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Organization of the  
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Asia-Pacific Fishery Commission (APFIC)

# SUSTAINABLE DEVELOPMENT FOR RESILIENT BLUE GROWTH OF FISHERIES AND AQUACULTURE

Seventh APFIC Regional Consultative Forum Meeting

Cebu, Philippines, 7–9 May 2018





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

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# Contents

<b>Acknowledgements</b> .....	v
<b>Abbreviations and acronyms</b> .....	vii
<b>Executive summary</b> .....	ix
<b>Opening of the meeting</b> .....	1
<b>Regional overview of fisheries and aquaculture</b> .....	2
Sustainable development for resilient blue growth of fisheries and aquaculture .....	2
Asia-Pacific Fishery Commission regional overview of fisheries and aquaculture in the Asia-Pacific region .....	3
<b>Parallel sessions on aquaculture and fisheries: summaries of presentations</b> .....	5
<b>Theme 1. Improvements in fisheries and aquaculture governance</b> .....	5
1.1 Strengthening aquaculture planning and management through the adoption of relevant tools .....	5
1.2 Strengthening aquaculture regulation, the ecosystem approach to aquaculture (EAA) and zonal development .....	7
1.3 Sharing experiences and lessons on combating illegal, unreported and unregulated (IUU) fishing .....	9
1.4 Promoting and implementing the ecosystem approach to fisheries (EAF), co-management approaches .....	12
<b>Theme 2. Innovative aquaculture and fisheries production and management systems and practices for more effective and sustainable production</b> .....	15
2.1 Promoting climate resilient/smart aquaculture .....	15
2.2 Promoting scaling up of innovative aquaculture systems/practices for more sustainable and efficient production .....	18
2.3 Implementing the Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication (SSF Guidelines) .....	20
2.4 Innovations in technologies and practices for sustainable fisheries/use of information and communication technology (ICT) .....	21
<b>Theme 3. Building resilience of fisheries and aquaculture systems</b> .....	22
3.1 Aquaculture insurance for the resilience of small farm holders .....	22
3.2 Risk of antimicrobial resistance in aquaculture and required coping strategy and actions .....	24
3.3 Lessons and experiences on risk management, disaster risk management (DRM), and climate change adaptation (CCA) for resilient fisheries .....	27
<b>Theme 4. Gender-sensitive and inclusive fisheries and aquaculture value chains</b> .....	34
4.1 Enhancing woman's role and benefit sharing along the aquaculture value chain .....	34
4.2 Actions, experiences, and lessons on value addition, reducing food loss, improving access to markets and trade, and promoting gender equality in capture fisheries value chains .....	35
4.3 Promoting responsible production and use of feed and ingredients for sustainable aquaculture growth .....	38

<b>Conclusions and recommendations of the Seventh RCFM for reporting to the Thirty-fifth Session of APFIC .....</b>	<b>42</b>
Progress toward resilient blue growth in the region .....	42
Theme 1. Improvements in fisheries and aquaculture governance .....	43
(a) Strengthening aquaculture planning and management through the adoption of relevant tools .....	43
(b) Strengthening aquaculture governance through regulation and appropriate management approaches such as ecosystem approach to aquaculture and zonal development .....	44
(c) Experiences and lessons on combating illegal, unreported and unregulated (IUU) fishing .....	45
(d) Promoting and implementing the ecosystem approach to fisheries (EAF), co-management approaches .....	45
Theme 2. Innovative fisheries and aquaculture production and management systems and practices for more efficient and sustainable production .....	46
(a) Promoting climate-resilient and climate-smart aquaculture .....	46
(b) Promoting scaling up of innovative aquaculture systems/practices for more sustainable and efficient production .....	47
(c) Implementing the Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication (SSF Guidelines) ...	47
(d) Innovations in technologies and practices for sustainable fisheries/use of information and communication technology (ICT) .....	48
Theme 3. Building resilience of fisheries and aquaculture systems in the Asia-Pacific region ....	49
(a) Aquaculture insurance for the resilience of small farm holders .....	49
(b) Risk of antimicrobial resistance in aquaculture and required coping strategy and actions .....	50
(c) Lessons learned and experiences of risk management, disaster risk management (DRM), and climate change adaptation (CCA) for resilient fisheries .....	50
Theme 4. Gender-sensitive and inclusive fisheries and aquaculture value chains .....	52
(a) Enhancing woman's role and benefit sharing along the aquaculture value chain .....	52
(b) Actions, experiences, and lessons on value addition, reducing food loss, improving access to markets and trade, and promoting gender equality in capture fisheries value chains .....	52
(c) Promoting responsible production and use of feed and ingredients for sustainable aquaculture growth .....	53
<b>Closing of the Regional Consultative Forum Meeting (RCFM) .....</b>	<b>54</b>
<b>Appendix A. List of participants .....</b>	<b>55</b>
<b>Appendix B. Agenda of the Seventh APFIC Regional Consultative Forum Meeting .....</b>	<b>66</b>
<b>Appendix C. Opening statements .....</b>	<b>69</b>

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## Abbreviations and acronyms

ABNJ	areas beyond national jurisdiction
AMR	antimicrobial resistance
APFIC	Asia-Pacific Fishery Commission
ASEAN	Association of Southeast Asian Nations
ARFMM	ASEAN Regional Fisheries Development and Management Mechanism
ARI	Aquaculture Regional Initiative
BGI	Blue Growth Initiative
BMP	better management practice
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	Committee on Fisheries
COFI-AQ	COFI Sub-Committee on Aquaculture
CPUE	catch per unit effort
CSO	civil society organization
CTI	Coral Triangle Initiative
CTNI	Coral Triangle Network Initiative
EAA	ecosystem approach to aquaculture
EAF	ecosystem approach to fisheries
EAFM	ecosystem approach to fisheries management
EEZ	exclusive economic zone
EMS	early mortality syndrome
ETP	endangered, threatened and protected
FAO	Food and Agriculture Organization of the United Nations
FMA	fisheries management area
GAP	good aquaculture practice
GEF	Global Environment Facility
GHG	greenhouse gases
GCP	Government Cooperation Programme
HACCP	Hazard Analysis and Critical Control Point
ICSF	International Collective in Support of Fishworkers
ICT	information and communication technology
IGO	Intergovernmental Organization
IPOA	international plan(s) of action
IUU fishing	illegal, unreported and unregulated fishing
LME	large marine ecosystem
MRC	Mekong River Commission
MCS	monitoring, control and surveillance
MDF	Multi Donor Fund
MMPA	Marine Mammal Protection Act (USA)
MPA	marine protected area
MSC	Marine Stewardship Council
MSY	maximum sustainable yield
NACA	Network of Aquaculture Centres in Asia-Pacific
NAPA	national adaptation programme(s) of action
NGO	non-government organization
NPOA	national plan(s) of action
PSA	productivity susceptibility analysis

PSM	port state measures
PSMA	Agreement on Port State Measures to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing (Port State Measures Agreement)
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
SPF	specific pathogen free
TAC	total allowable catches
TCP	Technical Cooperation Programme
TCPF	FAO Technical Cooperation Programme Facility
UNFCCC	United Nations Framework Convention on Climate Change

## Executive summary

This is the report of the Seventh Asia-Pacific Fishery Commission (APFIC) Regional Consultative Forum Meeting (RCFM) on **Sustainable Development for Resilient Blue Growth of Fisheries and Aquaculture**. The meeting was convened in Cebu, Philippines from 7 May to 9 May 2018 at the Bai Hotel and was attended by 80 participants from 16 countries, together with representatives from ten regional and international partner organizations and projects. The Department of Agriculture (DA), Bureau of Fisheries and Aquatic Resources (BFAR), the Government of Philippines, the Food and Agriculture Organization of the United Nations (FAO) and APFIC hosted the meeting.

This Seventh APFIC RCFM preceded the Thirty-fifth Session of APFIC and served as a regional briefing on the activities of the Commission and its member countries. It also provided an opportunity to receive updates on the work of various regional and global 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 Seventh RCFM commenced with welcome remarks by Eduardo B. Gongona, the Undersecretary for Fisheries, Director of the DA-BFAR, and current Asia-Pacific Fishery Commission (APFIC) Chairman and Allan Poquita, the Regional Director of BFAR Central Visayas. The opening remarks were by José Luis Fernandez, the FAO Representative in the Philippines. Vera Agostini, the Deputy Director of the FAO Fisheries and Aquaculture Division, delivered a keynote address on sustainable development for resilient blue growth of fisheries and aquaculture in the plenary session, providing a global perspective of the contributions of fisheries and aquaculture to sustainable blue growth and examples of blue growth implementation around the world. The second part of the plenary session reviewed the status and trends and major issues in aquaculture and fisheries and the importance of blue growth.

Following the plenary session, the Seventh RCFM convened two parallel fisheries and aquaculture sessions on four thematic areas for member countries and regional organization partners to share their recent efforts and experiences on major issues faced by the sector in their countries and regions and to discuss the required strategy and actions to address the issues effectively. The four thematic areas included the following four sub-themes:

### **Theme 1. Improvements in fisheries and aquaculture governance**

- Strengthening aquaculture planning and management through the adoption of relevant tools
- Strengthening aquaculture regulation, ecosystem approach to aquaculture (EAA) and zonal development
- Experiences and lessons on combating illegal, unreported and unregulated (IUU) fishing
- Promoting and implementing the ecosystem approach to fisheries (EAF), co-management approaches.

### **Theme 2. Innovative fisheries and aquaculture production and management systems and practices for more efficient and sustainable production**

- Promoting climate resilient/smart aquaculture
- Promoting the scaling up of innovative aquaculture systems/practices for more sustainable and efficient production
- Implementing the Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication (SSF Guidelines)
- Innovations in technologies and practices for sustainable fisheries/Use of information and communication technology (ICT).

### **Theme 3. Building resilience of fisheries and aquaculture systems in the Asia-Pacific region**

- Aquaculture insurance for resilience of small farm holders
- Risk of antimicrobial resistance in aquaculture and required coping strategy and actions
- Lessons and experiences on risk management, disaster risk management (DRM), and climate change adaptation (CCA) for resilient fisheries.

### **Theme 4. Gender-sensitive and inclusive fisheries and aquaculture value chains**

- Enhancing women's role and benefit sharing along the aquaculture value chain
- Actions, experiences, and lessons on value addition, reducing food loss, improving access to markets and trade, and promoting gender equality in capture fisheries value chains
- Promoting responsible production and use of feed and ingredients for sustainable aquaculture growth.

Working group sessions were conducted to allow the participants to consolidate their experiences, to discuss the remaining challenges faced by countries and regional partners, and to make recommendations for both to address effectively the challenges.

The findings from the four thematic sessions were presented in a plenary session for comment, modification and endorsement on the third day of the meeting. The key conclusions and recommendations endorsed by the Seventh RCFM are summarized as:

- The RCFM recognized the great advances in the four thematic areas pertaining to sustainable and resilient fisheries and aquaculture for blue growth in the region. Particular mention was made of national and regional efforts to: address priority issues, such as combating IUU fishing; strengthen regulations on aquaculture, implement good fisheries and aquaculture development approaches and practices such as EAA, EAF, aquaculture zonal development; promote innovative aquaculture systems and practices; and develop an inclusive; and gender-sensitive fisheries and aquaculture value chain.
- There are a number of remaining and emerging challenges to the sustainability and resilience of fisheries and aquaculture sector. To address these challenges effectively requires concerted efforts within and across governments, non-government organizations (NGOs), civil society organizations (CSOs) and development and research partners. These include efforts to: (i) improve knowledge on the contributions of the sector to food and nutrition security; livelihoods and economic growth; the impacts of changes in the environment on the sector and dependent communities; and the environmental footprints of the sector; (ii) strengthen enabling environments, knowledge bases and human capacity for adopting appropriate planning and management tools, including information and communication technologies (ICTs); (iii) increase awareness and collaborative efforts to address issues relating to aquaculture feed, risk of antimicrobial resistance (AMR) associated with aquaculture and reduced fish loss in post-harvesting; and (iv) more clearly understand the gender-differentiated roles of women and men along the value chain.
- In addition, there remains a great need in many countries for reinforced legal frameworks and guiding policies to ensure a human rights-based and environmentally friendly development of the region's fisheries and aquaculture sectors in line with the Voluntary Guidelines for Securing Sustainable Small-scale Fisheries (SSF Guidelines) and the Code of Conduct for Responsible Fisheries (CCRF).
- More targeted DRM and climate change strategies and technologies for the sector are needed in several countries. There is also a need for increased efforts to combat IUU fishing in the region. Continued and increased sharing of experiences and knowledge and collaborative efforts across the countries in the region are required to attain the full potential of blue growth in the Asia-Pacific region.

The RCFM considered the reviews of regional fisheries and aquaculture, presentations by member countries and regional organizations, reports of action plans of APFIC regional consultative workshops and the major issues outlined in the agenda and developed a report and recommendations to inform the Thirty-fifth 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.



## Opening of the meeting

The Asia-Pacific Fishery Commission (APFIC) Regional Consultative Forum Meeting (RCFM) Chair, Mr Allan Poquita, Regional Director, Bureau of Fisheries and Aquatic Resources, Philippines, welcomed the participants to the Seventh APFIC Regional Consultative Forum Meeting and stated that it was a great privilege to host the meeting in Philippines. He asked the participants to remain steadfast in the goal of promoting and developing more productive, sustainable and mutually reinforcing ocean-based economies. He extended his wishes for a fruitful and pleasant three-day discussion.

On behalf of Ms Kundhavi Kadiresan, Assistant Director-General of the Food and Agriculture Organization of the United Nations Regional Office for Asia and the Pacific, Mr José Luis Fernandez, FAO Representative to Philippines, warmly welcomed everyone to the meeting. He outlined how the RCFM is a biennial stocktaking of the work of APFIC, its member countries and regional partners. It is therefore relevant to the Commission's programme of work and provides an open platform to discuss and explore new and emerging ideas and issues related to fisheries and aquaculture. The theme of the Meeting, Sustainable Development for Resilient Blue Growth of Fisheries and Aquaculture, reflects the importance that Commission members have given to opportunities to increase the pace of development of sustainable fisheries and responsible aquaculture in the region. He said that for those who may be new to the concept of blue growth a broad overview would be provided. It was important to understand that although blue growth itself is a relatively new term, it is really just an umbrella term for a number of existing approaches to sustainable and responsible development of the fishery and aquaculture sectors and that at its core is the promotion and implementation of the FAO Code of Conduct for Responsible Fisheries (CCRF). The Forum was also tasked with developing recommendations to be presented to the Thirty-fifth Session of the Commission for its consideration. He outlined the importance of APFIC as a neutral forum, which strives to forge links between member countries, regional-partner-governmental organizations and relevant non-governmental organizations in order to give voice to the fishery and aquaculture sectors and those who depend upon them. On behalf of FAO, Mr José Luis Fernandez thanked the hosts, the Government of Philippines and the staff of the Bureau of Fisheries and Aquatic Resources, who so enthusiastically contributed to the organization and convening of this important meeting.

The APFIC Chair, the Honourable Eduardo Gongona, Undersecretary for Fisheries, Department of Agriculture, opened the Meeting and emphasized the importance of the Forum in gathering country-specific insights and recommendations toward a more resilient and sustainable blue economy in the Asia-Pacific region. He shared various initiatives that the Government of Philippines is undertaking to ensure the renewability of the country's fisheries resources. These initiatives include: (1) a five-year work plan for fish sufficiency, which is a comprehensive strategy towards developing the country's fisheries production, law enforcement, and post-harvest facilities, among others; (2) implementation of measures to combat illegal, unreported and unregulated (IUU) fishing such as acquisition of more patrol vessels, boosting capacity to guard Philippine seas, monitoring fishing operations, and development of an electronic catch documentation system; (3) rehabilitation of major bodies of freshwater to bring back native, non-invasive and commercially viable fishes to lakes and rivers; and (4) implementation of livelihoods development programmes for fisheries stakeholders. The Honourable Undersecretary reiterated the country's commitment to cooperate with partner states and organizations in advancing resilient and sustainable growth of the blue economy in the region.

Mr Weimin Miao, Secretary a.i. of APFIC, welcomed participants to the Seventh RCFM. He outlined the history and objectives of the RCFM as a strategic platform to raise awareness of priority issues, build consensus on urgent issues, share policy and technical experiences and provide priority recommendations to the APFIC Commission. Mr Miao explained how the RCFMs were organized to precede the Sessions of the Commission and were intended to provide a more open forum where the issues and priorities in the fishery and aquaculture sectors that are relevant to APFIC member countries and regional organizations

could be explored and discussed. He outlined how the Meeting would provide time for participants to work together to reach a consensus on the conclusions and recommendations on the major themes of fisheries and aquaculture in the region: governance, innovation, resilience, and gender sensitive value chains that are the final output of the RCFM. He expressed his gratitude to the Undersecretary for Fisheries, Department of Agriculture, Bureau of Fisheries and Aquatic Resources and to the FAO Representative to Philippines for taking the time to open the Regional Consultative Forum Meeting and for their assistance in making the arrangements and organization for the RCFM. He also thanked the Government of Philippines for its generous hosting arrangements.

## **Regional overview of fisheries and aquaculture**

To set the context for the technical discussions, the first session of the RCFM included a keynote address by Vera Agostini on Sustainable development for resilient blue growth of fisheries and aquaculture. This provided a global perspective of the contributions of fisheries and aquaculture to sustainable blue growth. In the second part of the session, Susana Siar reviewed the current status and trends in the fisheries and aquaculture sector in the Asia-Pacific region.

### **Sustainable development for resilient blue growth of fisheries and aquaculture**

Vera Agostini, Deputy Director, FAO Fisheries and Aquaculture Division

Ms Agostini provided a global perspective on the growing food demand resulting from population growth and on the worrisome increase in the number of undernourished people in recent years with the highest number in Asia. Fish has an important role in providing food and nutrition security around the world. One in ten people depend on fisheries for livelihoods around the world, 84 percent of whom are directly engaged in the primary sector in Asia. Moreover, Asia's fishing fleet is 73 percent (3.23 million vessels) of the world total. With respect to trade in fish products, Asia accounts for 38 percent of exports and 33 percent of imports. In terms of contribution to total fish production, aquaculture is increasing whereas that from capture fisheries is levelling off. Asia provides about 70 percent of global production, with major increases in aquaculture and a steady rise in capture production.

The marine and inland water fishery and aquaculture production systems of the Asian region have an enormous potential to contribute to sustainable development. Nevertheless, there are challenges around the world such as climate change and the rapid development of the sector with ineffective regulatory and management systems and a lack of scientific knowledge upon which to base fisheries production targets. The profitability of fisheries is generally declining and long-term sustainability is under threat, with consequent effects on the livelihoods of fishers and the ecosystems in general. However, the situation is not irreversible and recent commitments by a number of countries show how effective action can reverse the decline. It is worth noting that tropical fisheries tend to recover quite quickly and restoring fisheries through sustainable management gives economic advantages to fishers at every scale.

