development and poverty alleviation; R&D on the possible impacts of climate change on aquaculture and on the development of species and strains that are tolerant to changes in environmental conditions; development of alternative protein sources for aquaculture feed; capacity building on aquatic animal health; and enhancing the quality and safety of aquaculture products.

Note should however be taken that the Plan of Action comprises a wide range of priority issues that require actions/interventions at different levels, starting from local, national, subregional, until regional levels; and different ASEAN member countries may have different priorities with respect to the issues.

It is therefore necessary for the individual countries to carefully scrutinize the Plan of Action, and identify actions that should be undertaken at the local and national levels in accordance with their respective development priority.

In addition, relevant regional and international organizations as well as the ASEAN dialogue partners should also look into the areas, within the mandate of the respective organizations, where support could be extended to countries, e.g. to enhance the capacity of countries in undertaking relevant initiatives and activities, and in undertaking activities to strengthen the regional/subregional cooperation, harmonize initiatives among countries, and enhance the competitiveness of the region towards emerging issues/challenges.

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**The ASEAN/SEAFDEC Plan of Action elaborates 76 priority actions for countries in the region**

- **Planning and information**
  - **Fisheries management (marine-inland)**
  - **Aquaculture**
  - **Optimal utilization of fish and fishery products**
  - **Fish trade**
  - **Regional and international policy formulation.**
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## **Improving fisheries and resource management**

*Don Griffiths, FAO/AECID Regional Fisheries Livelihoods Programme*

The objective of the Spanish-funded and FAO-executed Regional Fisheries Livelihoods Programme (RFLP) which is conducting activities in Cambodia, Indonesia, the Philippines, Sri Lanka, Timor-Leste and Viet Nam is *Strengthened capacity among participating small-scale fishing communities and their supporting institutions to drive improved livelihoods and sustainable fisheries resources management.*

One hundred years ago there were far fewer fishers and fishing boats than today and the bounty of the seas seemed limitless. The current backdrop is an ever growing world population with much of that growth centered on Asia.

Inshore waters are the most heavily fished, with 80 percent of fishing vessels taking perhaps 20 percent of total world catch. The reality is that there are now too many fishers and too many fishing boats. Although governments and fishery managers and most fishers recognize the need to reduce fishing pressure, the number of fishing boats, fishing effort, implementing this poses a massive political and social challenge.

The improvement of fisheries resource management falls under RFLP Output 1 – *Implementation of co-management mechanisms for sustainable utilization of fishery resources* and key programme initiatives include:

### *Improved government and fisher collaboration*

The promotion of improved fisheries management and alternative livelihoods options requires a holistic approach that needs collaboration and information sharing with projects/programmes, across ministries, departments, NGOs and INGOs, fisher groups and other people's groups, both within the countries and the region.

RFLP has promoted the establishment and operation of co-management mechanisms in a manner appropriate to the local context. Capacity strengthening and co-management training have been conducted for government, and NGO staff, and fisher organization members and fishers. A participatory consultation process with key stakeholders has been followed by RFLP for the planning, implementation, monitoring and evaluation of all RFLP activities in all six countries and the region, and for the development and implementation of fisheries management plans with joint government and fisher group enforcement mechanisms.

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**Reduced fishing pressure is the key goal for fishery and coastal management. One hundred years ago there were far fewer fishers and fishing boats than today and the bounty of the seas seemed limitless.**

**The backdrop we are all working against today is an ever growing population. There are now too many fishers and too many fishing boats. Inshore waters are the most heavily fished, with 80 percent of the fishing vessels taking perhaps 20 percent of the total world catch.**

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**A sardine fishery improvement plan was produced for Zamboanga del Norte, Philippines. Key priority activities include awareness raising on the three-night sardine fishing ban, the three-month ban on commercial sardine fishing and provision of alternative livelihoods options when not fishing.**

**Anti-trawl devices (concrete poles and cubes) laid in Cambodia and planned for Indonesia. Trawl nets are being destroyed and fish are repopulating the area.**

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### *Improved nursing and recruitment*

RFLP has promoted an ecosystems approach to fisheries management. Improved nursing and recruitment is supported through habitat assessments, participatory mapping, the development of fishery improvement plans, awareness raising of seasonal fishing bans and illegal gear types, support for the establishment of MPAs, concrete anti-trawling devices in MPAs, boundary delineation, lagoon and mangrove management plan development, mangrove rehabilitation and replanting and the provision of alternative livelihoods support for fisher households. Trainer of trainer training was delivered to 22 key staff from five RFLP countries (excluding Timor-Leste) in December 2011 in Cambodia on mangrove ecosystem health monitoring using community participation.