FAO's approach is to support the conservation and sustainable management of living aquatic resources and balance economic, social and environmental considerations. One of the key features of blue growth is its use of existing policy instruments, technical guidelines and approaches to natural resource management. The Blue Growth Initiative leverages existing instruments such as the Code of Conduct for Responsible Fisheries, the Voluntary Guidelines for Securing Sustainable Small-scale Fisheries in the Context of Food Security and Poverty Eradication, the Ecosystem Approaches to Fisheries and Aquaculture, and Agreement on Port State Measures to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing. FAO's focus areas include the Blue Growth Initiative, implementation of the 2030 Agenda for Sustainable Development (SDG 14), the United Nations process to elaborate the text of an international legally binding instrument under the United Nations Convention on the Law of the Sea on the conservation and sustainable use of marine biological diversity of areas beyond national jurisdiction

(the role of regional fishery bodies), and cross-sectoral technical work (climate change, area-based management, spatial planning). Much of this work will be delivered through the framework provided by Blue Growth Initiative (BGI), which seeks to minimize environmental degradation, biodiversity loss and unsustainable use of resources while maximizing economic and social benefits. In focusing on the three pillars of sustainable development – economic, environmental, and social – Blue growth offers a holistic approach to the use of ocean and coastal resources that aims to empower local communities to realize the potential that our oceans have to offer.

Implementation places blue growth interventions within the context of creating enabling conditions, human and ecological system responses and transformational change in best practices and technologies, policies and investments.

The work is organized around three linked platforms – blue communities, blue production and blue trade – for transformational change focused on efficient resource use, decent work, energy efficiency and innovation.

Moving from concept to action will require FAO to focus on:

- policy and governance dialogue and reform;
- support for blue actions;
- capacity development;
- facilitation of partnerships, including with the private sector;
- provision of key information; and
- improvement of the uptake of knowledge, technologies and good practices – other means such as financing and research and development are covered by our partners.

Globally, there are a number of countries working with FAO that are considering, developing or implementing blue growth strategies as they seek to transition towards an ocean-based, blue economy, from Latin America and the Caribbean to Africa and the Indian Ocean, Asia and the Pacific.

Geared around the three platforms, the initial focus is on creating the enabling conditions necessary for transformational change, namely:

- legislation and policy frameworks;
- capacity building for public and private institutions;
- financial and technical innovation; and
- knowledge sharing and capacity development.

Blue growth is adaptable to country-specific needs and priorities – there is no one-size-fits-all approach. Some countries may focus on value chain interventions and reducing the vulnerability of coastal communities, whereas others may use tourism and coastal development to increase the economic benefits derived from their oceans and coastal resources.

### **Asia-Pacific Fishery Commission regional overview of fisheries and aquaculture in the Asia-Pacific region**

Susana Siar, APFIC Secretariat

The Asia-Pacific region remains the world's biggest capture fisheries producer in 2014 at 61 percent of the global total. Among the biggest producers of marine capture fisheries are (in descending order) China, Indonesia, Japan, India, Viet Nam, Myanmar, Philippines, Republic of Korea, Thailand, Malaysia, and Taiwan Province of China. Marine capture fisheries are dominated by pelagic marine fish at 32 percent of overall catch, with skipjack tuna as the main species, followed by Japanese anchovy, scads nei (not elsewhere included), large hairtail, club mackerel, and yellow-fin tuna. The fishing fleet increased from 3.3 million vessels in 2010 to 3.5 million in 2014, representing 75 percent of the global total. With respect to inland

capture fisheries, the contribution of the Asia-Pacific region is increasing and accounts for 66 percent of the global inland fisheries production in 2014, with South Asia and Southeast Asia accounting for most of the production. Among the major producer countries are China, Myanmar, India, Bangladesh, Cambodia, Indonesia, Philippines, Thailand, and Viet Nam.

The contribution of fisheries and aquaculture to the gross domestic product (GDP) is significant in Pacific island countries and greater than 1 percent in some South Asian and Southeast Asian countries. There were 48 million fishers in 2012, with China estimated as having 9.9 million, accounting for 24 percent of the world total. In terms of fish trade, fisheries and aquaculture commodities remain among the most traded worldwide. Among the top ten exporters of fish and fishery products are China, Viet Nam, Thailand, and India. Among the top ten importers of fish and fishery products are Japan, China, and Republic of Korea. Fish is an important source of protein and micronutrients for rural, urban and coastal populations, with varying rates of fish consumption, for example, Maldives at 185 kg per person per year, Cambodia at 63.2 kg per person per year and India 2.9 kg per person per year.

In terms of aquaculture, the Asia-Pacific region remains the largest contributor, accounting for 91 percent (92 million tonnes) of total global supply in 2014. The region produced 65 million tonnes of fish and aquatic animals (71 percent) and 27 million tonnes (29 percent) of aquatic plants. There are 225 species cultured in the region, divided as follows: 129 species of finfish, 33 species of mollusks, 31 species of crustaceans, 18 aquatic plants, 10 other invertebrates, 2 amphibians, and 2 reptiles. Herbivorous and omnivorous freshwater species such as carps remain the top commodity for culture with production volume equivalent to 41.6 percent of total fish production in the region. Seven of the top ten highest aquaculture producing countries in 2014 are in the region, namely, China, Indonesia, India, Viet Nam, Philippines, Bangladesh, and Republic of Korea. China is the largest producing country, accounting for 63.7 percent of Asia-Pacific production, and 58 percent of global supply. In terms of employment, Asia accounted for 94 percent of 18 million people engaged in fish farming in 2014, equivalent to 16.9 million. Women accounted for 19 percent of all people directly engaged in the primary sector of fisheries and aquaculture in 2014, equivalent to 10.7 million worldwide.

The current and emerging issues in capture fisheries in the Asia-Pacific region include: strengthening fisheries management and implementing the ecosystem approach to fisheries management; addressing illegal, unreported and unregulated (IUU) fishing; implementing the Voluntary Guidelines for Securing Sustainable Small-scale Fisheries in the Context of Food Security and Poverty Eradication; addressing climate change impacts and developing resilience; and promoting inclusive and gender-sensitive value chains. The current and emerging issues in aquaculture include preventing disease outbreaks in aquaculture farms; maintaining the health of the environment in aquaculture areas; ensuring the sustainability of the use of pelleted feeds in aquaculture; preparing the aquaculture sector for a future warmer global climate; and developing an inclusive aquaculture value chain for equitable benefit sharing.

# Parallel sessions on aquaculture and fisheries: summaries of presentations

The following sections present the summaries of presentations<sup>1</sup> held in two parallel sessions, one on fisheries and one on aquaculture, under four themes:

Theme 1: Improvements in fisheries and aquaculture governance

Theme 2: Innovative aquaculture and fisheries production and management systems and practices for more efficient and sustainable production

Theme 3: Building resilience of fisheries and aquaculture systems in the Asia-Pacific region

Theme 4: Gender-sensitive and inclusive fisheries and aquaculture value chains.

Each thematic session started with an introductory presentation from the APFIC Secretariat. The summary and recommendations of the fisheries and aquaculture groups for each thematic session were fed back in a plenary session. The conclusions and recommendations of the Seventh Regional Consultative Forum Meeting were also discussed and agreed during the plenary session for reporting to the Thirty-fifth Session of the Asia-Pacific Fishery Commission.

## Theme 1. Improvements in fisheries and aquaculture governance

### 1.1 Strengthening aquaculture planning and management through the adoption of relevant tools

#### Strengthening aquaculture planning and management tools in Thailand

Putth Songsangjinda, Senior expert on marine shrimp culture, Department of Fisheries, Thailand and Sontipan Pasugdee, Director of Inland Aquaculture Research and Development Division, Department of Fisheries, Thailand

The FAO Regional Technical Cooperation Programme (TCP) project Piloting of aquaculture planning and management tools in selected ASEAN members (TCP/RAS/3511) has been implemented in Thailand. Three tools were selected and successfully implemented in the inland aquaculture area of Thailand: (i) feasibility study (FS); (ii) ecological carrying capacity (ECC); and (iii) farm level biosecurity plan (FLS). The results reveal that these three tools could serve as technical support tools to get the necessary data/information to implement fisheries policies and other management measures. These tools could also improve the technical capacity of the fisheries biologists of the Department of Fisheries (DoF) and provide greater knowledge and lessons learned for sustainable aquaculture planning and management in Thailand. The Royal Ordinance on Fisheries (2015) is being implemented to strengthen the sustainable development of aquaculture in Thailand for the achievement of long-term economic, social and environmental sustainability and ecosystem balance. Under this Ordinance, Ministerial Regulations are used to control aquaculture development. The notifications of the Provincial Fisheries Committee are used for aquaculture zoning. The Director-General of DoF has the authority to determine the aquaculture requirements of the country. Aquatic animal purchasing documents (APDs) are used for traceability. In addition, the Royal Ordinance also provides powers to the competent officials for the implementation, administrative measures and criminal sanctions to support aquaculture planning and management in Thailand.

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<sup>1</sup> Fully referenced versions of the complete presentations may be available from the authors.

## **Strengthening aquaculture planning and management through the adoption of relevant tools**

Erna Yuniarsih, Directorate General of Aquaculture, Ministry of Marine Affairs and Fisheries Republic of Indonesia

Indonesia has a great opportunity to develop its aquaculture sector. More than 60 percent of Indonesia's area (land and water) has aquaculture culture potential but only 2.3 percent has been utilized. Recently there has been a change of orientation in aquaculture development, from land-based aquaculture to marine-based aquaculture or mariculture. It is expected that an expanded aquaculture sector can have significant positive impacts on employment, welfare, food security and GDP. In 2017 Indonesia, along with Viet Nam and Thailand, became involved in the FAO Project TCP/RAS/3511 to pilot selected planning and management tools. Indonesia decided to pilot three tools in marine aquaculture that are expected to contribute to aquaculture planning and implementation to achieve sustainable aquaculture. The three tools are: (i) *Ecological carrying capacity* to support aquaculture sustainability; (ii) *Feasibility study* to support economic success; and (iii) *Traceability systems* to support food safety. The project is located in Riau Archipelago Province, which has huge potential in marine aquaculture and also geographically close to many international markets. The activities of the project consist of capacity building and piloting through data sampling for the three tools. Data sampling was undertaken through collecting primary data, taking secondary data from related institutions and also interviewing aquaculture stakeholders. The results of the project are: (i) the ECC tools can be implemented successfully but need to be simplified; (ii) for feasibility systems it is concluded that as the aquaculture business is strongly influenced by seed price, feed price, infrastructure and business scale, the commodity farmed should be of high economic value and the business should be run by a group of fish farmers; and (iii) for traceability systems to be successful, increased awareness of the need for record keeping is necessary.

## **Supporting aquaculture resources mapping and development planning through information and communication technology (ICT)-based solutions**

P. Caparas, GIS-specialist, UN-FAO Philippines; J.P. Zulueta, Project staff, DA-BFAR Aquaculture Division; R. Daguil, Project Consultant on ICT; C.D. Gabinete, UN FAO Philippines Program Officer and R.C. Ortega, National Project Coordinator, TCP-F 3603-C2

Effective governance of aquaculture development necessitates an inventory of available biophysical resources and their current state of utilization. In addition, possession of this important information will guide national agencies and stakeholders in general towards better implementation of the ecosystem approach to aquaculture, promotion of zonal good aquaculture practices, and application of natural hazard risk reduction strategies among others.

This ongoing technical cooperation project framework initiative aims to develop a GIS-based, web-enabled aquaculture resources mapping system integrated with key functionalities such as: (i) farm inventory and productivity recording; (ii) site suitability assessment; (iii) natural hazard (geological and atmospheric and associated risks) exposure assessment.

The system has been pilot tested in the vast brackishwater pond areas of Province of Catanduanes. Once completed, this project will be used by DA-Bureau of Fisheries and Aquatic Resources as its primary tool in the registration and inventory of aquaculture farms (Aqua R accessible via <http://aquar.carsu.edu.ph/>). The system is currently designed for land-based facilities, meanwhile, modules are being developed to accommodate semi-fixed aquaculture farming systems situated in open bodies of water.

## **Strengthening aquaculture planning and management through adoption of relevant tools in Viet Nam**

Chau Thi Tuyet Hanh, Department of Aquaculture, Directorate of Fisheries, MARD

The ecological carrying capacity (ECC), project feasibility study and biosecurity tools were selected for piloting in Hoang Hoa, Thanh Hóa Province for the management of the fisheries sector in Viet Nam. The pilot site is a small island, the major source of livelihoods and income of the islanders is shrimp-fish-crab-seaweed integrated farming. Most of the ponds are adjacent to each other, having the same water supply and drainage system. The implementation of the three tools in the same site helps the project team to share information and cross-check the accuracy of the information. The lessons learned from the pilot project are: (i) the ECC tool is a new, strong and very useful tool, it is relatively straightforward to understand and apply but requires a lot of secondary and primary data, leading to difficulties for local users such as local management officials; nevertheless, the tool should be further developed for clam farming and lobster farming, for example; (ii) the application of biosecurity tools for disease prevention at shrimp farm level is only effective when applied at a large scale and the ponds' banks are adjacent and have the same water supply and discharge channel; and (iii) the feasibility study tool can be applied in an aquaculture zone. The farmers must record all data (related to production, capital costs and operating costs).

### **1.2 Strengthening aquaculture regulations, the ecosystem approach to aquaculture (EAA) and zonal development**

#### **Aquaculture regulations in India**

S. K. Rath, Assistant Commissioner (Fisheries), Department of Animal Husbandry, Dairying and Fisheries, Ministry of Agriculture and Farmers Welfare, Government of India

The Coastal Aquaculture Authority (CAA) was established in 2005 after the intervention of the Apex Court of India against the backdrop of unregulated growth of shrimp aquaculture and related environmental issues. The CAA is responsible for regulating aquaculture activities for sustainable development of the coastal aquaculture sector without causing damage to the coastal environment. The major responsibility of the CAA is to ensure registration of all kinds of coastal aquaculture farms and hatcheries in the country. It is mandatory for all farmers carrying out coastal aquaculture activities to register their farms with the CAA.

In addition, the CAA also has the power to survey the entire coastal area and advise the central government, provinces and centrally administered territories on formulating suitable strategies for achieving eco-friendly development. The CAA also fixes standards for seed, feed, growth supplements and chemicals used for the maintenance of waterbodies. Furthermore, it has the power to constitute various technical committees, sub-committees and working groups, for example for the preparation of technical manuals.

The crisis in shrimp aquaculture in India during the 1990s, prompted the Government of India to allow the introduction of specific pathogen free (SPF) *L. vannamei* farming at commercial scale in 2009 within the rules and guidelines established by the CAA Act. The CAA also identifies, shortlists, and approves overseas suppliers based on an evaluation of genetic and disease status for supplying SPF broodstock to Indian shrimp hatcheries for seed production. Thus, the *L. vannamei* production was boosted in a sustainable manner.

The introduction of SPF *L. vannamei* resulted in the revival of abandoned shrimp farms, closed hatcheries and feed mills in a regulated manner. The import of SPF *L. vannamei* broodstock is regulated under the Livestock Importation Act 1898 (as amended in 2001). A sanitary import permit (SIP) is mandatory for such import. A state-of-the-art aquatic quarantine facility (AQF) is available at Chennai, which is the only

designated port of entry for import in India. Twenty antibiotics/chemicals are banned for use in coastal aquaculture and hatchery operations by the CAA. The authority regulates feed and other aquaculture inputs free of antibiotics and so far 892 such products are registered as antibiotic-free aquaculture inputs.

### **Strengthening aquaculture regulations, ecosystem approach to aquaculture (EAA) and zonal development in Indonesia**

Maskur Maskur, Senior Aquaculture Applied Researcher, Directorate General of Aquaculture, Ministry of Marine Affairs and Fisheries, Indonesia

Indonesia is an archipelagic country whose potential for aquaculture is relatively high. Under current conditions the potential area for the development of mariculture, brackishwater and freshwater aquaculture is about 16 596 379 ha, of which only 7.4 percent has been utilized. Opportunities for the development of mariculture are still very large because the utilization rate is only 2.36 percent of the total potential area of 12 123 383 ha. Since the government policy changed from a land-based approach to a maritime-based approach aquaculture development policies have been promoted such as self-sufficiency, competitiveness, and sustainable aquaculture. In order to develop and achieve sustainable aquaculture, the Indonesian government has established many regulations such as fisheries laws, regulations related to food security, fisher and fish farmer protection, zoning, quarantine, drug use in aquaculture, marine conservation. In addition to these regulations, the ecosystem approach to aquaculture (EAA) has been implemented in cooperation with World Wildlife Fund (WWF) Indonesia. This started with the development of a roadmap, then the use of indicators/criteria and pilot projects at Pinrang District, South Sulawesi Province to assess the existing aquaculture practices. In developing aquaculture zonation, an inland aquaculture zone and a coastal aquaculture zone for fisheries and aquaculture spatial planning were established. Another three types of aquaculture zoning have been piloted: integrated aquaculture industry zones, zonal management for fish diseases control, and integrated economic zones based on the blue economy concept.

### **Strengthening aquaculture regulations, the ecosystem approach to aquaculture (EAA) and zonal development**

Roslan Bin Abu Hasan, Department of Fisheries, Malaysia

Aquaculture is an important subsector of Malaysian fisheries which contributes to national food security, income and employment generation and foreign exchange earnings. Aquaculture has been playing an important role as an alternative source of income for rural folks especially coastal fisheries communities. It also contributes towards reducing the pressure on marine natural resources. The development of the aquaculture industry has been accelerated recently to boost the economic contribution of fisheries (part of the agro-food sector) to the national economy. Environmental protection and conservation will be prioritized in aquaculture development to ensure a more sustainable future. The current agricultural policy, the National Agro-Food Policy 2011–2020, has made sustainable agricultural development one of its key pillars. In addition, the path towards sustainability as envisioned by the policy requires cooperation from all stakeholders in the aquaculture sector. The laws governing the aquaculture sector include provisions for environmental protection. The Department of Fishery (DoF) has initiated the Aquaculture Industrial Zone (AIZ) Programme involving the development of 49 zones, located across Malaysia, that will be used for culture of various types of high-value aquatic species. The DoF has identified several strategic areas or activities that will be developed for downstream activities such as fish seed production, feed mills, fish processing plants, and other supporting industries. AIZs are designated through a zoning programme that identifies suitable lands and waterbodies for commercial scale projects. AIZs are dedicated for aquaculture with the purpose of increasing fish production under the Third National Agriculture Policy (NAP3). All designated AIZs are supported by the state government.

## **Promoting sustainable aquaculture through industry engagement**

E. J. Morales and A. J. Immink, Sustainable Fisheries Partnership

The sustainability of the seafood industry is complex and requires the engagement of multiple stakeholders at multiple levels. The Sustainable Fisheries Partnership (SFP) believes that industry engagement is critical to ensuring that improvement initiatives succeed, including those related to governance; and industry needs the tools and information to engage properly. There are three tiers involved in achieving sustainable aquaculture: at farm level, farms performing best management practices; at industry level, an industry management structure built around units that recognize the interconnected nature of farms; and at national level, effective national policy to protect the resource base as the industry grows. We call this zonal management. Improvement initiatives should assess all three tiers as elements as each are essential for addressing critical issues in the industry such as environmental impacts and disease risks. Implementing effective management systems at the industry level will reduce boom and bust scenarios and increase investment.

SFP has several industry engagements in the region to promote sustainability: a roundtable dialogue space for major buyers and their suppliers to jointly engage in aquaculture improvement projects; a project with industry and government in Thailand piloting a data driven health management system for shrimp aquaculture; and a project with the Government of Indonesia developing improved models of the ecosystem carrying capacity for the coastal aquaculture sector (shrimp and marine fish). In order to provide stakeholders with information at the appropriate scale, SFP has developed FishSource ([www.fishsource.org](http://www.fishsource.org)) profiles for aquaculture, to complement those for fisheries. The profiles are written at the province/state level for particular species groups and provide assessments of regulations, industry structure, disease management, environmental management and sustainable marine ingredients sourcing for feed. These assessments provide information and improvement recommendations across the three tiers of zonal management.

The aim of all these initiatives is to develop professional capacity to support industries and the government to deliver sustainable aquaculture growth through increased professionalism across the three tiers of zonal management.

### **1.3 Sharing experiences and lessons on combating illegal, unreported and unregulated (IUU) fishing**

#### **Indonesia's policy reform in combating illegal, unreported and unregulated (IUU) fishing**

Anindita Laksmiwati, Secretariat General, Ministry of Marine Affairs and Fisheries of the Republic of Indonesia

Because fish is one of the world's most wanted sources of food, fisheries have become one of the world's most overexploited resources. According to the last State of World Fisheries and Aquaculture (SOFIA) in 2014, 90.1 percent of the world's fish stocks are fully exploited or overexploited and, thus, require effective and precautionary management. Our global fishing fleet is two to three times larger than what the oceans can sustainably support. In other words, people are taking far more fish out of the ocean than can be replaced by those remaining.

Illegal, unreported and unregulated or IUU fishing is the biggest cause of overfishing. Last year, the World Bank Managing Director stated that ineffective fish stock management and illegal fishing waste USD 75 billion to USD 125 billion of global output annually. In Indonesia alone, IUU fishing leads to some USD 20 billion worth of lost revenue.

Indonesia is the world's largest archipelago, consisting of over 13 000 islands spread across nearly 2 million km<sup>2</sup>, and also has the second longest coastline in the world. Despite this, Indonesia was only ranked as the third largest seafood (this includes aquaculture) exporter in Southeast Asia. The number of Indonesian

fisheries households decreased in the span of one decade, from 1.6 million fisheries households (2003) to only 800 thousand fisheries households (2013).

Grasping the urgency of this situation, the Ministry of Marine Affairs and Fisheries (MMAF) of the Republic of Indonesia imposed a national moratorium on granting new licences to all ex-foreign vessels from November 2014 to October 2015. Immediately after the moratorium was imposed, MMAF established the Task Force on Prevention and Eradication of IUU Fishing. This Task Force is responsible for the analysis and evaluation or audit process for the ex-foreign vessels.

Tackling these issues, MMAF has also issued several regulations and policies, including: (i) prohibition on the utilization of trawls and seine nets; (ii) human rights certification for capture fisheries businesses; (iii) improvement in licencing procedures; (iv) enhancement of law enforcement; and (v) compassionate treatment for those human trafficking victims trafficked to work on fishing boats, that consists of rescue, release, repatriation, and remediation.

The implementation of the Port State Measures Agreement is very important in the international effort to combat IUU fishing as it serves to hinder and block the movement of IUU-caught fish onto national and international markets.

### **Experiences and lessons from illegal, unreported and unregulated (IUU) fishing: significant modifications of the administrative structure and procedures to revoke the European Union fish import ban**

H.J.M. Nihal Palitha, Director (Industries), Department of Fisheries and Aquatic Resources, Sri Lanka

During the last 15 years, there has been a phenomenal expansion in Sri Lanka in the size of the fishing fleet, the number of persons employed as fishers, national marine fish production, and total earnings from fish exports. Meanwhile in the global context, the European Union (EU) is attempting to combat IUU fishing by introducing an import ban. Accordingly, on 15 January 2015, the European Commission placed a ban on the import of fisheries products from Sri Lanka based on IUU fishing concerns.

Since Sri Lanka was the second largest exporter of fishery products to the EU in 2013 (Sri Lanka accounted for Euro 74 million of fisheries imports to Europe), the ban had a strong impact.

As the main implementation agency of fisheries management of Sri Lanka under the Ministry of Fisheries, the Department of Fisheries and Aquatic Resources (DFAR) were provided with a target of implementing a road map with 57 tasks demanding a rapid change in the high seas fisheries operation management process. Significant changes to the regulations concerned: (i) the introduction of new management practices such as vessel monitoring system; (ii) fishing trip verification within 24 hours after landing; and (iii) boat inspections and observers on board. These measures were completely new to the administrative system. Moreover, the attitude of the field officers and fishermen towards such changes was even more of a challenge.

DFAR faced the challenge by establishing new units at head office level, namely a high seas operation unit and a vessel monitoring unit and twelve fisheries harbour operation units with well demarcated work processes incorporating the latest technology (such as satellite screening) to meet EU standards. A co-management strategy was adopted to acquire the active participation of the fishermen concerned. The national level steering committee established at Prime Minister's office successfully overcame bottlenecks caused by the current administrative and financial constraints.

The strategic administrative and co-management practices adopted were based on a strengths, weaknesses, opportunities, threats (SWOT) analysis and the ban itself became an opportunity to establish a responsible fisheries culture in Sri Lanka and thus persuaded the EU to lift the fish import ban on Sri Lankan fish in June 2016.

## **Thailand's experiences and lessons on combating illegal, unreported and unregulated (IUU) fishing**

Suttinee Limthammahisorn, Fisheries Resources Management and Measures Determination Division, Department of Fisheries, Thailand

As a global player in the seafood and fisheries industry, the Thai government has been, and continues to be, fully committed to fulfilling its international obligations and being a full partner of the international community in the fight against IUU fishing and the protection of global marine resources.

Reforming, overhauling and modernizing the fisheries sector has been an absolute priority. Thailand started a complete overhaul of its fishing and fisheries sector, starting from putting in place a new legal framework in order to ensure compliance with international and regional rules applying to the conservation and management of fishing resources. Thailand's Fisheries Management Plan (FMP) and the National Plan of Action on IUU (NPOA-IUU) were adopted and implemented. The Monitoring, Control and Surveillance (MCS) system was established with the Vessels Monitoring and Surveillance (VMS) Centre and later upgraded to become a Fisheries Monitoring Centre (FMC). A Port-In Port-Out (PIPO) control system was set up across all coastal provinces and improved the control and inspection measures at port and at sea. Law enforcement and serious deterrent sanctions (both administrative and criminal) were introduced and later strengthened. The national traceability system was enhanced for both fisheries products from Thai-flagged vessels as well as imported raw materials, so as to make sure the origin and the movement of fishery products through the supply chain can be accurately tracked, monitored and inspected. Additionally, the Department of Fisheries, as Thailand's Competent Authority has been restructured. This important development has enabled additional human and financial resources to be allocated to the DoF so that it can effectively manage the new fisheries governance architecture and systems. Since 2015, a total budget of approximately USD 250 million has been allocated to facilitate this new fisheries governance and to combat IUU fishing.

Although the Thai government is making every effort to combat IUU fishing, the large scale of fishing and the fisheries sector which has over 40 000 large and small fishing vessels, requires significant human and time resources to adjust and reform the sector. Changes in the Thai fisheries industry will impact the livelihoods of two million fishermen and locals who depend on the industry. To manage to do all of this with a focus on the wellbeing of all the people impacted by these changes is very important. Based on the sustainable platform that has been put in place for the fisheries sector, the right foundations to tackle all the challenges have been established and the fisheries governance system has been significantly improved.

## **How the United States is combating illegal, unreported and unregulated (IUU) fishing and seafood fraud through seafood traceability and partnerships: a primer**

Michael Abbey, NOAA Fisheries (NMFS), Office of International Affairs and Seafood Inspection, Foreign Affairs/Asia-Pacific

The United States Seafood Import Monitoring Program (SIMP) established permitting, data reporting, and record keeping requirements for the importation of 13 priority species of fish and fish products entering the United States that were identified as being especially vulnerable to IUU fishing and/or seafood fraud. The objective of SIMP is to combat IUU fishing and seafood fraud. The final rule thus requires United States' importers to report certain information upon entry into the United States and retain other information that allows the shipment to be traced back to the point of catch or harvest in order to prevent the United States market being used as a place to sell fraudulently marketed seafood or seafood products produced from IUU fishing.

The National Oceanic and Atmospheric Administration (NOAA) stayed the effective date of SIMP for shrimp and abalone species until comparable reporting and record keeping requirements for domestic aquaculture production were identified or established. The mandatory compliance date for shrimp and

abalone was no later than 31 December 2018. NOAA intends to continue to offer technical guidance to exporting nations and industry to support SIMP implementation, subject to the availability of resources.

Additionally, NOAA and the United States Agency for International Development (USAID) work together with our partners in the Southeast Asian Fisheries Development Center (SEAFDEC) and the Coral Triangle Initiative on Coral Reefs, Fisheries and Food Security (CTI-CFF) on the ecosystem approach to fisheries, marine spatial planning, combating IUU fishing through port state measures and other issues that impact, specifically in its application to Southeast Asia but applicable to all regions. The focus in the last year of the partnership between USAID and NOAA will be on developing tools and curricula that support our Asian partners in their efforts to manage fisheries through the ecosystem approach as well as include catch documentation and traceability components.

### **The USAID Oceans and Fisheries Partnership: a regional cooperation to combat illegal, unreported and unregulated fishing (IUU) and promote sustainable fisheries in the Asia-Pacific region**

Len Garces, Fisheries Management Expert, The Oceans and Fisheries Partnership (USAID Oceans)

The USAID Oceans and Fisheries Partnership (USAID Oceans) works to combat illegal, unreported and unregulated (IUU) fishing, promote sustainable fisheries and conserve marine biodiversity in the Asia-Pacific region. USAID Oceans, in collaboration with the Southeast Asian Fisheries Development Center (SEAFDEC) and the Bureau of Fisheries and Aquatic Resources (BFAR), has chosen the General Santos Fishing Port Complex (GSFPC) and areas around the Sarangani Bay Protected Seascape (SBPS) as a project learning site. USAID Oceans aims to develop, demonstrate and expand a catch documentation and traceability (CDT) system using a market based approach that promotes sustainable fisheries and builds on the foundation of the ASEAN Catch Documentation Scheme and Philippines' existing CDT protocols. Although the development of the CDT system is the backbone of the programme, it is complemented by other components, such as regional coordination and capacity building of regional stakeholders to combat IUU fishing; promotion of sustainable fisheries and conservation of biodiversity; public and private sector engagement and partnership development to ensure uptake and sustainability of the CDT system; and integration of social welfare issues (gender, labour) into all aspects of programme design. A core tenet of the project is also to strengthen an ecosystem approach to fisheries management (EAFM) by developing a Sustainable Fisheries Management Plan (SFMP) for the coastal area (namely Sarangani Bay, Philippines) through participatory approaches, and implementing an adaptive management approach. The presentation also provided updates on the CDT activities and testing in the learning sites that include interventions for small-scale fisheries such as tuna handlines.

## **1.4 Promoting and implementing the ecosystem approach to fisheries (EAF), co-management approaches**

### **Marine capture fisheries management in China**

Huang Hongliang, East China Sea Fisheries Research Institute, Chinese Academy of Fisheries Sciences, Shanghai, China

China holds very rich marine fishery resources. Marine capture fisheries play an important role in the marine economy of the country. In the past 30 years, China's marine capture fishery sector has achieved explosive growth, which has posed a huge threat to the sustainability of fisheries resources. How to apply the ecological management approach to promote the sustainable development of fishery has become the focus of national attention and research. China has adopted many measures with respect to the ecological management approach. Major measures include:

- (i) implementing a fishing licence system and access system, which specifies the marine capture fishery operating range to ensure that fishery resources have the time and space to grow and breed;

- (ii) changing the methods of fishing vessels and the jobs of fisherman to reduce fishing capacity and to protect fishery resources;
- (iii) buying back fishing vessels for scrap and pursuing measures to increase the prevention and control of seawater acidification, both of which help to reduce carbon dioxide emissions and mitigate environmental degradation in fishing waters;
- (iv) implementing the minimum net size management system to reduce the quality and quantity of bycatch to protect juvenile fish resources; and
- (v) constructing artificial reefs and building marine ranches to create a suitable habitat for marine life.

As a responsible fishing country, China has formulated sustainable fisheries development plans. From 2015 to 2020, the number of fishing vessels decreased by 12.7 percent, the total power of fishing boats decreased by 12.1 percent, and the total production of marine fishing was no more than 10 million tonnes.

### **Mainstreaming the ecosystem approach to fisheries management in Philippines: an overview**

Rafael V. Ramiscal, Chief, Capture Fisheries Division, Bureau of Fisheries and Aquatic Resources, Philippines

The legal basis of the ecosystem approach to fisheries management (EAFM) and provisions under the amended Fisheries Code recognize the EAFM as the foundation for managing fisheries resources in Philippines. The country has learned many important lessons from existing management experiences (coastal resources management, integrated coastal management, bay-wide management, inter-local government unit arrangements) which have been combined with participatory approaches.

The M-EAFM programme ensures that the plans and programmes of the Bureau of Fisheries and Aquatic Resources (BFAR) are developed and implemented following the principles of EAFM and that activities are consistent with plans adopted by stakeholders in specific management areas. A customized EAFM guidebook/modules were prepared in collaboration with USAID/NOAA/Ecofish Project, as the basis of the planning process and implementation. National and regional M-EAFM teams are also at present in some areas.

A number of pilot areas have adopted EAFM plans (San Bernardino/Ticao, Biliran Island, Paguil Bay, Balayan Bay, Sarangani Bay and Samar Sea) emphasizing the importance of engaging stakeholders in every step/ stage in planning and implementation, and the key role of a champion as a leader that can influence decisions among major stakeholders/sectors. Both are vital in EAFM planning and implementation.

### **Promoting and implementing the ecosystem approach to fisheries management (EAFM) in South Asia: lessons learned**

Bay of Bengal Programme Inter-Governmental Organisation

The ecosystem approach to fisheries management (EAFM) has been recognized as a practical and effective means to manage fisheries more holistically. This concept, which is relatively new to the South Asian region, poses challenges to fisheries agencies in developing management plans that will work locally as well as fit into broader fishery/ecosystem strategies. To address this issue and to develop capacity and understanding of the essential ecosystem approach to fisheries management (essential – EAFM), the Bay of Bengal Programme Inter-Governmental Organisation (BOBP-IGO) conducted three training courses in Chennai (India), Chittagong (Bangladesh) and Kochi (India) between 2014 and 2016. Each course was designed to build human capacity in understanding and operationalizing EAFM in order to influence decision-making processes on marine resources and fisheries management. In total, 71 officials and academicians from ministries/departments of fisheries or environment and R & D organizations from Bangladesh, India, Maldives and Sri Lanka have acquired training and are equipped to: (i) develop and implement an effective EAFM plan by selecting a fishery management unit; (ii) manage fisheries more holistically; (iii) better resolve fisheries issues and challenges; (iv) reduce user group conflicts; and (v) work cooperatively with other stakeholders. Furthermore, to develop a pool of trainers within the region,

a Training of Trainers course was also conducted after each training course by selecting trainees who had just completed the course. In total, 14 trainers have developed the capacity to deliver the EAFM full course, which provides the region with a strong cadre of trainers to draw on as the EAFM training expands and develops in the region. These capacity building programmes are a pragmatic approach to understanding how conventional fisheries management can be improved to incorporate ecosystem considerations and more properly deal with the social dimension. However, despite the progress made in promoting the application of an ecosystem approach, challenges still remain in implementation. Based on what was learned from the training courses, the following steps are required: (i) conducting short-term EAFM workshops for decision makers to build awareness among senior fisheries officials/leaders within each country in the region; and (ii) conducting advanced EAFM workshops to address specific needs for identified areas that will advance implementation of an EAFM. The BOBP-IGO has also conducted complementary training programmes to member countries on the Code of Conduct for Responsible Fisheries, fish stock assessment and documentation. These interventions are making the following positive changes in the member countries: (i) improved data collection and analysis; (ii) stock advisory and conservation measures for tuna and tuna-like species; (iii) stock validation in India; (iv) management plan for hilsa in Bangladesh and grouper in Maldives; (v) updating of fisheries policies; and (vi) strong anti-IUU fishing measures in Sri Lanka and the Maldives. The BOBP-IGO could provide technical assistance to further support member country efforts to develop EAFM plans as well as other capacity improvement programmes at both national and regional levels.

### **Promoting and implementing an ecosystem approach to fisheries (EAF), co-management approaches: lessons learned in the Lower Mekong Basin**

Mekong River Commission (MRC) Environmental Management Division, Vientiane, Lao People's Democratic Republic

The 1995 Mekong Agreement establishes the goals, objectives and underlying principles by which the four Member Countries (Cambodia, Lao People's Democratic Republic, Thailand and Viet Nam) intend to cooperate, and to which the Integrated Water Resources Management based Basin Development Strategy responds. These may be summarized as: to cooperate in all fields of sustainable development, utilization, management and conservation of the water and related resources of the Mekong River Basin, including but not limited to irrigation, hydropower, navigation, flood control, fisheries, timber floating, recreation and tourism (Article 1); to promote the development of the full potential of sustainable benefits to all riparian States and the prevention of wasteful use of Mekong River Basin waters with an emphasis and preference on joint and/or basin-wide development projects and basin programs through the formulation of a basin development plan (Article 2); to protect the environment, natural resources, aquatic life and conditions, and ecological balance of the Mekong River Basin from pollution or other harmful effects ... (Article 3). The Integrated Water Resources Management-based Basin Development Strategy (BDS) 2016–2020 is a statement of the Lower Mekong Basin (LMB) countries setting out how they will utilize, manage and conserve the water and related resources of the Mekong Basin. The MRC Secretariat has implemented the strategy by continuing to execute the Mekong and Sekong Rivers Transboundary Fisheries Management Project that is funded by the World Bank. The objective of this joint project is to make sure that fisheries management is improved in the bordering provinces of Stung Treng and Kratie in Cambodia and Champasack and Attapeu in Lao People's Democratic Republic. The Project has actively practiced co-management to achieve three outcomes of the project which are: (i) a joint transboundary issues paper; (ii) development and agreement on a coordination mechanism for sharing information and improving cooperation; and (iii) a joint action plan to implement a coordination mechanism.

## **Promoting the ecosystem approach to fisheries management in Southeast Asian countries**

Worawit Wanchana, Assistant Policy and Program Coordinator, SEAFDEC Secretariat

The ecosystem approach to fisheries management (EAFM) is one of the latest methods for managing fisheries activities with consideration given to the surrounding conditions around the fishery sector. EAFM could be applied not only for coastal and marine capture fisheries but also for inland fisheries. Many ASEAN Member States (AMS) are now adopting EAFM, which puts more emphasis on balancing ecological and human well-being based on good governance. Training courses on the essential-EAFM have been organized by SEAFDEC Training Department through its projects REBYC-II CTI (Strategies for Trawl Fisheries Bycatch Management) and the Japanese Trust Fund since 2014. Adoption and application of the EAFM concept by AMS have resulted in various significant outputs to the AMS as most fisheries officers have now become more capable of applying the approach for developing appropriate national/site-specific fisheries management plans for their respective countries/areas.