The finalization of the Management Plan for the Savu Sea Marine National Park (MNP) in Indonesia, includes use zonation, and was conducted in collaboration with the Nature Conservancy, the provincial fisheries authorities in Nusa Tenggara Timur, and a national conservation area agency.

Traditional systems like *tara bandu* and *lilifuk* systems in Timor-Leste and Indonesia have been promoted and supported to keep harvesting of natural resources within sustainable limits.

### *Strengthened information systems*

Better fisheries information of all types including gear types, fishing effort, fishing boat numbers, fishing locations, fishing seasons for both government institutions and staff, and fishers and fisher groups facilitates more informed decision-making. Activities have included the (re)drafting of new or existing fisheries legislation to specifically include co-management, supporting improved boat registration, a national fishing boat census in Timor-Leste, a fisher household frame survey in Sri Lanka and the piloting of community-based catch recording in Cambodia. In addition, cheap, appropriate information technologies (global positioning system (GPS), bathymetric GPS, echo sounders and GPS cameras, SPOT satellite GPS messengers etc.) have been used to gather and share improved data via appropriate media such as Web sites ([www.peskador.org](http://www.peskador.org)). This data can be used for planning and management purposes and is also made available in real time to district fisheries officers, who share the automatically updated weather and fish price data with fishers at key fish landing sites.

### *IUU reduction*

In a win-win scenario that benefits both fishers and the authorities, RFLP is promoting the use of SPOT VMS in Timor-Leste. These: a) get fishers to report IUU fishing; b) allow small-scale fishers to call for help if their boat is sinking or being attacked; and c) track where small-scale fishers fish. The hand held GPS devices cost about US\$100 per unit and about US\$50 per year for the service. RFLP has also supported fishery law enforcement in various countries through the provision of equipment (binoculars, mobile phones, etc.) and multipurpose boats. These initiatives have resulted in:

- joint community and local authority monitoring, control and surveillance patrolling;
- stronger links between the fishers and the authorities;
- empowerment of communities and fisher organizations;

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**More than 60 000 mangrove seedlings replanted around Pitay village of Kupang district, Indonesia.**

**Trainer of trainer training on mangrove ecosystem health monitoring with communities.**

**Mangrove management plans being produced in a participatory process in Sri Lanka involving various government ministries and departments and communities around Chilaw, Negombo and Puttalam lagoons.**

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- improved fishery resource management;
- illegal fishers arrested and income generation from violation fines contributing to fisher group funds; and
- improved fisher safety.

*Key RFLP recommendations for improving fisheries management*

- promote greater fisher community and government cooperation and trust building;
- move away from top-down approaches and facilitate more situations where both fishers and the government see and receive benefits; and
- involve fisher communities in fishery information gathering to be used to make better and more informed joint fishery (co-) management decisions.

**Training and capacity building in the ecosystem approach to fisheries management**

*Chris O'Brien, Bay of Bengal Large Marine Ecosystem Project*

The Bay of Bengal Large Marine Ecosystem Project (BOBLME) is supporting countries to implement an ecosystem approach to fisheries management (EAFM) on the respective shared fisheries for hilsa and Indian mackerel and apply the ecosystem approach to the fisheries and environment of the Bay of Bengal.

The need to apply an ecosystem approach to fisheries management is now globally accepted and has been endorsed in a range of international decision-making fora. This approach represents a move away from fisheries management systems that focus only on the sustainable harvest of target species, towards systems and decision-making processes that balance environmental well-being with human and social well-being, within improved governance frameworks.