## **Theme 2. Innovative aquaculture and fisheries production and management systems and practices for more effective and sustainable production**

### **2.1 Promoting climate-resilient/smart aquaculture**

#### **A journey to climate-smart aquaculture in Bangladesh: key drivers, challenges and advancements**

A.K.M. Aminul Haque, Department of Fisheries, Bangladesh Ministry of Fisheries and Livestock

Aquaculture in Bangladesh is undertaken mainly with selective freshwater finfish and shellfish species including Indian and Chinese major carps, barbs, cichlids, catfishes, mud eels, shrimps and crabs. It dates back largely to the late 1970s when aquaculture initiatives, despite many challenges, flourished in traditional rich capture fishery areas such as oxbow lakes, beels (natural depressions) and floodplains through stocking of fry and fingerlings. Some enthusiastic entrepreneurs used supplementary formulated feed and hatchery-induced seeds of Indian and Chinese major carps in hitherto ill-stocked, nature-dependent, little-cared for and low-income traditional ponds having no protection, control and management over natural hazards and disasters. These entrepreneurs brought a drastic change in overall management, which included timely stocking of high yielding varieties (HYV) of fry/fingerling of selective species, with proper ratio in consideration of their trophic levels and trophic niches, as well as consideration of floods, droughts and other natural hazards, market demand, supply and value chain, water quality maintenance, inclusion of vitamins and minerals, and prevention and treatment of diseases. With the introduction of these modern aquaculture interventions, within a decade aquaculture in Bangladesh graduated from traditional extensive and improved extensive to semi-intensive, intensive and super-intensive aquaculture and now it is ranked fifth largest producer in the world. The Government of Bangladesh, international development agencies, inter-government organizations, non-government development organizations and community-based peoples' cooperatives along with policy and financial support from the government and financial sectors have all played important roles in bringing to fruition entrepreneurs' initiatives. But special mention should be made of the research, extension and innovative technological support from the government agencies of Bangladesh, notably the Department of Fisheries (DoF) and the Bangladesh Fisheries Research Institute (BFRI). The introduction of climate-resilient innovative agro-aquaculture (IAA) through rational utilization of common resources such as land, water, labour, capital and organization with an emphasis on resource recycling, environmental compatibility, food safety and product quality boosted primary production in multi-dimensional ways. With 30 agro-ecological zones in Bangladesh, aquaculture has found its way through ten major climate-resilient smart aquaculture and agro-aquaculture initiatives: (i) pond and lake aquaculture; (ii) aquaculture in rice fields; (iii) Sorjan-

aquaculture in fruit gardens; (iv) aquaponic-aquaculture with vegetables; (v) recirculating aquaculture system (RAS); (vi) aquaculture in floodplains; (vii) floating net cage aquaculture in floodplains and open waters; (viii) floodplain aquaculture nursery; (ix) Daudkandi model agro-aquaculture; and (x) Vabadaha model agro-aquaculture.

### **Improving knowledge-base and information dissemination towards climate resilient tilapia farming in Philippines**

R.C. Ortega, National Project Coordinator, TCP 3503-D; J.P. Zulueta, Project staff, DA-BFAR Aquaculture Division and A.C. Gonzal, Project Consultant

Most if not all circulating aquaculture technology knowledge products assume fair weather or climatic conditions that do not often reflect day-to-day realities, particularly in Philippines. Considering that the entire country is exposed to climatic and weather hazards and associated risks, it would be practical to invest on early warning systems with sensible sets of practical advice to guide our aquaculturists to adjust their activities in view of maximizing use of inputs, avoiding losses of stocks and damage to properties.

Through a Department of Agriculture, Bureau of Fisheries and Aquatic Resources (DA-BFAR) and UN-FAO technical project (TCP/PHI/3502-D), an innovative knowledge processing system was developed through participatory workshops between farm operators/workers, aquaculture and meteorology subject matter specialists. The result was a new set of aquaculture knowledge products known as the Impact Management of Weather System Series. The Series is a unique set of knowledge products intended for fishery extension workers, aquaculture operators and even for instructional use. Initially piloted on pond-based tilapia farming systems, the Series now covers the effects and interactions of various weather systems on the farming operations of seven aquaculture commodities across numerous farming systems. The technical contents of the Series publications have also been integrated in five-day weather forecasts using statistically downscaled data supplied by the government weather agency, Philippine Atmospheric Geophysical and Astronomical Services Administration (PAGASA). Visualization of the forecast coupled with early warning messages are then packaged and circulated on the Internet equipped with short messaging services (SMS).

A separate knowledge product was also prepared titled Local tilapia farming practices in Philippines: a documentation of practical innovative approaches on impacts of climate change. This was a product of field surveys in the country's key tilapia pond-based farming systems.

The capacities of local fisheries extension workers (25 persons) were also improved through a customized two-phase training titled Community aqua-meteorologists training. Upon completion, the extension workers were provided with Automated Weather Stations (AWS) and a set of water quality test kits and equipment for immediate use. The project implementation unexpectedly coincided with the 2015–2016 El Niño phenomenon. In response, the El Niño Forum covering three key tilapia farming areas was organized. Thereafter, a bulletin titled, Technical advisory to build awareness and mitigate the impact of El Niño Southern Oscillation (ENSO) on tilapia farming systems and freshwater aquaculture was released in February 2016.

The innovative approaches of this technical project are currently being disseminated through TCP/RAS/3603, Promoting scaling-up of innovative climate resilient tilapia pond culture practices for blue growth in Philippines and the lessons learned have been incorporated into project design and management.

## **Climate change impact on fisheries and aquaculture in Sri Lanka**

R.H. Pothuwila, Assistant Director, National Aquaculture Development Authority of Sri Lanka

Sri Lanka is an island in the Indian Ocean just north of the equator. The total land area is 65 610 km<sup>2</sup> with the topography in the central highlands above 300 m and surrounded by an extensive lowland area. Normally the mean annual temperature in the lowland area is about 27°C, but it is less in the highlands. Considering the annual rainfall pattern, then we can categorize the three climatic zones as wet zone (over 2 500 mm), intermediate zone (1 750 mm to 2 500 mm) and the dry zone less than 1 750 mm.

Sri Lanka is a negligible contributor to global warming, but has been identified as vulnerable to the impacts of climate change, especially an increase in the frequency and intensity of natural disasters such as droughts, floods and landslides, variability and unpredictability of rainfall patterns, overall increase in rainfall or reduced rainfall predicted for the dry zone area.

Sri Lanka has started two pilot project on climate resilience in the aquaculture sector. One of them is in Putham District and focuses on saline tilapia farming. The other project is in Nuwaraeliya District and focuses on blue tilapia farming. These projects are ongoing so results should be available next year.

## **Promoting climate-resilient aquaculture in Asia – progress and challenges**

Cherdsak Virapat, Director General, Network of Aquaculture Centres in Asia-Pacific

Fisheries and aquaculture remain important sources of food, nutrition, income and livelihoods for hundreds of millions of people around the world. Climate change will affect food security in Asia by the middle of the twenty-first century, with South Asia most severely affected. Almost 90 percent of aquaculture production takes place in Asia. One study identified Bangladesh, Cambodia, China, India, Nepal, Philippines and Viet Nam as the most vulnerable countries worldwide.

Several strong inter-governmental agencies have been established in support of aquaculture development in the Asia-Pacific region. To meet the increasing demand for food fish, it is necessary to promote the sustainable intensification of aquaculture (SIA), which means to produce more with less. Four basic tenets of sustainable aquaculture strategy are: (i) responsible access to and use of aquatic genetic resources and genetic improvement; (ii) sustainable farming systems; (iii) aquatic animal health, including responsible transboundary movement of aquatic animals; and (iv) appropriate responses to climate change impacts. SIA has now been identified as a regional initiative in support of the blue growth initiative (BGI). With respect to goal 14.7 of the Sustainable Development Goals (SDGs), the aquaculture sector plays and will continue to play a prominent role in world food security.

Regional initiatives can be categorized into four groups, namely: (i) increasing climate resilience of fish farmers, farming systems and breeds available for farming; (ii) increasing capacity to manage short-term and long-term climate risks and reduce losses from weather-related disasters; (iii) improving sustainability of genetic diversity in broodstocks as a resource for long-term, continuous adaptation to climate change; and (iv) reducing and/or sequestering greenhouse gas emissions.

NACA and its partners have played a vital role in implementing many activities, such as strengthening adaptive capacities with respect to the impacts of climate change in some member countries (AquaClimate Project); implementing culture-based fisheries development in Lao People's Democratic Republic (low emission food production); sharing meetings on Climate Change and Disaster Risk Reduction in Nepal and Efforts for Strengthening Adaptive Capacity to Climate Change in aquaculture and fisheries; environmental monitoring and early warning systems for fisheries and aquaculture in the Lower Mekong Basin; organization of a Global Conference on Climate Change Adaptation within Fisheries and Aquaculture (FishAdapt); sharing experiences on the ground; adaptive learning in sustainable aquaculture best practices for small-scale shrimp farmers in Thailand; conducting a seminar on food security through sustainable aquaculture development and disaster risk reduction for Bangladesh.

Some current and proposed future activities are: the second phase of the Culture-based Fisheries Development in Cambodia Project; activities to address climate change implications for aquaculture and aquaculture inventory to improve the sector's capacity to adapt to climate change impacts in the southern districts of Bangladesh; a monitoring and early warning system relevant to fisheries and aquaculture in the Lower Mekong Basin; a regional training programme in aquaculture governance in the Asia-Pacific region; a strategic network programme known as the National Broodstock Improvement Network (NBIN) to promote smallholder farmer networks for aquaculture genetic improvement in a variety of environments and farming systems; pilot programmes for emergency rapid appraisal of genetic biodiversity, inbreeding and adaptive capacity in small-scale aquaculture systems; and a new paradigm of planting mangroves for integrated multiple benefits.

It is suggested that combined efforts should be made for setting up a regional climate change impact assessment, showing the possible effects of climate change on aquaculture in different countries over the next 15 years (increasing temperature, change in rainfall patterns, storm intensity and frequency, increased CO<sub>2</sub> levels and sea level rise). This would provide farmers with information to make informed choices about how they should be adapting their aquaculture production systems to climate change. Other suggestions are defining adaptation strategies for the main environmental, disease and genetic threats caused by climate change to inform and guide the aquaculture community; communicating the results of the vulnerability assessment and adaptation planning and strategies at all levels; and implementing pilot projects on adaptation and providing capacity building required to manage aquaculture systems.

## **2.2 Promoting scaling up of innovative aquaculture systems/practices for more sustainable and efficient production**

### **Sustainable aquaculture development in China**

Shengming Sun, Freshwater Fisheries Research Center, Chinese Academy of Fishery Sciences, Wuxi, Jiansu, China

The systems and technology used in aquaculture have developed rapidly in the last fifty years. They vary from very simple facilities (such as family ponds for domestic consumption in tropical countries) to high technology systems (such as intensive closed systems for export production, rice-fish culture, rice-crab culture). Much of the technology used in aquaculture is relatively simple, often based on small modifications that improve the growth and survival rates of the target species, for example improving food, seeds, oxygen levels and protection from predators. Simple systems of small freshwater ponds, used for raising herbivorous and filter feeding fish, account for about half of global aquaculture production.

A greater understanding of complex interactions between nutrients, bacteria and cultured organisms, together with advances in hydrodynamics applied to pond and tank design, have enabled the development of closed systems. These have the advantage of isolating the aquaculture systems from natural aquatic systems, thus minimizing the risk of disease or genetic impacts on the external systems.

Developments in engineering, some adapted from offshore oil rig construction, increase the possibilities for a progressive offshore expansion of aquaculture using robust cages. Culture-based capture fisheries involving the release of young fish into the wild to improve harvest (an operation also referred to as restocking, stock enhancement or ranching) have existed for a long time for freshwater and anadromous species such as salmon. Sea ranching, however, has just made a start and its long-term viability is being assessed. Advances have also been made in capture-based aquaculture involving the growing/fattening of young fish (for example tuna) captured from the wild. Potential conflicts with capture fisheries are being assessed. Major progress have also been made in the aquafeeds technology, combining a large number of ingredients into very small pellets.

## Promoting scaling up of innovative aquaculture systems/practices for more sustainable and efficient production

Maw Maw Than, Deputy Director, Department of Fisheries, Myanmar

Aquaculture has a major role in terms of food security and is one of the most important contributors to the national economy of the country. Currently over 20 species of freshwater fishes including common carp, Indian major carps, Chinese carps, tilapia, pangasius and walking catfishes and pacu are being cultured. The Department of Fisheries (DoF) contributes and transfers basic and applicable aquaculture technology to fish farmers and conducts environment-friendly and sustainable aquaculture methods such as Good Aquaculture Practices (GAP) to align with the Guidelines on ASEAN Good Aquaculture Practices (GAqP) for Food Fish and European Union market requirements. To support GAP, the DoF has established directives and regulations for prohibiting the use of chemicals in aquaculture. Though Myanmar is among the top twenty-five aquaculture producers, GAqP is being applied on only 4 439 ha which represents only 3 percent of the total aquaculture farm area. Since the ASEAN guidelines on GAqP aims at preventing or minimizing the risks in food safety, animal health and welfare, environmental integrity and the socio-economic aspects of the aquaculture of food fish, Myanmar needs to accelerate the implementation of GAqP across the country. In terms of aquaculture purposes, biosecurity measures have been issued for both inland and marine aquaculture. The DoF is monitoring the waste discharged from aquaculture ponds and the use of chemicals is restricted.

## Promoting scaling up of innovative aquaculture systems/practices in Nepal

Bhagwat Prasad, Program Chief, National Inland Fisheries and Aquaculture Development Programme, Balaju, Kathmandu and Baikuntha Adhikari, Program Director, Directorate of Fisheries Development, Balaju, Kathmandu

Nepal is a landlocked country surrounded by India on three sides and by China on its north side. It is mainly a mountainous country but it has also a narrow strip of plain land called Terai in its southern part. The climate of the country ranges from tropical in the southern plain of the Terai to Arctic in the snow-covered mountains of the Himalayas. The country is rich in freshwater resources, namely: rivers (395 000 hectares); lowland irrigated rice fields (398 000 hectares); swampy wetlands (12 500 hectares); lakes (5 000 hectares); reservoirs (1 500 hectares); and ponds (11 396 hectares). There are 230 species of indigenous freshwater fish species belonging to 11 orders, 34 families and 104 genera, of which 16 species are endemic and 8 species are catadromous.

The total annual fish production in the country has reached 83 898 tonnes (2016/17), of which 75 percent is contributed by aquaculture and the rest is from inland capture fisheries. The main aquaculture systems practiced at present (2017/17) in the country are: (i) pond aquaculture (carps, pangasius and tilapia 55 842 tonnes from 11 396 hectares); (ii) fish culture in wetland (carps 6 300 tonnes from 3 500 hectares); (iii) cold water fish culture (rainbow trout 315 tonnes from 31 500 square metres of raceways); (iv) cage fish culture (carps 299 tonnes from 71 000 cubic metres); (v) fish culture in enclosures (carps 98 tonnes from 75 hectares); and (vi) fish culture in rice fields (mainly common carp 23 tonnes from 75 hectares). Pond aquaculture contributes nearly 89 percent of the total aquaculture production. Between 2001/02 and 2016/17, the average annual growth rate of the aquaculture production in the country was about 17.8 percent whereas the fish production from inland capture fisheries remained almost stagnant. Three indigenous carp species (*Labeo rohita*, *Cirrhinus cirrhosus* and *Catla catla*) and four exotic carp species (*Cyprinus carpio*, *Hypophthalmichthys molitrix*, *Aristichthys nobilis* and *Ctenopharyngodon idella*) are the main fish species being cultured in ponds using a polyculture system. Some fish farmers have started to culture *Pangasianodon hypophthalmus* intensively in ponds. Although Nile tilapia (*Oreochromis niloticus*) was introduced a few decades ago, it is still being cultured (both sexes together) by a few farmers along with carps in ponds. Rainbow trout (*Oncorhynchus mykiss*) is cultured in cold water (below 20°C) in mid-hill and mountain regions of the country.

The aquaculture productivity in the country is still very low compared to the high productivity practices adopted in other parts of the world. However, some innovative practices (in Nepal's context) are being initiated in the country, for example: (i) rainbow trout farming; (ii) Chhadi fish production; (iii) pangasius farming; (iv) big sized carp production; (v) all-male tilapia monoculture; (vi) periphyton as natural food for fish; and (vii) aquaponics. The government is implementing various support programmes to increase fish production in the country.

## **2.3 Implementing the Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication (SSF Guidelines)**

### **Current status of SSF Guidelines implementation in Cambodia**

Chhuon Kimchhea, Fisheries Administration, Ministry of Agriculture, Forestry and Fisheries, Cambodia

The fisheries sector of Cambodia is a significant contributor to employment and livelihoods of the poor, to food security of the population, and to the GDP and foreign exchange balance of the country. The fisheries sector is also important to small-scale fishers in the country in terms of their socio-economic and cultural development.

The SSF Guidelines have been implemented for more than a decade in the country through community fisheries (CFi) co-management with the government. The CFi/SSF Guidelines principles have been supported with policies, strategy and a legal framework and have been implemented at the ground level with the small-scale fishers.

The Government of Cambodia has taken the pro-active decision to support the implementation of the Guidelines through cancellation of the long-established fishing lots concessions in fisheries. The cancelled fishing lots have been transferred to small-scale fishers to co-manage with the government to ensure their sustainability. This is the main objective of the establishment of CFi and it is in line with the SSF Guidelines. The CFi demonstrate how the small-scale fishers have been involved in the decision-making and implementation of sustainable fisheries and development. The CFi have a clear institutional structure and a mandate from the government on using and managing their resources sustainably.

The introduction of CFi has resulted in many social, environmental and economic achievements. Local communities now recognize and understand the benefits and importance of fisheries resources through direct participation in managing, using and protecting the fisheries resources. They have secured their rights and access to the fisheries resources. Both illiterate and literate people have equal rights and there is no discrimination in becoming a member of the CFi. There is an overall increase of participation of men, women and youth in the fish-related activities and conservation activities. Flooded forests and fisheries resources in the CFi areas are better protected and fish production has increased. Nevertheless, cash income from the fishing activities of CFi members is very modest.

The main lessons learned from this CFi initiative is that co-management of community organizations with the government and development partners can be successful. But without proper financial and technical support to the community fisheries (small-scale fishers), this type of small-scale fishers development will never work because of the limited capacity and resources of rural communities.

There are both constraints and opportunities with respect to the implementation of CFi and this co-management initiative with the government, and with respect to sustainable fisheries resources in the country and in the region as a whole. The Cambodia Fisheries Administration has a target strategy and plans for the development of small-scale fishers and fisheries resources in the country for the next ten years. The government has taken several actions to address the small-scale fisheries problem.

## **Implementing the SSF Guidelines in the Indo-Pacific region: a civil society perspective**

Sebastian Mathew, Executive Director, International Collective in Support of Fishworkers

The implementation of the Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication (the SSF Guidelines) is within the framework of the Blue Growth Initiative of FAO and would contribute to fulfilling the functions and responsibilities of the Asia-Pacific Fishery Commission (APFIC), especially by conserving fishery resources, by keeping under review the social aspects of fishing, by improving living and working conditions of fishers and other workers, and by augmenting the contribution of fisheries to meet economic and social goals.

Discussing small-scale fisheries and the nascent national and regional initiatives towards implementing the SSF Guidelines by several governments and regional bodies, and by providing information on planned civil society initiatives in the region over the next biennium (2018–2019 to 2019–2020), the attention of APFIC Contracting Parties and all relevant stakeholders is drawn to expediting national and regional plans of action for implementing the SSF Guidelines within a human rights-based approach, especially to conserve and manage fishery resources, to promote gender equality, to attain food security, to minimize malnourishment, to progressively eradicate poverty of fishers, fishworkers and their communities in the region and thus to reduce their marginalization.

## **2.4 Innovations in technologies and practices for sustainable fisheries/use of information and communication technology (ICT)**

### **Artificial reef deployment activities for fisheries resources enhancement in SEAFDEC member countries**

Akito Sato, SEAFDEC Deputy Secretary-General

Many Southeast Asian countries have been concerned with declining resources, and thus have mainstreamed coastal fishery resource enhancement programmes in their respective national plans, policies, and legislation. As a result, various resource enhancement measures including deployment of artificial reefs have been adopted to alleviate the declining coastal/marine resources. SEAFDEC has supported various kinds of fisheries resources enhancement activities for the SEAFDEC member countries (MC). Recently, SEAFDEC organized a Regional Technical Consultation on Resources Enhancement in Southeast Asia on 26 April 2018 in Bangkok, aiming to identify the appropriate and effective resources management tools and measures for fishery resources enhancement and habitats rehabilitation for the SEAFDEC MC.

### **Building capacity in the use of information and communications technologies to support small-scale fisheries in Asia**

Alexander Tilley, WorldFish Center

In the past decade since the publication of the FAO's ICTs benefit small-scale fisheries report, there has been very little critical analysis of information and communication technologies (ICTs) in small-scale fisheries (SSF). A new assessment from a user entry point structured according to the guiding principles of the voluntary guidelines (VGs) was carried out by WorldFish Center, with the specific objective of evaluating the current and potential role of ICTs in achieving the objectives of the VGs. The preliminary findings of a global review of ICTs applications in small-scale fisheries shows that the scale of ICT development and adoption matches the regional importance given to SSF, but that technology innovations tend to be lacking in local context and integration, and as such suffer from a design-reality gap.

## Theme 3. Building resilience of fisheries and aquaculture systems

### 3.1 Aquaculture insurance for the resilience of small farm holders

#### Experience from fisheries and aquaculture mutual insurance in China

Sun Shengming, Freshwater Fisheries Research Center, Chinese Academy of Fisheries Sciences, Jiansu, China

Fishery and aquaculture insurance in China has been important for helping farmers cope with natural disasters including: (i) *physical hazards* (flood, drought, storms, cyclones, abnormal temperatures, and so on); (ii) *biological hazards* (diseases, pests, harmful algal blooms); (iii) *chemical hazards* (oil spills, chemical leaks, contaminated run-offs); and (iv) *geological hazards* (landslides, mudslides, tsunami).

China has long experience in providing insurance to fishery and aquaculture since the 1980s. Through time, the expected role of fishery and aquaculture insurance broadened from coping with disasters to good aquaculture practices when awareness was raised among governments and the industries of the opportunities and benefits offered by insurance as a financial tool for risk management: farmers can recover their businesses easier and faster after a disaster; recovery can be combined with better management and new technology; and it lightens the burden on the government who would otherwise be responsible for costly disaster relief, recovery and rehabilitation efforts.

The presentation reports on a variety of insurance arrangements: mutual, commercial, mutual + commercial and cooperative + commercial. The country has greatly improved the insurance organization and efficiency, but still there are limitations in terms of the coverage of fishermen and fish farmers. Fishers and fish farmers used to consider that insurance was necessary only for loss of life, accident injury and catastrophe, not as a risk management measure.

China Fishery Mutual Insurance Association was established in 1994, and is the largest organization of mutual insurance programme providers in China. It realized the importance of insurance awareness and continued to promote mutual insurance for fishery and aquaculture. With the support from the central government and local government, insurance regulations were initiated and the policy insurance programme was carried out in China with great success.

To improve the insurance programme management and ease the production loss assessment, the insurance scheme was diversified in China. Weather index-based insurance (wind speed and temperature) in China for species such as seaweed, mitten crab, and bivalves has provided indications of technical and economic efficiency of administration, reduction of fraud, and proper compensation. The insurance scheme shows its suitability for risks that are the direct impacts of climate variability. A cooperative + commercial model provided incentive to the members of the cooperative to reduce losses from disease with better management practices. In China, the models mutual + commercial and cooperative + commercial have proved successful in finfish aquaculture insurance and shrimp aquaculture insurance. The commercial insurance companies, aside from having well-trained field operatives, rely on the expertise of fishery and aquaculture cooperatives in risk identification and assessment.

Innovative insurance programmes can promote good farm management practices and a risk mitigation approach. Public-private partnership models such as mutual insurance are likely to be feasible in providing insurance services to groups of small farmers.

## **Role and prospects of aquaculture insurance among tilapia fishpond operators in Philippines**

G. Defiesta, Project Consultant, University of Philippines in the Visayas, Miag-ao, Iloilo; J. Scott, Project Consultant, United Kingdom; R. Pagaddu, DA-Philippine Crop Insurance Corporation; D. Borbon, Project staff, DA-BFAR Aquaculture Division and R.C. Ortega, National Project Coordinator, TCP 3503-D

Crop insurance in Philippines started in the late 1970s. It was subsequently formalized for the fisheries sector in 1998, through enabling laws and policy guidelines (Presidential Decree No. 1467 and Republic Act No. 8550). Recently, the Department of Agriculture identified crop insurance as an important disaster risk management strategy in accordance with key national legislation that addresses disaster recovery and climate change adaptation (for example Republic Act No. 10121 and Republic Act No. 9729). Crop insurance remains largely a government funded and managed programme in Philippines.

In view of promoting the adoption of government crop insurance, developing a weather-index based mechanism was investigated, as were the primary issues limiting the subscription by farmers to the already available insurance package for aquaculture. The results of the investigations were the key deliverables under Output Number 4, Innovative crop insurance and financial products/systems to enhance tilapia farmers resiliency identified, which was part of TCP 3502-D, Building capacities for climate resilient tilapia farming in Philippines.

A series of focus group discussions and key informant interviews was conducted with tilapia fishpond operators from Pampanga, Isabela and Camarines Norte. Preliminary farmer observations were gathered using formal surveys. Technical meetings with DOST-PAGASA (the weather bureau) and DA-Crop Insurance Corporation (government insurance provider) were also held.

Although most tilapia farmers are receptive to buying insurance, they are generally not aware how it works, and some are skeptical because of the premium payments that they consider would be a sunk cost if no damage to their crop occurs. Insurance in general is suitable for low frequency fortuitous events whereas the threats identified by farmers (fish kill, for example) occur quite frequently (at least once a year), hence they are more often anticipated rather than unexpected. Consequently, insurance schemes will require high premium payments, which will be expensive for fish farmers. If perils are occurring frequently, then a more appropriate strategy is risk avoidance strategy and/or recovery measures are needed instead of merely insurance systems. DOST-PAGASA maintains a comprehensive and complete historical agro-meteorological database, and stations are geographically well positioned providing coverage to key tilapia farming provinces. Unfortunately, the current DOST-PAGASA recording and securing of weather data remains traditional, consequently, will not pass the scrutiny of insurance and re-insurance service providers. Thus, it is difficult for functional market-driven insurance programmes to succeed. Furthermore, setting up a weather-based crop index insurance programme has yet to overcome key technical concerns as mentioned above.

Government-sponsored crop insurance for aquaculture in general, therefore needs to integrate critical interventions not only to minimize moral hazards but also improve the overall profitability of aquaculture enterprises: (i) improve access to low-cost formal credit; (ii) promote adoption of good aquaculture practices; (iii) popularize community-level early warning systems; (iv) improved zoning of aquaculture areas to avoid high risk areas; (v) other disaster recovery loan programmes; and (vi) overhaul of the programme.

## **Shrimp aquaculture insurance development in Thailand: opportunities and challenges**

Pongpat Boonchuwong and Cherdasak Virapat, Network of Aquaculture Centres in Asia-Pacific

The continuing ability of aquaculture to provide livelihoods for millions of people in Asia and food and nutrition for millions more around the world is threatened by numerous risks. Disease, pollution, extreme events such as typhoons, floods, drought, very high or very low temperature, and other hazards could damage, and indeed have damaged, an entire crop or wipe out the investments and assets of farmers.

Insurance and the accumulation of savings and other assets could reduce the impacts of such losses and improve the ability of farmers. The Royal Thai Government provides supporting measures to relieve the farmers affected by natural disasters. In 2008, the Government of Thailand developed a policy on risk management and an insurance system for agricultural commodities. The National Fisheries Committee came up with a policy to support the development of an aquaculture insurance system. A shrimp insurance policy was developed. However, the process was not continued. Understanding and addressing the issues that affect the viability and sustainability of aquaculture insurance for small farmers remain a major challenge that should be met resolutely. The increasing seriousness of biological, natural and economic risks to aquaculture underline the urgency of providing insurance for aquaculture. Insurance can lighten for governments and donor agencies the heavy financial burden of disaster relief, rehabilitation and recovery. An enabling policy framework is required for the insurance industry to improve the insurance and lower its cost. Reinsurance as a mechanism for risk spread and transfer is well recognized but reinsurers need to be assured that aquaculture is a viable business opportunity. It is desirable to involve reinsurers in the design of insurance products. A study of the demand for shrimp aquaculture insurance by FAO and Kasetsart University from a specific market provides useful information for insurers, reinsurers, technical agencies and representatives of the target client to design an insurance programme.

### **Aquaculture insurance for resilience of small farm holders**

Chau Thi Tuyet Hanh, Directorate of Fisheries of Viet Nam

The pilot programme on agricultural insurance for shrimp farming, rice and pig production piloted by the government took place from 2011 to 2013. The aim of the programme was to compensate farmers for their losses from natural disasters and epidemics, stabilize rural social security and promote production. During 2011 to 2013, there were 7 487 shrimp farming households participating in the insurance pilot programme. The total cost of insurance was VND 883.7 billion, the total premium was VND 0.22 billion, the total loss coverage was VND 0.669 billion. Piloting agricultural insurance has contributed to stabilizing production but this model is only successful for rice and livestock. For shrimp farming, losses from disease outbreaks and natural disasters normally are large scale and cover a large area. Thus, it was beyond the solvency of the insurance company. The lesson learned is that the earlier involvement of functional bodies such as the local government and the insurer in monitoring the technical procedures and identifying losses contributes to a more precise compensation of the beneficiary. There should be support for poor and near poor households. International support is important in the case of large losses from disease outbreaks or natural disasters as it can lead to reinsurance for farmers.

## **3.2 Risk of antimicrobial resistance in aquaculture and required coping strategy and actions**

### **Risk of antimicrobial resistance in aquaculture and required coping strategy**

Maw Maw Than, Deputy Director, Department of Fisheries, Myanmar

Myanmar exports a major share of its aquaculture production and as such is highly dependent on maintaining competitiveness and developing access to highly lucrative export markets. Many importing countries, including the European Union (EU), require exporting countries to have a national food control programme that includes a monitoring programme for drug residues and contaminants. Myanmar has such a programme, which includes the National Residues Monitoring Plan (NRMP) for certain harmful veterinary drugs and environmental contaminants in aquaculture fish and products. This was approved by the Ministry of Agriculture, Livestock and Irrigation (MOALI) and is implemented by the Department of Fisheries. The Residues Monitoring Committee (RMC) is responsible for managing the effective implementation, monitoring and reporting of all NRMP activities. The Department of Fisheries has organized the Work Committee for Authorization and Control of the Use of Veterinary Medicine, Feed and Feed Supplements in Aquaculture (VMFAq- Work Committee) according to Notification No.16/2017 dated

on 31 January 2017. There is no record of antimicrobial use in Myanmar because most fish farmers are practicing an extensive culture system and the use of antimicrobials is non-existent. Consequently they are not aware of antimicrobial resistance.

### **Aquaculture antibiotic use in the United States of America**

Michael Abbey, NOAA Fisheries (NMFS), Office of International Affairs and Seafood Inspection, Foreign Affairs/Asia-Pacific

The Minor Use and Minor Species (MUMS) Animal Health Act, passed in 2004, helps the Food and Drug Administration (FDA) ensure that innovative treatments are available for small populations of animals. This law helps to increase the availability of drugs for minor species, such as ferrets and fish, and for minor uses in a major species, such as to treat certain types of cancer in dogs. Greater access to these MUMS drugs gives veterinarians more options in treating unique species and uncommon conditions.

Reasons for the use of drugs in aquaculture include the need to: (i) treat and prevent disease; (ii) control parasites; (iii) affect reproduction; and (iv) provide tranquilization (for example for weighing).

When a drug is approved by the Center for Veterinary Medicine (CVM), the conditions of the approval are listed on its label (see Title 21 Code of Federal Regulations Part 514.1 – New Animal Drug Applications (21 CFR 514.1)). These conditions specify the species for which the drug is approved for use; indications (disease or other circumstances) for use; dosage regimen; and other limitations, such as route of administration and withdrawal time. Labelled withdrawal times must be followed to ensure that no harmful drug residues are present in the edible tissue of the animal when harvested for human consumption and offered for sale. Tolerances for some drug residues in the edible tissue have been established (21 CFR 556).

The label is important. Aquaculture drugs are approved and labelled for species, indication (disease and/or bacterial organism), rearing conditions (for example freshwater, cold water, warm water), application and directions for use (for example in the feed, immersion or bath), environmental considerations and other important information.

FDA does allow for approved drugs to be used for an unapproved indication or in an unapproved age group, dosage, or route of administration (known as off-label or extra-label use) only under veterinary supervision.

There are no approved antibiotics for use in shellfish (except lobster) and for marine environments. Therefore, any drugs used in that context will constitute extra-label or off-label use.

### **Risk of antimicrobial resistance in aquaculture and required coping strategy and actions in Viet Nam**

Chau Thi Tuyet Hanh, Department of Aquaculture, D-Fish

The excessive use of antibiotics in medical treatment for humans, livestock and aquaculture has led to the growing threat of antimicrobial resistance (AMR) in microorganisms. There is considerable evidence showing that there is a growing threat of AMR in Viet Nam. The World Health Organization has ranked Viet Nam in the group of countries having the highest AMR rate in the world. The National Steering Committee for Prevention and Control of Drug Resistance was established by Decision No. 2888/QD/BYT dated 5/8/2014, covering the period 2016 to 2020 and has 31 members from 4 ministries and 9 sub-committees. Following the Committee's establishment, the Ministry of Agriculture and Rural Development of Viet Nam (MARD) launched the National Action Plan (NAP) for the management of antibiotic use and control of antibiotic resistance in livestock production and aquaculture. The NAP established seven specific objectives, namely: (i) strengthening the governance of AMR and AMU management; (ii) improving the legal basis for AMR and AMU management; (iii) enforcing the legislation in place; (iv) increasing awareness

of AMU and risk of AMR; (v) implementing good practices in animal treatment, animal feeding production and livestock production and aquaculture; (vi) monitoring AMR, AMU and antibiotic residue; (vii) strengthening intersectoral collaboration in AMR management. The detailed coping strategy and action and relevant stakeholders to implement the NAP in the period 2017 to 2020 have been approved by the Minister of Agriculture and Rural Development.

### **Risk of antimicrobial use and antimicrobial in aquaculture in Asia**

Eduardo M. Leaño, Network of Aquaculture Centres in Asia-Pacific

Aquaculture is a rapidly growing industry that currently accounts for almost half of the fish used for human consumption worldwide. Intensive and semi-intensive practices are used to produce large stocks of fish, but frequent disease outbreaks occur, and antimicrobial use (AMU) has become a customary practice to control them.

The WHO defines antimicrobial resistance (AMR) as a microorganism's resistance to an antimicrobial drug that was once able to treat an infection by that microorganism. The occurrence and distribution of antibiotic resistance (AR) in areas designed for fish farming has exponentially increased in the past few decades. Antimicrobial drugs play a critical role in the treatment of diseases, and their use is essential to protect both human and animal health. However, antimicrobials are often misused for treatment and prevention of diseases in the livestock sector, aquaculture and crop production. There is a potential risk of emergence and spread of AMR because antimicrobials can remain in and be transmitted through food, water and waste. AMR can occur and spread across continents in a few hours and can affect the safety of food. The risk is particularly high in countries where legislation, surveillance and monitoring systems are weak or inadequate.

At a high-level meeting on AMR at the 71st UN General Assembly (UNGA, September 2016), the UNGA called upon FAO as global leader for food and agriculture, the OIE as global leader for animal health and welfare and the WHO as global leader for human health and other intergovernmental organizations to support the development and implementation of national action plans (NAPs) and AMR activities at the national, regional and global levels under the One Health platform. The FAO Action Plan on AMR 2016–2020 supports the implementation of the Global Plan of Action on AMR adopted during the 68th World Health Assembly in May 2015 by addressing four major focus areas, namely: (i) awareness – improving awareness on AMR and related threats; (ii) evidence – developing capacity for surveillance and monitoring of AMR and AMU in food and agriculture; (iii) governance – strengthening governance related to AMU and AMR in food and agriculture; (iv) best practices – promoting good practices in food and agricultural systems and the prudent use of antimicrobials. Enhanced efforts are now underway to support FAO members in the development and implementation of the food and agriculture components of the NAPs on AMR.

NACA have been working to document and characterize AMU in the aquaculture sector, including current and proposed practices in aquaculture and aquatic disease status in Asia. It has also carried out a review and a comparative study of AMU and practices in the aquaculture sector on selected aquaculture species in Indonesia, Myanmar, Thailand and Viet Nam and has developed a plan for applying the methodology in other countries in Asia. It also recently started a process for organizing a regional consultation and related study on AMR risk related to aquaculture in Asia in support of SO2: Making agriculture, forests and fisheries more productive and sustainable, SO5: Increase the resilience of livelihoods to threats and crises, FAO Asia-Pacific regional initiative for Blue Growth and FAO Asia-Pacific's One Health Initiative.

### **3.3 Lessons and experiences on risk management, disaster risk management (DRM), and climate change adaptation (CCA) for resilient fisheries**

#### **Lessons and experiences on risk management, disaster risk management (DRM) and climate change adaptation (CCA) for resilient fisheries in Bangladesh**

A.K.M. Aminul Haque, Director (Marine), Department of Fisheries, Bangladesh and MD Abu Bakar Siddique, Deputy Director, Ministry of Fisheries and Livestock, Bangladesh

Climate change and its impacts on natural disasters have become a serious global concern. It is a particularly prominent concern in Bangladesh. Risk Management (RM), Disaster Risk Management (DRM) and Climate Change Adaptation (CCA) are three key management and adaptation tools for climate-resilient fisheries that have been adopted worldwide. These tools were introduced into Bangladesh in the early 1970s through different projects. Some lessons learned from and experiences with such projects are: (i) Fisheries Rehabilitation Programme (Norwegian Agency for Development Cooperation (NORAD), 1972–1975); (ii) Mechanization of Country Fishing Boats (Union of Soviet Socialist Republics (USSR) – Japan International Cooperation Agency (JICA), 1974–1978); (iii) Boat Building and Mechanization (Danish International Development Agency (DANIDA), 1974–1980); (iv) Empowerment of Coastal Fishing Communities for Livelihood Security (Bangladesh (BGD)/97/017); (v) United Nations Development Programme (UNDP) (1999–2006); (vi) Bangladesh Marine Fisheries Capacity Building Project (Islamic Development Bank (IDB), 2007–2017); and (vii) Emergency 2007 Cyclone Recovery and Rehabilitation Project (World Bank, 2009–2014) are worth mentioning. The most important effects of climate change in open water capture fisheries are: (i) change in habitat; (ii) loss of habitat; (iii) disease outbreak; (iv) hindrance to migration routes; (v) loss of genetic diversity; (vi) reduced biodiversity; (vii) reduced reproduction; and (viii) reduced production. The impacts of climate change on fisheries include cyclones, tidal surges, inland and coastal flooding, droughts, salinity intrusion, changes of river beds because of sedimentation and morphological processes, which in turn affect fish and fisheries at different levels. Climate change imparts adverse impacts on the outbreak of new diseases. Erratic and irregular rainfall and change in temperature affect the readiness, maturity, gonadal development and ovulation of fish followed by reduced hatching and survival rate of spawns, growth and recruitment, which in turn reduces fishery production. The people of Bangladesh have been early adopters of RM, DRM and CCA to deal with the risk and effects of floods, droughts and cyclones. The promotion of salt-tolerant and short duration high-yield varieties, fencing and dyke raising of ponds, aquaculture in floating net cages and introduction of innovative climate-smart aquaculture systems are climate-resilient adaptations for aquaculture. In terms of mechanization, redesigning fishing boats and dredging of river beds have been important. Support has been received from the Climate Change Resilient Fund for the poor fishers so as to build their capacity to engage in climate resilient fisheries.