The FAO Code of Conduct for Responsible Fisheries (CCRF) provides a global framework for responsible fisheries, but member countries, fisheries organizations and fisheries stakeholders require a practical framework to implement the recommendations of the CCRF. The ecosystem approach to fisheries (EAF) management presents such a practical framework whereby the objectives of responsible and sustainable fisheries and aquaculture can be implemented at national and local levels. Although there is an increasing will to move towards more holistic fisheries and aquaculture management and planning frameworks, the practical approach and application of ecosystem based planning and management remains challenged by a lack of familiarity with EAF and the need for considerable policy reform.

The 31<sup>st</sup> Session of APFIC recommended the development of basic ecosystem based management training for a wide range of fisheries professionals within the region. This builds on earlier recommendations of the APFIC 30<sup>th</sup> Session and the 29<sup>th</sup> Asia-Pacific Regional Conference which called for greater implementation of ecosystem approaches to aquaculture and fisheries management. In particular the request was that such a training course would be applicable to the small-scale production sector, developing offshore fisheries and in the data-poor situations that prevail in the APFIC region.

The APFIC Strategy 2012–2018 recognizes the need for capacity building in the institutionalization and implementation of the EAF and to promote the development of training courses and training opportunities in EAF.

In response to this, a regional collaboration between the BOBLME Project, APFIC Secretariat and the US Coral Triangle Initiative (US-CTI) has led to the development of a regional training course to build capacity in Ecosystem Approach to Fisheries.

The training course provides basic knowledge on the EAF process and how this can assist in decision making for responsible and sustainable fisheries. The EAF course objectives are that participants will understand the concept and need for EAF, and will have acquired skills and knowledge to develop, implement and monitor the “EAF Plan” so as to influence decision making processes on marine environment and fisheries management. The course will provide basic knowledge on EAF process and how this can assist in decision making for responsible and sustainable fisheries and its interactions and trade-offs.

At the higher level, the EAF course is intended to assist countries to develop national and provincial (state) strategic fisheries and aquaculture management plans. This would necessitate resolving conflicting objectives, something that has not been really attempted in the past. Examples of such conflicting objectives for the fishery might be:

- the fishery is being managed to promote wealth generation for a limited number of primary stakeholders, that is expected to flow on to others
- the objective of the fishery is to provide increased employment
- limits and constraints are not placed on the fishery since it is used by poor fishery-dependent communities

This EAF training course is tailored to address such developing country challenges that are presented by the common characteristics of tropical fisheries:

- predominantly small-scale, but with interactions with larger scale operations
- typically coastal/nearshore
- multi-gear and multi-species
- usually based around communities for whom fisheries is a principal source of livelihood

The training course also addresses the consideration that management of these fisheries requires a shift from production/stock oriented approaches towards a more benefits-oriented (social and economic) paradigm.

The course is designed such that it can be provided as stand-alone capacity building course for those who are directly concerned with fisheries management (fishers and fisher organizations, government institutions at the local level, policy makers, managers, technical officers). It will assist in developing human capacity of staff in fishery agencies at all levels that raises understanding of the causes and consequences of current fishery issues, improves familiarity with EAF/EAA as a solution and, especially for district staff, helps them become more competent to facilitate the EAF/EAA process, especially in using participatory tools.

The EAF course is also intended to be used as part of a broader capacity building/training effort for those whose professional works brings them into contact with the fisheries sector (coastal planning/management stakeholders; provincial planners/managers).

The expectation is that the course content (which will be made freely available) will be picked up by training institutions, as well as tertiary education institutions; and used for professional skill development or as a module within coastal management or fishery management degree courses.

The course is currently being validated and it is expected that the first pilot trainings will take place in early 2013. The partners will also work on how to get the training course into curricula and programmes of fishery and coastal management training institutions in the Asia-Pacific region.



## **RCFM SUMMARY AND RECOMMENDATIONS FOR REPORTING TO APFIC**

The participants at the APFIC RCFM were presented with the consolidated conclusions and recommendations for action, which were derived from the forum meeting. These were commented on and amended and subsequently endorsed by the forum. The consolidated conclusions and recommendations of the RCFM will be forwarded to the Thirty-second Session of APFIC (20–22 September 2012) for consideration by the Commission and are presented at the front of this document (page 1).

### **CLOSING OF THE RCFM**

In closing, the APFIC Secretary thanked the hosts, the Ministry of Agriculture and Rural Development (MARD), Viet Nam, for their generous support and excellent facilitation of the Fourth APFIC RCFM. The secretary also thanked the chairperson, Mr Nguyen Viet Manh for his efforts which contributed to the outcomes of the forum. He also thanked all the participants from APFIC member countries and other organizations for their active participation.

## APPENDIX A – LIST OF PARTICIPANTS

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## APPENDIX B – AGENDA

### Fourth APFIC Regional Consultative Forum Meeting “Improving management and governance of fisheries and aquaculture in the Asia-Pacific region”

Da Nang, Viet Nam, 17–19 September 2012

<b>Day 1</b>	<b>17 September 2012</b>
<b>08:00-08:55</b>	<b>Registration</b>
<b>09:00-09:25</b>	<b>Opening ceremony</b> <b>Welcome remarks by the Mr Nguyen Viet Manh</b> <i>APFIC Chairman, Ministry of Agriculture and Rural Development (MARD)</i> <b>Address by Mr Simon Funge-Smith</b> <i>Secretary, Asia-Pacific Fishery Commission on behalf of Assistant Director-General, FAO Regional Office for Asia and the Pacific</i> <b>Opening speech by Mr Vu Van Tam</b> <i>Vice-Minister, Ministry of Agriculture and Rural Development (MARD)</i>
<b>09:25-09:30</b>	<b>Group photo</b>
<b>09:30-10:00</b>	<b>Morning tea/coffee</b>
<b>10:00 – 10:05</b>	<b>Election of chair</b>
<b>10:05-10:15</b>	<b>Forum arrangements</b> <i>Presented by Mr Simon Funge-Smith, Secretary, Asia-Pacific Fishery Commission (APFIC)</i>
<b>Theme 1</b>	<b>Regional overview of fisheries and aquaculture</b>
<b>10:15-10:45</b>	<b>Status and potential of fisheries in the subregions of Asia</b> <i>Presented by Mr Simon Funge-Smith, Secretary, Asia-Pacific Fishery Commission (APFIC)</i>
<b>10:45-11:10</b>	<b>Status and trends of aquaculture in the subregions of Asia</b> <i>Presented by Mr Miao Weimin, Aquaculture Officer, APFIC Secretariat</i>
<b>Theme 2</b>	<b>Regional initiatives promoting improved assessments for strengthening management</b>
<b>11:10-11:35</b>	<b>The Bay of Bengal Large Marine Ecosystem – RFMAC</b> <i>Presented by Mr Chris O’Brien, Regional Coordinator, Bay of Bengal Large Marine Ecosystem Project (BOBLME)</i>
<b>11:35-12:00</b>	<b>Managing complex fisheries using risk based assessments – some ideas to facilitate the adoption of management regimes in Southeast Asia</b> <i>Presented by Mr Duncan Leadbitter, Technical Director, Sustainable Fisheries Partnership (SFP)</i>
<b>12:00-12:20</b>	<b>Developing responsible fishmeal for Asian aquaculture</b> <i>Presented by Ms Maggie Xu, China Manager, International Fishmeal and Fish Oil Organisation (IFFO)</i>