#### **Bhutan: climate change, adaptation and disaster risk management in fisheries**

Singye Tshering, Program Director, National Research Centre for Riverine and Lake Fisheries Department of Livestock, Ministry of Agriculture and Forest, Bhutan

Bhutan is a landlocked country situated between two giant nations, India in the south and China in the north. The water resources include, rivers, streams, man-made reservoirs (hydropower reservoirs) and high altitude lakes. The country's inland fisheries comprise both aquaculture and wild fisheries.

However, as the scale of production from both aquaculture and wild fisheries is small they may be considered as small-scale aquaculture and small-scale fisheries. The country's total fish production in 2017 was a little over 200 million tonnes.

Wild fishery is a new concept in Bhutan. Fish production from wild fisheries, although small scale, started only from 2010 with the development of two community-based river fishery programmes. This does not include the production of fish through illegal fishing. As of 2018 there are seven communities. As these people are mostly part-time fisherman they also engage in other activities such as animal husbandry and agriculture for their livelihoods.

Such being the case, the impacts of climate change on their livelihoods has not been much of a concern as these communities are engaged in diverse activities. Although there may be impacts of climate change on aquatic ecosystem and fish biodiversity, no proper study has been done in Bhutan to assess that.

Given the increasing interest in fisheries from different communities across the country with increasing demand for food fish, the prospect of the engagement of more communities in fisheries and eventually their reliance on fisheries for their livelihoods is high. Therefore, it is important that issues such as climate change, adaptation and risk management are considered in the fisheries system.

As far as the institutional framework is concerned, Bhutan has agencies such as the National Environment Commission, the Department of Disaster Management and the Ministry of Agriculture and Forests. They have produced National Adaptation Programmes of Action and a National Disaster Risk Management Framework, which looks at all aspects of impacts of climate change and adaptation and disaster risk management. However, for fisheries the challenge remains in mainstreaming fisheries into climate change, adaptation, risk management as is being done for livestock and agriculture.

### **Experiences of disaster risk management (DRM) in China**

Huang Hongliang, East China Sea Fisheries Research Institute, Chinese Academy of Fishery Sciences, Shanghai, China

China is one of the rare sufferers from marine disasters in the world. In recent years, marine disasters such as storm surges, red tides, sea ices, sea level rise, have caused significant economic losses, and many people are suffering from these kinds of disasters. Among these, storm surges are the severest marine disaster in the coastal areas in China. Through establishing an ecological shelterbelt along the coastal zone and a project to raise the standards of protection, developing a monitoring and forecasting system for marine disasters, and sharing the data and information about marine disasters, China was able to decrease the chances of marine disasters occurring and reduce the losses from marine disasters.

Marine disasters, including storm surges and ocean waves left 17 people dead or missing in 2017, according to a recent State Oceanic Administration (SOA) report. The death toll marked a sharp decline from the previous year when 60 people died or were reported missing. In 2017, direct economic losses caused by marine disasters amounted to CNY 6.4 billion (about USD 1 billion dollars), of which 87 percent was caused by storm surges, according to the same report. Guangdong Province was hit economically by storm surges, with direct economic losses of CNY 5.36 billion (about USD 850 million). In 2017, both the death toll and the economic losses were below the average of the last ten years, according to the report.

In response, China's measures for disaster prevention and reduction mainly include:

(i). Establishing an emergency response mechanism

- a. Pre-disaster prevention
- b. Forecast warning
- c. Emergency disposal
- d. Continued control
- e. Recovery

(ii). Establishing a fishery insurance system

Fishery insurance is an important part of any fishery disaster prevention and mitigation system. It requires unified design, unified deployment, policy support and funds for comprehensive security.

In 2017, the guarantee capacity of fishery mutual insurance will be improved steadily. The national fishery mutual protection system covers 850 000 fishermen, 64 000 fishing boats and 39 333 ha of water surface. It provides more than CNY 350 billion in risk protection. The amount of economic compensation was nearly CNY 800 million.

(iii). Improving ability to prevent and mitigate natural disasters

Converting some of the natural good fishing ports into tertiary and secondary fishing ports will help to reduce the impacts of typhoons and improve the ability of fishing boats to avoid and mitigate natural disasters.

(iv). Improving coordination and cooperation among departments

- a. strengthening coordination and cooperation among departments, and giving full play to the management synergy – jointly promoting the security of fishery production;
- b. strengthening cooperation with meteorological and marine environmental monitoring departments – improving the monitoring and early warning system for fishery disasters; and
- c. establishing a mechanism for the sharing of disaster monitoring and early warning information.

### **Lessons learned from the Ockhi cyclone in India**

Sanjay Pandey, Assistant Commissioner (Fisheries), Department of Animal Husbandry, Dairying and Fisheries, Ministry of Agriculture and Farmers' Welfare, New Delhi, India

The main authorities dealing with disaster and risk management in India include the National Disaster Management Authority (NDMA) and the National Disaster Response Force (NDRF) under the Ministry of Home Affairs (MHA), the Indian Meteorological Department (IMD), the Indian Navy and Coast Guard under the Ministry of Defence (MOD) and the State(s) Disaster Management Authorities (SDMAs). A system exists for the release and dissemination of fishermen's warnings, port warnings, coastal weather bulletins and sea area bulletins. A four-stage warning system is in place, viz. pre-cyclone watch, cyclone alert, cyclone warning and post-landfall outlook. A Regional Specialized Meteorological Centre (RSMC) is located in New Delhi for naming of tropical cyclones in the Arabian Sea and the Bay of Bengal, which issues tropical weather outlooks, advisories and warnings of tropical cyclones for the benefit of panel countries such as Bangladesh, Maldives, Myanmar, Oman, Pakistan, Sri Lanka and Thailand. The Indian National Center for Ocean Information Services (INCOIS) is mandated to establish, maintain and provide the best possible ocean information and advisory services to society, the coastal population, fishermen, industry, government agencies and the scientific community. The Indian Space Research Organization (ISRO) has launched dedicated satellites for disaster management applications, for climate and environmental applications, earth observation, communication and disaster management. The NDMA, which is an apex body that lays down the policies, plans and guidelines for disaster management to ensure timely and effective response to disasters has formulated: the National Policy on Disaster Management 2009; the National Disaster Management Plan (NDMP) 2016; the National Disaster Management Guidelines: Preparation of State Disaster Management Plans 2007; the Model Framework for District Management Plan 2014; and the Compendium of Laws on Disaster Management 2015. India has also launched a National Cyclone Risk Mitigation Project (NCRMP) and has mapped the cyclone hazard prone areas for preparedness and planning.

Cyclone Ockhi originated on 28 November 2017 in the southwest bay off Sri Lanka and affected the coast of Tamil Nadu, Kerala and Lakshadweep and caused a high magnitude of destruction and the death of more than 104 fishers. The devastating impact of Ockhi provides lessons and experiences on disaster risk management and climate change adaptation for resilient fisheries and also warrants a relook at the country's disaster response system. Two uncommon features of cyclone Ockhi were noted, viz. its rapid intensification in a short span of time from a deep depression into a cyclonic storm and its long gestation period of 6.75 days (against an average of 4.7 days in the North Indian Ocean). Post-Ockhi analysis was made by authorities to take stock of mid-sea communications with the fishermen and to work out the way forward by understanding the failures and lessons from Ockhi. It was noted that effective communication with outbound fishermen could not be established during the Ockhi cyclone. It was learned that the last mile of connectivity and the successful dissemination of information are very important in disaster management. Taking lessons from Ockhi, requisite initiatives have been adopted for deep sea

communications by ISRO and INCOIS. The Navigation Satellite Communication System – NavIC – app has been developed, which is configured in local languages for fishers. It was learned that the format and content of the messages should be simple, easily understandable and cater to a large number of fishers. Moreover, there should be separate messages for fishers who have already ventured into the mid sea. This device and app can effectively track the fishing vessels and send messages till 800 nm to 900 nm. The possibilities of linking of requisite communication devices with the registration and renewal of fishing licenses were also felt necessary for effective implementation.

### **Lessons and experiences of risk management, disaster risk management (DRM), and climate change adaptation (CCA) for resilient fisheries**

Hadzley Harith, Fisheries Research Institute, Batu Maung, Penang, Department of Fisheries, Malaysia

Disaster in general may be classified into three categories of events: (i) natural (hydro meteorological); (ii) technological (technological failure); and (iii) complex emergency (military action/internal or external conflict). Successful management and mitigation of these events is the ultimate goal. Malaysia has had considerable experience and has learned from these three types of disasters since independence. Each disaster was studied and several new policies were introduced and some new agencies were formed, for example the National Disaster Management Agency (NADMA) and the East Sabah Security Command (ESSCOM). In terms of food security, climate change has been studied seriously and this has led to new policies such as the National Policy on Climate Change 2010, the National Agro-Food Policy 2011–2020 and the National Plan of Action for the Management of Fishing Capacity (NPOA) 2015–2020. Two approaches were outlined for the NPOA namely: (i) developing appropriate strategies (effective conservation, strengthening capacity and capability for monitoring and surveillance); and (ii) implementation, monitoring and evaluation (public awareness and education programmes). Several management measures were adopted to manage the fishery resources such as: licencing (fishermen, fishing gears, boats/vessels); restructuring the ownership patterns; fishing zoning system (conservation zone, Zone A, B, C and C2); conservation and rehabilitation of the marine ecosystems (artificial reefs of various designs and types); encouraging relocation of fishers into other economic activities (buy-back scheme for inshore trawl-net boats in Kedah); and research and development in fisheries (currently being conducted by the Fisheries Research Institute). Some of the disasters had a direct impact on fishermen and the local fishery industry such as the Indian Ocean tsunami of 2004 that affected traditional fishermen and coastal fish cage culture in Penang and Kedah. They were given support (including capacity building) and resettlement through various relief programmes organized by the government and non-governmental organizations. The Lahad Datu standoff of 2013 (a military conflict involving militants from Philippines) affected local fishermen and seaweed culturists in Semporna, Kunak, Lahad Datu, Sabah. The affected fishermen were given the same support as the tsunami victims to help them to recover and strengthen their livelihoods. As can be seen from these disaster events, risk management and mitigation has been a priority of the Government of Malaysia. Several new and revised policies were also implemented as guidelines for a resilient fishery sector.

### **Climate change implications and adaptation for fisheries and aquaculture in Myanmar**

Aye Aye Zaw, Department of Fisheries, Ministry of Agriculture, Livestock and Fisheries, Myanmar

The fisheries and aquaculture sector in Myanmar is important for food and nutrition security and the economy. Climate change is forecast to have a significant impact on the sector. For capture fisheries (marine and inland) these impacts include changes in sea surface temperature, higher inland water temperature, changes in ocean currents, changes in the frequency of El-Niño Southern Oscillation (ENSO) events, sea level rise and changing levels of rain and water availability. Climate change impacts are the major threats to fishers and farmers and these can devastate their lives and assets. Cyclone Nargis in 2008 was the most destructive cyclone in Myanmar's history and since that event the fisheries sector has faced numerous challenges because of the lack of capacity, high vulnerability of communities, and the lack of climate-resilient practices in the region. During March, April and May, the temperature was so high – up

to 44°C – and pond water temperatures reached 38°C to 40°C resulting in the mass mortality of fish in fish farms. The Department of Fisheries (DoF) raised awareness of fish mass mortality and appropriate measures to take through various levels of the DoF and the Myanmar Fisheries Federation and also through various media such as television, radio, newspapers and journals.

### **Lessons and experiences of risk management, disaster risk management and climate change adaptation for resilient fisheries in Viet Nam**

Nguyen Mai Huong, Directorate of Fisheries, Ministry of Agriculture and Rural Development

#### (i). Viet Nam legal documents on disaster management

- Law on Disaster Prevention No. 33/2013/QH13 dated 19/6/2013.
- Decree No. 14/2010/ND-CP dated 17 February 2010 of the Government of Viet Nam stipulating the organization, tasks, powers and coordination mechanism of the Central Steering Committee for Flood and Storm Prevention and Control.
- Decision No. 264/2006/QD-TTg of the Prime Minister stipulating the regulation on announcement of earthquake and tsunami warning.
- Decision No. 78/2007/QD-TTg dated 29 May 2007 of the Prime Minister stipulating the regulation on earthquake and tsunami prevention.
- Decision No. 172/2007/QD-TTg dated 16 November 2007 of the Prime Minister, approving the Strategy for Natural Disaster Prevention, Response and Mitigation to 2020.
- Decision No. 133/2009/QD-TTg dated 3 November 2009 of the Prime Minister stipulating the regulation on information of warning and forecast of natural disasters at sea.
- Decision No. 2139/2011/QD-TTg dated 5 December 2011 of the Prime Minister approving the National Strategy for Climate Change.

#### (ii). Disaster management government agencies of Viet Nam

##### a. Viet Nam Disaster Management Authority under the Ministry of Agriculture and Rural Development (MARD)

Its main tasks are:

- to consult with MARD on issuing legal documents, mechanisms and policies related to disaster prevention and control; and
- capacity building on disaster prevention and control, promoting international cooperation on disaster prevention and control.

##### b. The National Committee for Search and Rescue, an inter-Ministries agency

Its main tasks are:

- to assist the Prime Minister in directing and coordinating the search and rescue activities – nationwide and regional – and strengthen international cooperation in performing the search and rescue activities; and
- to direct the steering committee for disaster prevention and control under the government ministries and the province to perform the search and rescue activities.

#### (iii). Actions/Measures to be taken for disaster risk management

- develop a national strategy for disaster prevention and control;
- build capacity of disaster management agencies from central to local levels and search and rescue forces;
- apply scientific and technological advances and techniques in performing natural disaster prevention and control;

- complete the communication system and the management of fishing vessels operating on the sea;
- raise community awareness in performing disaster prevention activities;
- promote community-based disaster risk management: participation of the community in disaster prevention activities;
- check and adjust the layout of storm shelters for fishing vessels before the rainy season; and
- strengthen the fishing vessels registration system, inspect the technical safety of fishing vessels, the safety equipment and update weather information before going to sea.

(iv). Specific threats/risks of climate change

Climate change causes a rise of temperature on surface water, reducing the amount of oxygen, leading to changes in the reproductive performance of marine species, most of which are negative in species' volume (especially shrimp). Therefore the food chain of seafood species is also declining. Because of temperature changes, coral reefs in some areas in the central provinces have died, so that the habitat of marine species is narrower, affecting ecosystem structure and function, for example mangroves and sea grasses.

Climate change is changing sea currents, salinity, sediment thickness and is having a remarkable impact on the migration of aquatic species, fluctuations of marine resources, and inherent biodiversity.

The negative impacts of climate change include natural disasters such as terrible storms, unexpected cyclones, floods, that have destroyed fishery infrastructure such as fishing ports, fish landing sites and fishing boats leading to huge human and financial losses for the fisheries industries.

(v). Viet Nam's efforts to build climate change adaption to fisheries

a. National strategy and action plan development: The Vietnamese Government and MARD have issued many important strategies and policies to cope with climate change. These include:

- The strategies and policies approved by The Prime Minister: The national target programme to respond to climate change; the national climate change strategy; the national target programme to cope with climate change in the period 2012 to 2015; the national action plan on climate change for the period 2012 to 2020.
- The strategies and policies approved by the Minister of Agriculture and Rural Development: The plan of training staff in the agriculture and rural development (ARD) sector and the community on mitigation and adaptation to climate change; the action plan to respond to climate change in the ARD sector to 2020 and vision to 2050; integrate climate change elements in the formulation and implementation of strategies, master plans, programmes, projects in the period 2011 to 2015; the project to reduce greenhouse gas emissions in agriculture and rural areas to 2020; the plan to cope with climate change in the period 2012 to 2020; building a community model to actively prevent and mitigate natural disasters and adapt to climate change; the plan for implementation of tasks under the national target programme to respond to climate change.

b. Programme/project activities addressing climate change in fisheries, covering both adaptation and mitigation:

In the period 2011 to 2015, the total number of tasks identified in the action plan to respond to climate change in agriculture and rural development was 54 with the proposed budget about USD 2.1 million from the national budget. The Coastal Resources for Sustainable Development Project (CRSD) received a USD 117.9 million loan from The World Bank.

Specific solutions/activities have been implemented: development of policies to restructure fisheries production in adapting to climate change; integration of issues of climate change into a review of fisheries development planning; development of integrated technical solutions for sustainable fisheries;

development of community models which actively prevent and mitigate natural disasters and adapt to climate change.

(vi). Difficulties in building climate change adaptation to fisheries

To overcome some of the difficulties encountered:

- strategies and action plans should be more detailed and be concentrated in vulnerable areas;
- the communities' awareness of climate change should be improved; and
- an adequate budget should be allocated for climate change adaptation and mitigation.

(vii). Recommendations on regional strategy and actions to support the national effort to build climate resilient fisheries

It is recommended to:

- build a common regional vision of climate change adaptation and mitigation in fisheries;
- develop a regional strategy for adaptation to climate change;
- implement regional projects on climate change adaptation and mitigation in fisheries;
- promote international cooperation for a project on capacity building for disaster risk management, especially the risks associated with climate change
- collaborate and share experiences and information on preventing and controlling disaster in the region;
- establish the national and regional network for emergency rescue; and
- call for support to carry out the training programme on site rescue for survival.

### **Lessons and experiences of climate change adaptation for resilient marine fisheries in India**

Bay of Bengal Programme Inter-Governmental Organisation, Chennai, India

Marine fisheries in India forms an important component of the national economy, generating income, employment, livelihoods, and food and nutritional security for a large population. In recent years, evidence is accumulating that climate change poses one of the major threats to the sustainability of fisheries. Scientific studies have shown that climate change impacts fisheries at ecological and social levels. At the ecological level, responses of different fish species indicate that climate change increases vulnerability of fish populations, thereby negatively affecting their abundance. In turn, this reduces fish catches and economic profitability from fishing, with negative impacts on the social and economic conditions of fishers, traders and others in the supply chain. In addition, climate change increases the vulnerability of coastal communities and infrastructure to flooding, sea level rise and storm surges, and increases risks associated with fishing. As vulnerability to climate change involves social and ecological factors, efforts to develop a long-term socio-ecological resilience approach on two levels is vital: (i) improving the resilience of fish populations by adopting effective fisheries management measures; and (ii) improving the resilience of fishing communities by adopting effective livelihood and life protection measures. For improving the resilience of fish populations, it should be recognized that climate change and fishing are strongly interrelated pressures on fish production and have to be addressed jointly. Hence, it is important to reduce/optimize fishing mortality of fully exploited or overexploited fish stocks by regulating fishing effort, mainstreaming biodiversity conservation in production processes, and adopting species-specific and area-specific management plans. Appropriately regulated fisheries leads to higher sustainable catches and increases economic profitability. For increasing the resilience of fishing communities, it is necessary to: (i) adopt disaster risk management strategies; (ii) support integrated resource management; (iii) improve awareness on climate change; and (iv) promote context-specific and community-based adaptation strategies. Although generalized strategies at the national level are necessary to build the resilience of fish species and fishing communities, it has been found that there are large location-specific variations within the country in the response of fish species as well as fishing communities to climate change. Therefore, it

is critical to develop local measures to build resilience and adaptive capacity to ensure that resource-dependent communities are able to cope with the immediate and long-term effects of climate change. As the impact of climate change is steadily increasing, fisheries management needs to understand these complex dynamics to build resilient systems for the future.