<b>12:20-12:30</b>	<b>Using assessments to inform management of fisheries and aquaculture in the APFIC region</b> Results of the APFIC regional consultative workshop, <i>FAO Regional Office for Asia and the Pacific</i>
<b>12:30-13:30</b>	<b>Lunch</b>
<b>13:30-13:55</b>	<b>The way forward for trawl fisheries management in Southeast Asia and the Coral Triangle</b> <i>Presented by Mr Isara Chanrachkij, Project Technical Advisor, FAO/GEF project "Strategies for trawl fishery bycatch management" (REBYC-II CTI)</i>
<b>13:55-14:20</b>	<b>Fish and fisheries of the Lower Mekong River Basin – updated information</b> <i>Presented by Mr So Nam, Fisheries Programme Coordinator, Mekong River Commission (MRC)</i>
<b>14:20-14:45</b>	<b>FAO/APFIC/NACA regional study/workshop on adoption of aquaculture assessment tools (AATs) for sustainability in the Asia-Pacific region</b> <i>Presented by Mr C.V. Mohan, Research and Development Program Manager, Network of Aquaculture Centres in Asia-Pacific (NACA)</i>
<b>14:45-15:15</b>	<b>Implementing an ecosystem approach to fisheries (EAF) in small-scale fisheries in the Philippines</b> <i>Presented by Mr Len Garces, Research Fellow, WorldFish Center</i>
<b>15:15-15:45</b>	<b>Afternoon tea/coffee</b>
<b>Theme 3</b>	<b>Country experiences improving fisheries management and CCRF</b>
<b>15:45-17:15</b>	<b>Country experiences improving fisheries management and CCRF</b> <i>Brief (ten minutes) presentations from nine APFIC member countries</i>
<b>17:15-17:45</b>	<b>Plenary theme discussion</b>
<b>18:30</b>	<b>Buffet dinner reception and cultural show at the Coral Reef Restaurant</b> <i>Hosted by Ministry of Agriculture and Rural Development (MARD)</i>
<b>Day 2</b>	<b>18 September 2012</b>
<b>09:00-10:00</b>	<b>Country experiences with improving fishery management and CCRF (cont.)</b> <i>Brief (ten minutes) presentations from six APFIC member countries</i>
<b>10:00-10:30</b>	<b>Plenary theme discussion</b>
<b>10:30-11:00</b>	<b>Morning tea/coffee</b>
<b>Theme 4</b>	<b>Adaptation and mitigation of climate change, livelihoods and support to small-scale fisheries</b>
<b>11:00-11:25</b>	<b>Climate change implications for fisheries and aquaculture</b> <i>Presented by Mr Robert Lee, Fishery Industry Officer, APFIC Secretariat</i>
<b>11:25-11:50</b>	<b>Climate change action plans in APFIC member countries (workshop outcome)</b> <i>Presented by Ms Angela Lentisco, APFIC Secretariat</i>
<b>11:50-12:10</b>	<b>The FAO guidelines on small-scale fisheries: importance of getting it right</b> <i>Presented by Ms Nalini Nayak, International Collective in Support of Fishworkers (ICSF)</i>

**12:10-12:30**      **RFLP regional synthesis – lessons learned for improving livelihoods and resilience in coastal communities**  
*Presented by Mr Steve Needham, Information Officer, FAO/AECID Regional Fisheries Livelihoods Programme (RFLP)*

**12:30-13:30**      **Lunch**

**Theme 5**            **Country experiences improving aquaculture management and the CCRF**

**13:30-15:00**      **Country progress on aquaculture management and CCRF implementation**  
*Reports from nine APFIC member countries*

**15:00-15:30**      **Afternoon tea/coffee**

**15:30-16:30**      **Country progress on aquaculture management and CCRF implementation (cont.)**  
*Reports from six APFIC member countries*

**16:30-17:00**      **Plenary theme discussion**

**Day 3**              **19 September 2012**

**Theme 6**            **Priorities and capacity building for implementation of the CCRF**

**08:30-08:55**      **Priority areas for fishery management in South Asia – the experience of BOBP-IGO**  
*Presented by Mr Md. Sharif Uddin, Fisheries Resource Officer, Bay of Bengal Programme Inter-Governmental Organisation (BOBP-IGO)*

**08:55-09:20**      **ASEAN-SEAFDEC Resolution and Plan of Action Towards 2020: priority areas of the Southeast Asian region**  
*Presented by Ms Nualanong Tongdee, Information Program Coordinator, Southeast Asian Fisheries Development Center (SEAFDEC) Secretariat*

**10:00-10:30**      **Morning tea/coffee**

**10:30-10:55**      **Improving fisheries and resource management**  
*Presented by Mr Don Griffiths, Chief Technical Advisor, FAO/AECID Regional Fisheries Livelihoods Programme (RFLP)*

**10:55-11:20**      **Training and capacity building in the ecosystem approach to fishery management**  
*Presented by Mr Chris O'Brien, Regional Coordinator, Bay of Bengal Large Marine Ecosystem Project (BOBLME)*

**11:20-12:00**      **Plenary theme discussion**

**12:00-13:00**      **Lunch**

**Final Session**      **Summary and recommendations for reporting to APFIC**

**13:00-14:30**      **Plenary discussion**  
**Summary and recommendations for APFIC**

**14:30**              **Field trip**

## **APPENDIX C – OPENING STATEMENTS**

### **Welcome remarks**

**by**

**Mr Nguyen Viet Manh  
Chairman, Asia-Pacific Fishery Commission**

H.E. Mr Vu Van Tam, Vice-Minister for Ministry of Agriculture and Rural Development,  
Distinguished Mr Simon Funge-Smith, Secretary of Asia-Pacific Fishery Commission,  
Distinguished Guests, Participants,  
Ladies and Gentlemen,

On behalf of the Fisheries Administration of Viet Nam, please allow me to express my warmest welcome to all of you to the Fourth Regional Consultative Forum Meeting that will be followed by the APFIC Thirty-second Session. Today, I feel highly honoured and most appreciative to have His Excellency, the Vice-Minister of the Ministry of Agriculture and Rural Development, Mr Vu Van Tam to preside over the inauguration of this meeting.

We must recall that in 2010 the Third Regional Consultative Forum Meeting with the theme “Balancing the needs of people and ecosystems in fisheries and aquaculture management in the Asia and Pacific region” addressed important issues pertaining to the ecosystem approach to fisheries and the human dimensions of fisheries management and made important contributions to policy formulation in the region.

With the development of the fisheries sector in the region, the issue of enhancing governance and management of fisheries and aquaculture based on a practical approach is critical at this time. Some major emerging issues such as adapting fisheries resources assessment tools for small-scale fisheries in developing countries, reducing losses in the food production and supply chain, ensuring livelihoods for coastal communities and adapting to climate change are continuously and increasingly challenging the region’s policy makers. Against this background, it is quite timely and significant for us to try to address the current concerns related to fisheries and the emerging challenges that may impede the sustainable development of fisheries and their contribution to food security in the region.

Under the agenda of this Meeting, a number of success stories on fisheries and aquaculture management will be shared among participants. This will provide us with comprehensive and practical examples that can guide policy frameworks and priority actions at the regional and national level.

Excellencies, Distinguished Guests, Ladies and Gentlemen,

Today is the first day of our Forum Meeting; we will have two more days with the Forum Meeting followed by three days with the Session. I hope that our time together will be fruitful and we will, with the cooperation of the delegates, reach successful conclusions.

Once again, I welcome all of you to these events arranged by APFIC.

Thank you very much for your kind attention.



**Opening remarks**  
**by**  
**Mr Simon Funge-Smith**  
**Secretary, Asia-Pacific Fishery Commission**

Excellency, Mr Vu Van Tam, Vice-Minister, Ministry of Agriculture and Rural Development,  
Excellency, Mme Damitha De Zoysa, Secretary, Ministry of Fisheries and Aquatic Resources,  
Sri Lanka,

Mr Nguyen Viet Manh, APFIC Chairman, Ministry of Agriculture and Rural Development,  
Dr Chumnarn Pongsri, Secretary General, Southeast Asian Fisheries Development Center,  
Mr Ing Try, Deputy Director General, Fisheries Administration Cambodia,  
Dr Mohammad Shiham Adam, Director General, MRC, the Maldives,

Distinguished Participants from APFIC member countries,  
Colleagues from regional and international partner organizations, projects and programmes,

On behalf of Mr Hiroyuki Konuma, Assistant Director-General of the Food and Agriculture Organization of the United Nations Regional Office for Asia and the Pacific, I warmly welcome you all to this Fourth APFIC Regional Consultative Forum Meeting, to be held here in Da Nang, over the next three days.

This APFIC Regional Consultative Forum Meeting is titled “Improving management and governance of fisheries and aquaculture in the Asia-Pacific region” and acts as a biennial stock-taking of the work of APFIC, her member countries and her regional partners that is relevant to the programme of work of the Commission. The APFIC Regional Consultative Forum Meeting also provides an open platform to discuss and explore new and emerging ideas and issues related to fisheries and aquaculture.