## **Theme 4. Gender-sensitive and inclusive fisheries and aquaculture value chains**

### **4.1 Enhancing woman's role and benefit sharing along the aquaculture value chain**

#### **Women in aquaculture in Philippines: seaweed sector**

Irma F. Ortiz and R.C. Ortega, Aquaculture Division, DA-Bureau of Fisheries and Aquatic Resources, Diliman, Quezon City

Seaweed is the major commodity being produced in the aquaculture sector in Philippines involving more than 200 000 fisher families or more than a million individuals along the seaweed producing coastal areas. Filipina women are notably active in almost every segment of the extensive value chain of the local seaweed industry. The majority of the women are involved in seaweed production, specifically sourcing and tying the seaweed propagules to be installed in the farm, and drying (post-harvest) the harvested seaweeds. Processing of seaweed products is another livelihood that women are now actively engaging in. The Department of Agriculture, Bureau of Fisheries and Aquatic Resources (DA-BFAR) through its regional and provincial offices scaled up its non-carrageenan seaweed product development programme engaging mostly women and youths. Another key milestone in the seaweed sector is the formation and strengthening of seaweed farmers into cooperatives, particularly on the island of Palawan. The project aimed to strengthen their capacity to become entrepreneurs through establishing marketing cooperatives. A case in point is the Quinluban Islands Agutaya Fisherfolk Marketing Cooperative (QIAFMC), founded and currently chaired by a woman, Ms Mila Quiñones. Formerly, these individual seaweed farmers were generally very poor and were heavily indebted to trader/financiers. Over the last five years, they proved that they could overcome poverty by conquering all the challenges facing them to achieve the success that their cooperative, QIAFMC, has attained today. From 38 members with only PHP 38 000 starting capital, to 358 members and current cash assets of PHP 1 800 000 and modest property of a 1 000 m<sup>2</sup> multi-purpose warehouse of the cooperative office. The cooperative on average produces 500 to 600 tonnes of raw dried seaweeds at any given time. Recently, QIAFMC secured a production loan from DA-BFAR of PHP 1 500 000 to scale up their production. The BFAR is now presently expanding this project in other seaweed producing provinces with the assistance of QIAFMC leaders such as Ms Mila Quiñones. Supporting the participation of women in this industry can be an effective strategy to improve the lives of this gender in the countryside.

#### **Enhancing woman's engagement and benefit sharing along aquaculture value chains: insights from WorldFish**

Compiled by Cynthia McDougall and presented by Alexander Tilley, WorldFish Center

Gender equality and the empowerment of women and girls is a key contributor to growing and strengthening national, regional and global economies, and an established pathway to enhanced household nutrition. In fisheries and aquaculture, women comprise approximately 50 percent of the workforce, where they can represent as much as 90 percent of processing jobs. Women's roles in the value chain are significant, yet they face substantial challenges in achieving equitable benefits and decision making. These challenges are underpinned by gender norms and power relations within social and economic contexts, which drive lesser access to training and extension opportunities and limited control

of assets and resources. The recent work of WorldFish and partners to highlight case studies and methodologies for improving women's empowerment in fisheries and aquaculture led to a number of key recommendations including: conducting more empirical research to generate high quality, gender disaggregated data on employment and entrepreneurship, and to analyze value chains through a gender lens; promoting a greater understanding of the barriers to women's control of key assets and time and labour burdens in value chains; exploring ways to mitigate risks of entering, staying and progressing in value chains; and exploring pathways to learn from successful value chain interventions. These recommendations can inform the development of policy that enables gender equal access to and control of resources in fisheries and aquaculture.

## **4.2 Actions, experiences, and lessons on value addition, reducing food loss, improving access to markets and trade, and promoting gender equality in capture fisheries value chains**

### **Experiences of value addition, reducing food loss, improving market access and promoting gender equality**

Hawwa Raufath Nizar, Research Officer, Ministry of Fisheries and Agriculture, Malé, Republic of Maldives

The key pillars of the Maldivian Fisheries Policy Framework include: banning net fishing for tuna (purse seine and gill nets); increasing profit through eco-labelling (Marine Stewardship Council (MSC) certification); exploring new markets for tuna; promoting the one-by-one (pole and line fishing) sustainable fishing approach; ensuring only local fleets fish in the Maldivian exclusive economic zone (EEZ); promoting value addition in the processing sector; and using the fisheries promotion board to promote fisheries. With the changes in the global market, and the move towards allocation of marine resources, Maldives is keenly aware that value-added seafood products are becoming all the more important. Some of the value-addition initiatives by the Government of Maldives include research that empowers small-scale processors to get more value for their product, for instance, an ongoing project focusses on hot water sterilization, rather than retort sterilization (high investment) to increase the storability of vacuum packed dried fish. Some of the value-addition initiatives such as the ongoing work to establish refrigerated seawater systems on vessels and ice plants in each atoll, as well as promoting the use of tuna parts that are otherwise thrown away by using them as fishmeal (animal feed, fertilizer), also serve to reduce food loss and wastage. Furthermore, the distribution of equipment and training to ensure the quality of the products, has also been carried out. Maldives has also increased its focus on branding the fisheries via obtaining and retaining sustainability and ethical certifications, such as the MSC certification and the Fairtrade certification. The prestige of both labels allows for access to niche markets and an associated increase in value per unit. In terms of improving market access, one of the greater successes has been the establishment of a fisheries information system, an online database designed to share data from all aspects of a fishery, which promotes traceability and the easy flow of information across both sides of the value chain. Women are an integral part of the Maldivian fisheries sector, despite not being involved in the primary harvest sector. They are now increasingly in positions of power in processing facilities and vessel construction facilities. Women are also active in distribution and marketing, with women's fisheries cooperatives between and within islands enabling female entrepreneurs to expand market access. The government is currently carrying out a preliminary survey to collect gender-disaggregated data to gauge the involvement of women in the fisheries sector. It is hoped that this will further inform the policy making process in the future.

## **The United States of America's Seafood Import and Monitoring Program and USAID work**

Michael Abbey, NOAA Fisheries (NMFS), Office of International Affairs and Seafood Inspection, Foreign Affairs/Asia-Pacific

The United States of America's Seafood Import Monitoring Program – also known as SIMP – established permitting, data reporting, and record keeping requirements for the importation of 13 priority species of fish and fish products into the United States of America commerce identified as being especially vulnerable to illegal, unreported and unregulated (IUU) fishing and/or seafood fraud. The objective of SIMP is to combat IUU fishing and seafood fraud. The final rule thus requires importers to report certain information upon entry into the United States of America and retain other information that allows the shipment to be traced back to the point of catch or harvest in order to prevent the country's market being used as a place to sell fraudulently marketed seafood or seafood products produced from IUU fishing.

The National Oceanic and Atmospheric Administration (NOAA) stayed the effective date of SIMP for shrimp and abalone species until comparable reporting and recordkeeping requirements for domestic aquaculture production have been identified or established. The mandatory compliance date for shrimp and abalone will be no later than 31 December 2018. NOAA intends to continue to offer technical guidance to exporting nations and industry to support SIMP implementation, subject to the availability of resources.

Additionally, NOAA and the United States Agency for International Development (USAID) work together with our partners in SEAFDEC and the Coral Triangle Initiative on Coral Reefs, Fisheries and Food Security (CTI-CFF) on the ecosystem approach to fisheries (EAF), marine spatial planning, combatting IUU fishing through Port State Measures and other issues that impact, Southeast Asia but all other regions too. The focus in the last year of the partnership between USAID and NOAA will be on developing tools and a curriculum that supports our Asian partners in their efforts to manage fisheries through EAF as well as include catch documentation and traceability components.

## **Marine Mammal Protection Act, catch documentation and traceability**

Michael Abbey, NOAA Fisheries, the National Marine Fisheries Service (NMFS), Office of International Affairs and Seafood Inspection, Foreign Affairs/Asia-Pacific

The United States of America's National Marine Fisheries Service (NMFS) has published its final List of Foreign Fisheries (LOFF) for 2017, in accordance with the country's Marine Mammal Protection Act (MMPA) regulations implementing the fish and fish product import provisions governing marine mammal bycatch associated with fisheries that supply imports to the United States of America. The Federal Register Notice for the final LOFF has been published. The List of Foreign Fisheries (LOFF) classifies fisheries based on the frequency of marine mammal bycatch in commercial fisheries exporting fish and fish products to the United States of America.

In order to develop the LOFF, NMFS identified harvesting nations with such commercial fishing operations and classified those fisheries based on their frequency of marine mammal interactions as either exempt or export fisheries. Export fisheries are foreign commercial fishing operations that have more than a remote likelihood of incidental mortality and serious injury with respect to marine mammals in the course of its commercial fishing operations. Exempt fisheries are foreign commercial fishing operations that have a remote likelihood, or no known, incidental mortality and serious injury with respect to marine mammals in the course of commercial fishing operations. It is critical that harvesting nations review and understand the implications of the LOFF and the requirements of the MMPA import provisions.

After receipt of the LOFF, harvesting nations have until 31 July 2019 to submit a progress report to NMFS detailing their efforts to develop and implement regulatory programmes for reducing incidental mortality and serious injury with respect to marine mammals in these fisheries. Guidance for submitting a progress

report will be provided early in 2019. NMFS will use information from this progress report to revise and publish an updated draft and final LOFF in 2020. All harvesting nations must apply for a comparability finding for all fisheries included in the LOFF by 1 March 2021.

To continue exporting fish and fish products from these fisheries to the United States of America after 1 January 2022, all nations must have a comparability finding for all fisheries listed on the LOFF. The conditions to receive a comparability finding for export and exempt fisheries are set out in the rule in section 216.24(h)(6)(iii). Both exempt and export fisheries must obtain a comparability finding. Failure to receive a comparability finding for any fishery on the LOFF will result in import prohibitions for the fish and fish products from that fishery beginning in January 2022.

On the discussion of Catch Documentation and Traceability, the focus is on the USAID Oceans and Fisheries Partnership, in conjunction with SEAFDEC, to apply a system that enhances national efforts to meet the data requirements of importing countries. The USAID Oceans and Fisheries Partnership (USAID Oceans) Catch Documentation and Traceability (CDT) system will help answer the questions of who, what, when, where, and how fish are captured, landed, processed, transported, and ultimately brought to market. The CDT system will be an electronic, transparent, auditable trail of information and data that documents a catch's path through the entire seafood supply chain, from bait to plate. The CDT system will include information about fishing licenses and permits, fishing vessel monitoring, catch verification, and chain of custody for the catch – from the fishing vessel to the point of sale. The system will be an interoperable, open-source, and transparent system that takes advantage of available technologies, such as satellite automatic identification systems, barcoding or radio-frequency ID tags, and mobile technologies.

USAID Oceans' CDT system will inform the governance and science of sustainable catch and fisheries management and serve as a deterrent to IUU fishing. A CDT system fills a fisheries data gap by providing a means to collect, analyze, and communicate the environmental, economic and governance data necessary for sustainable management of fisheries. The accurate, verifiable data produced through the CDT system will empower fishers to report catch and plan future trips; allow scientists to better understand fisheries dynamics; and assist government regulators to make informed decisions on fisheries management, enforcement actions, trade, border and port inspections.

With this data, governments will be better equipped to address issues of overcapacity in fisheries and to combat IUU fishing. Furthermore, requiring seafood to be fully traceable using a transparent CDT system reduces the incentives for IUU fishing by serving as a deterrent to bringing illegally sourced fish into supply chains and to market.

### **USAID Oceans and Fisheries Partnership: gender integration strategies**

Len Garces, Fisheries Management Specialist, The Oceans and Fisheries Partnership (USAID Oceans)

The Oceans and Fisheries Partnership (or USAID Oceans, a collaboration between USAID Regional Development Mission for Asia and the Southeast Asian Fisheries Development Center) is a five-year activity working to strengthen regional cooperation to combat IUU fishing and conserve marine biodiversity in the Asia-Pacific region. USAID Oceans is working to advance the integration of gender considerations into regional, national and local laws, plans, development approaches, as well as promote the development of gender specific policies as appropriate. With its regional partners, the Southeast Asian Fisheries Development Center (SEAFDEC) and the Coral Triangle Initiative on Coral Reef, Fisheries and Food Security (CTI-CFF), have undertaken a number of initiatives, including the formation of a technical working group among fisheries agencies and the appointment of the gender focal persons in ASEAN. CTI-CFF already has its Women Leaders' Forum (WLF) whose focal persons are involved in the partnership. In addition, USAID Oceans also interacts with various initiatives and partners on gender, working regionally and globally. An overview of gender studies in the learning sites to determine gender differentials at each node of the fisheries value chain, a gender-responsive value chain analysis (GRVCA) framework was adopted and used the USAID's gender dimensions framework with its six domains: (i) access and control; (ii) knowledge,

beliefs and perceptions; (iii) practices and participation; (iv) time and space; (v) legal rights and status; and (vi) power and decision making.

### **4.3 Promoting responsible production and use of feed and ingredients for sustainable aquaculture growth**

#### **Towards responsible production and use of feed and ingredients for sustainable aquaculture growth in Bangladesh**

A.K.M. Aminul Haque, Director, Department of Fisheries, Bangladesh

Bangladesh, with a total area of 147 570 sq km is largely an agrarian country with agriculture, aquaculture, livestock, forestry and fisheries. Aquaculture in Bangladesh is second to agriculture with a production of 2.33 million tonnes, contributing 56.44 percent to the total fisheries production of 4.134 million tonnes, 24.41 percent to agriculture and 3.61 percent to GDP in 2016-2017. Bangladesh is a United Nations signatory country and follows the Code of Conduct for Responsible Fisheries (CCRF). As per Article 9 of the CCRF, the government of Bangladesh took initiatives for responsible development of its aquaculture sector through compliance and development of appropriate legal and administrative frameworks, notably: (i) The Protection and Conservation of Fish Act 1950; (ii) Fish and Fish Products (inspection and quality control) Ordinance 1993; (iii) Fish and Fish Products (inspection and quality control) Rules 1997 with subsequent amendments up to 2008; (iv) National Fisheries Policy 1998; (v) National Water Policy 1999; (vi) Coastal Zone Policy 2005; (vii) National Fisheries Strategy 2006; (viii) Fish Hatchery Act 2010; (ix) Fish Hatchery Rules 2011; (x) Fish Food Act 2010; (xi) Fish Food Rules 2011; (xii) Country Investment Plan 2011; (xiii) National Shrimp Policy 2014; (xiv) Five Year Plans (I–VII); (xv) Vision 2021; (xvi) United Nations sustainable development goals; and (xvii) Fisheries Master Plan 2018 including aquaculture. Besides these, the Aquaculture Policy 2018 is under way. The National Residue Control Plan (NRCP) monitors use of unauthorized and unhygienic ingredients in aquaculture through collection and chemical analyses in three accredited chemical laboratories of DoF at Dhaka, Chittagong and Khulna and other certified laboratories home and abroad for compliance with national and international quality standards. For quality assurance, DoF officials collect samples at regular intervals from aquaculture farms at random and implement legal tools as control measures whenever necessary. Use of aqua-medicines in aquaculture throughout Bangladesh needs prescriptions from the competent authority. Research and extension on the development of appropriate technologies related to production, management, value addition and overall value chain, the development of genetically sound high yield varieties of seeds, and cost-effective eco-friendly feed and other aquaculture ingredients give enormous support to sustainable aquaculture growth in Bangladesh. The Ministry of Fisheries and Livestock administers good governance and human resource development through its two research and extension wings: the Department of Fisheries and the Bangladesh Fisheries Research Institute. These implement motivation and awareness building, hands-on training, distribution of leaflets, folders, handouts, demonstration farms, field visits, implementation of projects, policy support and implementation of legal tools.

#### **Freshwater aquaculture: harnessing the potential in India**

S.K. Rath, Assistant Commissioner (Fisheries), Department of Animal Husbandry, Dairying and Fisheries, Ministry of Agriculture and Farmers Welfare, Government of India

Out of the 15 million people engaged in fisheries activities, 75 percent are involved in inland fisheries. This sector contributed 0.92 percent to the national GDP and earned USD 5.7 billion from exports in 2016–2017.

Inland fisheries are managed by provincial governments and the central government supplements the efforts of the provinces to develop the sector. The growth of fisheries on average was about 6 percent annum up to 2015–2016. The fish production of the country stands at 10.76 million tonnes in 2015–2016. To achieve the target of 15 million tonnes with a growth rate of about 8 percent per annum by 2020, the Government of India formulated a National Action Plan (NAP) in 2016–2017.

The productivity from the existing ponds, wetlands, reservoirs, cold water and brackish and saline water need to be increased by means of technological intervention, particularly the stocking of large sized advanced fingerlings and feed-based aquaculture adopting good aquaculture practices (GAP). It is estimated that the fish production potential of the country is approximately 20 million tonnes both from inland and marine resources. To harness the potential, fish production enhancement strategies have been formulated for integrated development and management of reservoirs, wetlands, the creation of more fingerling rearing areas and adoption of feed-based aquaculture. Apart from the above, the priority areas have been identified and action plans have been formulated for the development of cold water fisheries, the popularization of re-circulatory aquaculture system, cage culture, ornamental fisheries, brackish and saline water aquaculture. Infrastructure such as fish feed mills, hatcheries, cold chains and marketing infrastructure are the priority sectors for increasing the production and productivity in the country.

Intensive culture of catfishes (*Pangasianodon hypophthalmus*) and tilapia are promoted to increase the fish production and as a species diversification strategy. Accordingly, the Government of India has documented various implementable action plans for the period 2017–2022 for development of the sector in a holistic manner merging all the activities of the fisheries sector under the umbrella of the blue revolution.

### **Promoting responsible production and use of feed and ingredients for sustainable aquaculture growth**

Erna Yuniarsih. Directorate General of Aquaculture, Ministry of Marine Affairs and Fisheries, Republic of Indonesia

Responsible production and use of feed and ingredients for sustainable aquaculture growth will be achieved as follows: (i) by achieving aquaculture self-sufficiency through community-based resource utilization; (ii) by achieving competitiveness on aquaculture products through the improvement of innovative technology; and (iii) by utilizing aquaculture resources sustainably. Indonesia has established seven priority programmes to implement its policy. One of them is focused on self-sufficient fish feed production, which is intended to reduce the dependency on imported feed ingredients as inputs to fish feed, and also to reduce feed costs by more than 40 percent by using local feed ingredients. Indonesia's average fish production during 2012 to 2016, has increased about 15.24 percent per year. More than 65 percent of aquaculture production comprises seaweed, followed by fish (about 35 percent) and the rest is ornamental fish. To achieve Indonesia's fish production target, the need for fish feed in Indonesia will certainly increase. However, there are several obstacles: (i) high demand for raw materials for feed; (ii) availability of raw material (mostly imported); (iii) as the raw material for feed is still predominantly imported the price for aquafeed is high; and (iv) small-scale farmers find the feeds too expensive. To address the dependence on imported raw material and also to decrease the aquafeed price, the government has established a programme to develop aquafeed with local material through a self-sufficient fish feed programme (GERPARI) that still focuses on freshwater aquaculture. This programme consists of several activities as follows: (i) support for fish feed producing facilities; (ii) support for fish feed raw material; (iii) piloting small-scale aquafeed manufacture in freshwater aquaculture centers; and (iv) developing a national fish feed network.