The theme for this biennial meeting reflects the importance that APFIC members have given to the urgent need to improve the management of fisheries and aquaculture in the region and recognizes that this can only be achieved through the strengthened governance processes that underpin all management actions.

Mr Vice Minister, Distinguished Participants,

The Fourth APFIC RCFM has a full agenda, and we will be hearing first of all what the current status is of capture fisheries in the region and the trends in aquaculture in the region over the past ten years. The RCFM has linked themes that relate to the historic work of APFIC in the areas of resource management, ecosystem approaches and the livelihoods of those who depend upon fishing and aquaculture.

We will hear about ways that assessment tools can be used to understand better and plan effective fishery management interventions taking into account the complexities of the capture fisheries and the preponderance of small-scale multigear fisheries in the region. Presentations will span both the marine and freshwater sectors. We will be hearing from regional partners and projects about progress made in this area, as well as looking at how we may improve the implementation of these tools and approaches. APFIC member countries will inform us on key successes or changes that have occurred in their capture fisheries and aquaculture and how this relates to the implementation of the FAO Code of Conduct for Responsible Fisheries.

On the second day of the RCFM, we will hear how climate change affects the fishery and aquaculture sector and its linkages to livelihoods. Linkages to small-scale fisheries and livelihoods will be

explored, from local interventions thorough to the development of an international instrument. Regional organizations and projects will be informing the RCFM of their regional policy and capacity processes and some of the priorities that have emerged.

Excellencies, Distinguished Participants,

This Regional Consultative Forum Meeting precedes the Thirty-second Session of the Asia-Pacific Fishery Commission and a key outcome will be a summary set of conclusions and recommendations developed out of our discussions over the next three days. These will be put before the Commission for their consideration. APFIC's role as a regional body capable of drawing together diverse regional and sectoral representatives has become more important now that the FAO Regional Conference for the Asia-Pacific recognizes that priorities established by the Commission at its regular Session can be presented for consideration as priorities for FAO's work in the region.

APFIC, in its role as a neutral forum, is striving to forge links with member countries and regional partner governmental organizations and relevant non-governmental organizations in order to give voice to the fishery and aquaculture subsectors and those who depend upon it. In this regard, it is hugely encouraging to see so many of our member countries and regional partners participating here today, and I would like to thank you for your support. I would also like to take this opportunity to thank the member countries, regional organization partners and everyone who has enthusiastically contributed to convening this Regional Consultative Forum Meeting and the work of APFIC during this biennium.

The APFIC RCFM is deliberately structured to allow the contribution of all participants to the outcomes and recommendations and in this regard, I urge you all to participate fully and actively over the next three days. Your feedback and advice is both welcomed and necessary to inform and balance the RCFM outcomes.

Excellencies, Distinguished Participants,

On behalf of the APFIC Secretariat and FAO, I would like to sincerely thank the Government of Viet Nam for kindly hosting this event and for their generous support, which has made it possible for us to convene this forum meeting with so many participants from the APFIC member countries and regional organizations. I would also like to thank your Excellency for honouring us with your presence for the opening of this meeting.

Special thanks are due to the Chairman of APFIC, Mr Nguyen Viet Manh and his dedicated staff in the Ministry of Agriculture and Rural Development, who have been responsible for much of the meeting organization.

Finally, I thank you, the participants for your participation and look forward to working with you over the next three days, to help APFIC continue to perform its function as a regional advisory body in fisheries and aquaculture that is owned by its member countries and supports the sector in the region.

Thank you.

## **Opening speech**

**by**

**Mr Vu Van Tam**

**Vice-Minister, Ministry of Agriculture and Rural Development**

Distinguished Mr Simon Funge-Smith, Secretary of Asia-Pacific Fishery Commission  
Mme Damitha De Zoysa, Secretary, Ministry of Fisheries and Aquatic Resources, Sri Lanka,  
Distinguished Dr Chumnarn Pongsri, Secretary General Southeast Asian Fisheries Development Center,  
Dr Mohammad Shiham Adam, Director General, MRC, the Maldives,

Distinguished Guests, Participants, Ladies and Gentlemen,

Today it is a great honour for Viet Nam to be hosting the Fourth Regional Consultative Forum Meeting entitled “Improving management and governance of fisheries and aquaculture in the Asia-Pacific” and the APFIC Thirty-second Session. On behalf of the Ministry of Agriculture and Rural Development of Viet Nam, I warmly welcome all the honourable guests, participants from APFIC member countries, international organizations participating in the two important events of the Asia-Pacific Fishery Commission organized in Da Nang City, one of the most beautiful cities in Viet Nam. This is a good opportunity for participants present here to be involved in presentation, discussion, information exchange on achievements, successful lessons learned as well as challenges in fisheries governance and management in the region for the period of two years since the Third Consultative Forum and the APFIC Thirty-first Session, which was organized in Republic of Korea in 2010. These events will expand the cooperation opportunities among APFIC members countries in and with international organizations and create a common voice in the region for sustainable fisheries development serving for food security.

Distinguished Participants, Ladies and Gentlemen,

The Asia-Pacific region contributes the major share of the world’s total fisheries production and in 2010 this amounted to over half of the total. Aquaculture products from the region accounted for nearly 90 percent of global aquaculture production. In addition, the Asia-Pacific region also makes a great contribution to global food fish supply with the estimated average food fish consumption rate of 29 kg per person per year. It is estimated that to the year 2050, this demand will increase by between 30 and 40 million tonnes more fish per year.

One of the great challenges for the fisheries sector in the Asia-Pacific region is that most of the countries in the region have small-scale fisheries and fishing communities that are dependent on the fisheries resources. It is therefore required that in the policy formulation process, the application of fisheries management measures should take into consideration the sustainable livelihoods for coastal fishing communities, especially for small-scale fisheries.

In recent years Viet Nam’s fisheries sector has made a significant achievement, with total fisheries production in 2011 of 5.2 million tonnes, in which aquaculture production was 3 025 million tonnes, capture fisheries was 2.2 millions tonnes, and the export volume was valued at US\$6.1 billion. In this development process, Viet Nam has actively applied good management practices in capture fisheries such as log book system for the fishing boats over 90cv, a vessel monitoring system, the Catch Certification Scheme, market measures to control the quality and hygiene of fisheries products, zoning and co-management for coastal areas. In aquaculture, the practical approaches such as Good Aquaculture Practices (VietGAP), Good Management Practices, Certificate of Conformity (CoC) with the Safe, Quality Food Programme (SQF-1000), aquaculture advanced technology, biotechnology and environmental protection, and strengthened national monitoring programmes for biological toxins and

chemical residues in aquaculture areas have been applied. The Fisheries Development Strategy to 2020 has identified the objectives of aquaculture development towards advanced-modern technology, quality, sustainable food security, nutrition, hygiene and safety standards in compliance with international standards, making a contribution to national economic development, reduction in the causes of poverty, gender equality and environment-friendly economic development.

However, faced with the impacts of unforeseen climate change, volatile market conditions, and increasing international standards and requirements for food safety and traceability, it is necessary for Viet Nam in particular and other countries in the Asia-Pacific region in general to make greater efforts to implement sustainable development goals. Thus, the practical success stories in fisheries management and assessment tools being shared here are timely and critical to successful fisheries management in the region. I do think that in this context, the biennial theme “Improving management and governance of fisheries and aquaculture in the Asia-Pacific” is a practical approach satisfying the real requirements of fisheries governance and management for APFIC member countries.

I strongly believe that all the issues discussed and the recommendations made at the Fourth Regional Consultative Forum Meeting and APFIC 32<sup>nd</sup> Session, especially the adoption of the APFIC Strategic Plan for the period 2012–2018 will set a firm foundation for implementing regional policies and priorities for the sustainable development and prosperity for the Asia-Pacific fisheries.

On behalf of the Ministry of Agriculture and Rural Development, I would like to declare the APFIC Fourth Regional Consultative Forum Meeting open.

Thank you very much for your attention and I hope that the Meeting will be very successful. We wish you have a pleasant stay in Da Nang City and hope you enjoy our beautiful city with all its unique cultural aspects, its wonderful cuisine as well as the hospitality of its people.



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