### **Promotion of responsible production and use of feed ingredients for sustainable aquaculture growth**

Roger Edward P. Mamauag, Scientist, Southeast Asian Fisheries Development Center, Aquaculture Department, Tigbauan, Iloilo, Philippines

The aquaculture industry has been increasing steadily in Asia as a result of an expanding demand of food fish in the region as well as globally. Aside from its huge contribution to the world aquaculture production, fish is a major component of most diets in the region. Food fish production for the past several years has significantly increased and supporting this upward direction entails the reliance on cost-effective aquaculture feed production.

Reducing aquaculture feed dependency on fishmeal is a key for the sustainable development of feed aquaculture. Most feeds of omnivorous fish species such as tilapia, carp, catfish and milkfish are now devoid of fishmeal. However, reduction of fisheries products use in the diets of carnivorous species still poses a huge challenge. Feed accounts for 50 percent of the total operational costs in aquaculture when fishmeal is the main protein source (at an average inclusion level of 24 percent in the diets) and thus the aquaculture feed industry is beset with increasing costs, shortages and a conflict with human food consumption. This has led to the exploration of the use of unconventional ingredients in fish feeds.

Soybean meal is the most available and commonly used plant ingredient in aquaculture. Fishmeal replacement by oilseeds is only limited to between 20 percent and 40 percent and a mean incorporation of between 10 percent and 20 percent for carnivorous fish species. Oilseeds are characterized to be deficient in essential amino acids, particularly methionine and lysine. It also contains several anti nutritional factors that can be inactivated by heat processing or solvent extraction. Palatability is compromised when plant ingredients are incorporated in the diets of the fish, thus the addition of feed stimulants is needed.

Pea seed meal, *Pisum sativum* and lupin, *Lupinus* and other beans can contribute to the substitution of fishmeal. However, because of the minimal protein content (22 percent to 30 percent) its incorporation has become limited as a result of the presence of anti-nutritional factors. It can replace fishmeal at a level of 10 percent to 30 percent of the ingredient. Its incorporation has become limited because of the presence of anti-nutritional factors, poor essential amino acids profile, presence of non-starch polysaccharides and a high content of starch, which should be taken into consideration when formulating the diet.

Cereals, which include maize, rice and wheat, are incorporated in the diets to be used as an energy source (carbohydrates). It is low in protein (8 percent to 12 percent) but is a rich source of carbohydrates in the form of starch (about 60 percent). Cereal incorporation in the diets of carnivorous fish is limited at 10 percent to 20 percent, which provides 5 percent of the dietary protein. It is also deficient in essential amino acids especially lysine.

*Leucaena* leaf (ipil-ipil leaf meal), with an analyzed crude protein of 34.38 percent can be supplemented in the diets of tilapia. However, this plant protein source contains mimosine and tannin, which are toxic and can affect the digestive process of the fish and eventually leads to poor fish growth.

Groundnut cake, *Arachis hypogaea*, which contains 31.6 percent of crude protein, is an alternative protein source that is highly palatable and has an acceptable odour. It has better binding properties compared to soybean. In spite of its positive characteristics, it is deficient in some essential amino acids (methionine and lysine) and can be exposed to aflatoxin, which is toxic. Results from the studies suggested that groundnut cake can replace 10 percent of fish meal in the diets of *H. longifilis*.

The sweet potato, *Ipomoea batatas* is an important food crop in the tropical areas. The leaves of this plant have been used as a cheap protein source as ruminant feeds. The leaf meal has a protein content between 26 percent and 33 percent, a good amino acid profile and a good mineral and vitamin profile. However, it contains anti-nutritional factors that can significantly affect fish growth. Tilapia growth trials have suggested an up to 15 percent inclusion level of sweet potato in tilapia diets.

The identification and removal of anti-nutritional factors through heat treatment has improved the potential of taro, *Colocasia esculenta*, as a protein ingredient in fish feeds. Taro leaves have a high amount of protein (31.5 percent) and a high level of vitamins and minerals, which are needed in fish feed formulation. Growth experiments have indicated that a complete replacement of fishmeal with taro can be achieved in the diets of tilapia cultured in ponds with high natural productivity.

Harvested duckweed, *Lemna* spp., plants contain up to 43 percent protein on a dry weight basis and may be utilized without further processing as a complete food for fish. The essential amino acids profile of duckweed is relatively better than most of the other plant protein sources and it contains a high concentration of trace minerals. Studies have indicated that tilapia fed with duckweed at a feeding rate of up to 30 g dry matter/kg resulted in a higher survival rate and weight gain.

Coconut meal (copra), *Cocos nucifera*, is made from the process by-product of coconut oil extraction. It contains approximately 22 percent crude protein. Copra contains no known anti-nutritional factors and has a high protein digestibility. But relative to fishmeal and soybean meal it is deficient in all the essential amino acids required by fishes. Nevertheless, copra is a useful diet ingredient in areas where it is locally available in quantity.

The leaves of water hyacinth, *Eichhornia crassipes*, contain 20 percent protein and relative to other plants, its essential amino acids profile is relatively balanced. However, it has a high fibre content that limits the utilization of this ingredient. Reports have suggested that processing the water hyacinth as concentrates can improve its nutrient profile and can be fed to white shrimp, *Litopenaeus vannamei*, at the 25 percent level.

Rendered protein or animal by-product, which is comprised of meat meal, poultry meal, meat and bone meal, feather meal, blood meal has a high potential to be an alternative to fishmeal. However, these type of ingredients are heterogeneous in nutrient profile, limited in terms of essential amino acids and prone to bacterial contamination. The protein content of these animal by-products ranges from 50 percent to 80 percent and can replace fishmeal at the of 20 percent to 40 percent level. These types of ingredients have a good palatability and do not contain anti-nutritional factors similar to plants. However, rendered protein contains high levels of ash and saturated lipids. A high level of animal by-product meal in fish feed can cause excess dietary phosphorus which is harmful to the environment and has a deleterious effect on the nutritional health of the fish.

Shrimp by-product (heads and shells) is produced in large quantities from the processing plants and are commonly used as an ingredient in shrimp diets. Head meal, process residues and waste of the shrimp by-products have an average crude protein of 40 percent. Studies have indicated that *L. vannamei* growth and survival was significantly improved when shrimp by-product was included in the feeds at up to the 18 percent level. Fish (humpback grouper) growth experiments suggested that with the increase of the level of shrimp head meal (SHM) in the diets, growth and feed efficiency were adversely affected. High chitin and ash content of SHM poses a main constraint in the performance parameters of the fish fed the experimental diets. The study suggests a maximum of 10 percent SHM can be included in the diet of the fish.

By-products from the fish processing industry (milkfish and tuna) can be utilized as an ingredient in fish feeds. On average, derivatives from fish processing has a crude protein of 60 percent and several essential amino acids are not limited. Research trials have shown that these ingredients have performed well when fed to grouper, *Epinephelus coioides*, and red sea bream, *Pagrus major*, at an inclusion level of up to 25 percent. However, the product obtained from the processing plants will not ensure the homogeneity and freshness of the ingredients.

These alternative nutrient and locally available ingredients have been widely used in different countries. Several constraints and gaps in promoting these type of ingredients occur, however strategies are being implemented to address these limitations.

Most of the alternative nutrient ingredients are characterized to be inferior in protein content, have an unbalanced amino acid profile and there is the presence of anti-nutritional factors. Several studies have indicated that processing these ingredients into concentrates, isolates, hydrolysates and fractionated peptides can improve their nutrient profiles. Processed plant ingredients when added in the diets of the fish have resulted in improved growth, feed efficiency and palatability.

Utilization of fish processing waste should be researched and promoted. This ingredient has been characterized to have similar nutrient value and volume to fishmeal and fish oils sourced from the wild. The use of fish processing waste to produce fishmeal and fish oil can make aquaculture a net producer of fishmeal and oil. Studies suggested that further processing these ingredients into hydrolysates can result in an improved feed efficiency and growth rate.

Scientific information on feed ingredients, fish nutritional requirements and the interaction between the fish and the diet should be intensively studied. A combination of two or more alternative ingredients should be encouraged in order to create an optimized and cost-efficient diet for the industry.

Another approach to minimize the utilization of fishmeal is to promote the culture of fish species lower in the trophic level. Herbivorous and omnivorous fish requires minimal protein in their diet, thus reducing the fishmeal requirement in the diet formulation.

Nutritional compounds found in fishmeal and fish oil provide significant human health benefits. Fish fed on alternative feeds must continue to provide these health benefits to consumers. The methods adopted to address fatty acid modification in fish fed alternative nutrient ingredients include: (i) the implementation of new n-3 highly unsaturated fatty acid (HUFA) rich alternative lipid sources; (ii) the restoration of an optimal fatty acid profile with a finishing diet following a vegetable oil grow-out diet; (iii) the use of genetically modified n-3 HUFA rich grain crops; and (iv) the farming of transgenic fish with superior n-3 HUFA biosynthetic capabilities.

Current facts and figures have indicated that the use of alternative nutrient ingredients in feed aquaculture is the way forward.

Traditional fishmeal and fish oil are not nutritionally required for farmed fish to grow. Nutrients (amino acids, vitamins, minerals, and fatty acids) are required but they can be obtained from sources other than fishmeal and fish oil. Combining alternative nutrient ingredients to get the same balance is possible, but will require intensive research before its application in the aquaculture industry.

Feed companies making diets for carnivorous fish and shrimp have reduced their use of fishmeal and fish oil. The use of published scientific research led to cost-effective substitution using alternative ingredients, which reduced feed costs. The ratio of fish in to fish out has been reduced from 3 to 4:1 to an average of 1.5:1 for major aquaculture species because of increased use of protein and oils in diets from non-marine sources.

In conclusion, four key points are suggested to create a cost-effective feed in aquaculture: (i) reduce the level of fishmeal and fish oil in the diet of fish; (ii) choose aquaculture species which require low levels of protein and lipids in their diet, preferably herbivorous fish; (iii) formulate feeds which are environmentally friendly; and (iv) formulate feeds with ingredients that are sustainable.

## **Conclusions and recommendations of the Seventh RCFM for reporting to the Thirty-fifth Session of APFIC**

The participants at the APFIC Seventh RCFM were presented with the consolidated conclusions and recommendations for action, which were derived from the various meeting sessions. These were commented on and amended and subsequently endorsed by the forum. The consolidated conclusions and recommendations of the RCFM were forwarded to the Thirty-fifth Session of APFIC (10 May to 13 May 2018, in Cebu, Philippines) for consideration and subsequent endorsement by the Commission.

### **Progress toward resilient blue growth in the region**

The RCFM participants recognized the great advances in the four thematic areas pertaining to sustainable and resilient fisheries and aquaculture for blue growth in the region. Particular mention was made of national and regional efforts in addressing priority issues, such as: (i) combating IUU fishing; (ii) strengthening regulation on aquaculture; (iii) implementing good fisheries and aquaculture development approaches and practices such as EAF and EAA; (iv) aquaculture zonal development;

(v) innovative aquaculture systems and practices; and (vi) developing inclusive, human rights-based and gender sensitive fisheries and aquaculture value chains.

There are a number of remaining and emerging challenges to the sustainability and resilience of the fisheries and aquaculture sectors. To address these challenges effectively requires concerted efforts within and across governments, non-government organizations (NGOs), civil society organizations (CSOs) and development and research partners. These include: (i) improved knowledge on the contributions of the sector to food and nutrition security, livelihoods and economic growth, the impacts of changes in the environment on the sector and dependent communities, the environmental footprints of the sector; (ii) strengthened enabling environments, knowledge bases and human capacity for adopting appropriate planning and management tools, including ICTs; (iii) increased awareness and collaborative efforts to address issues relating to aquaculture feed, the risk of AMR associated with aquaculture and reduced fish loss in post-harvesting; and (iv) a clearer understanding of the gender-differentiated roles of women and men along the value chains.

In addition, there remains a great need in many countries for reinforced legal frameworks and guiding policies to ensure a human rights-based and environment-friendly development of the region's fisheries and aquaculture sectors in line with the Small-scale Fisheries Voluntary Guidelines and the CCRF.

More targeted disaster risk management and climate change strategies and technologies for the sector are needed in several countries. There is also a need for increased efforts to combat IUU fishing in the region. Continued and strengthened sharing of experiences and knowledge and collaborative efforts across the countries in the region are required to attain the full potential of blue growth in the Asia-Pacific region.

Specific summaries and recommendations for each thematic area are presented below.

## **Theme 1. Improvements in fisheries and aquaculture governance**

### **(a) Strengthening aquaculture planning and management through the adoption of relevant tools**

The regional consultation recognized the great importance of strengthening the planning and management of the aquaculture industry in order to mitigate the adverse impacts on the natural environment and other stakeholders and reduce the risks to the sector itself. The participants generally considered the application of appropriate planning and management tools as highly relevant and pressing for informed planning and management. Based on the sharing of experiences and lessons of a number of countries in piloting selected aquaculture planning and management tools, with FAO support and working group discussion the participants identified the major challenges and recommended strategies and actions for promoting the adoption of aquaculture planning and management tools.

#### **Major challenges:**

- lack of established laws and regulations or weak implementation of existing regulations in supporting the adoption of the tools;
- lack of common recognition of need for adopting the tools at different levels of government;
- lack of financial support and human capacity; and
- difficulty in adapting the tools for different culture systems (environments) and multispecies culture.

#### **Recommended regional strategies/actions:**

- regional awareness raising and sensitization to encourage member countries to adopt/implement planning and management tools;

- regional sharing of knowledge and experiences on aquaculture planning and management tools;
- support pilot projects on aquaculture planning and management tools in member countries;
- develop and disseminate more priority tools (impact evaluation and monitoring, for example) from the 16 draft tools for piloting; and
- regional capacity building for government officers and professionals.

#### **Recommended country strategies/actions:**

- strengthen national regulation and institution support to facilitate the adoption of relevant tools;
- conduct country assessment on the status of adoption of different planning and management tools and the potential for increased adoption;
- support pilot testing of relevant tools at national level; and
- technical capacity building through training for government officer, extension staff, fish farmers, key stakeholders and NGOs.

#### **(b) Strengthening aquaculture governance through regulation and appropriate management approaches such as ecosystem approach to aquaculture and zonal development**

The regional consultation reviewed the progress and successful experiences of some countries in strengthening aquaculture regulations and implementing the ecosystem approach to aquaculture (EAA), zonal development and other management approaches for the improved governance of aquaculture. The participants generally agreed improvement of aquaculture governance through strengthened regulatory frameworks and enforcement and implementation of new management approaches is highly relevant to all the countries in the region and require urgent actions by the different players in the region. The participants identified the major challenges and recommended strategies/actions for strengthening aquaculture regulation and implementing new management approaches, such as EAA and zonal development.

#### **Major challenges:**

- lack of strong political will and institutional support to enforcement of established laws and regulation;
- lack of concerted efforts at regional, national and local levels to strengthen aquaculture regulation and governance;
- lack of institutional support, financial support and human capabilities at national and regional level;
- lack of good understanding of the importance of aquaculture regulation, EAA, and zonal development among the policy makers and stakeholders; and
- lack of inter-sectoral collaboration to regulate and plan the aquaculture industry.

#### **Recommended regional strategies/actions:**

- regional documentation and sharing of successful cases of good aquaculture governance and implementation of EAA and zonal development;
- review and share existing laws and regulations governing aquaculture in different countries;
- support members countries in implementing or piloting EAA and zonal development; and
- arrange regional workshop on capacity building (government officers, extension officers) on aquaculture regulation, EAA and zonal development.

#### **Recommended country strategies/actions:**

- develop and implement a programme to strengthen aquaculture regulation and promote EAA and zonal development;

- strengthen the inter-sectoral coordination and engagement of different stakeholders including CSOs;
- establish appropriate administrative measures including budget for effective implementation of EAA and zonal development plans;
- develop human resource capabilities through training for government and extension officers; and
- strengthen institutional support for implementation of EAA and zonal development.

### **(c) Experiences and lessons on combating illegal, unreported and unregulated (IUU) fishing**

IUU fishing remains an issue of high relevance and priority to the region and requirements to combat IUU fishing from market states, port states, flag states and coastal states as well as from consumers are increasing as awareness grows about the prevalence and negative impacts to the aquatic ecosystems and society of IUU fishing. Many countries in the region have progressed significantly in their efforts to combat IUU fishing, including the development of NPOA-IUU, NPOA-capacity, accession to the PSMA, and efforts to strengthen MCS within and across the countries. Lessons learned from recent advances in countries will provide useful examples for other countries in the region. However, political will, technical capacity and funding to implement plans remain key challenges in many countries. The participants underlined that, although the costs of combating IUU fishing may be high in the short-term, the benefits to doing so will outweigh the costs. Increased knowledge of the biological, economic and social impacts of IUU fishing assist in garnering support to combat IUU fishing and to monitor the benefits derived from management actions.

#### **Recommended strategies/actions:**

- APFIC to revisit the APFIC IUU fishing report and disseminate the BOBP-IGO IUU fishing report to raise awareness of the impacts of IUU fishing and opportunities to combat IUU fishing;
- increase sharing of tools, knowledge, experiences and examples from the region on combating IUU fishing (for example NPOA) through reports and regional workshops;
- increase learning opportunities, such as through best practice platforms and working groups;
- encourage collaboration and coordinated efforts across agencies and partners within countries and among neighbouring countries;
- encourage political commitment and coordination from governments;
- implement catch documentation and traceability systems that are nationally relevant; and
- prioritize awareness raising and capacity development at the national and sub-national levels, within governments and across the value chains and communities.

### **(d) Promoting and implementing the ecosystem approach to fisheries (EAF), co-management approaches**

The RCFM embraced the EAF as a holistic approach to supporting social, economic and environmental well-being within the sector. Thanks to efforts across the region, there is broad understanding of the EAF concepts and approaches in many countries but implementation of the EAF principles and approaches is still facing challenges, including: lack of political will; lack of policy guidance and legal backing to support efforts to implement EAF; improving but still insufficient supporting data/information on the three EAF pillars; and insufficient monitoring systems to evaluate EAF implementation. Countries are gaining experience in developing EAF and co-management plans and are underlining the importance of effective participation of stakeholders and local leaders as the key to development and implementation. Experience in the region has also shown that EAF is rarely undertaken in one single, all-encompassing step but is generally an incremental, step-by-step process, with technical and facilitation skills being acquired along the way to support these efforts.

### **Recommended strategies/actions:**

- incorporate more thoroughly EAF principles into fisheries policies and legal frameworks;
- establish EAFM partnerships across the fisheries stakeholders and development partners within countries and in the region;
- ensure strong champions to facilitate successful implementation of EAFM efforts at all levels;
- regional organizations should continue their support to countries and provide coordination of EAFM efforts in the region;
- APFIC and other partners should organize an EAFM lessons-sharing workshop for practitioners;
- countries and partners should aim to improve translation and communication of EAFM documentation for increased uptake within the countries;
- organize gender-specific EAFM training and capacity building; and
- establish an EAFM rating/scoring system to support monitoring of EAFM implementation across the region.

## **Theme 2. Innovative fisheries and aquaculture production and management systems and practices for more efficient and sustainable production**

### **(a) Promoting climate-resilient and climate-smart aquaculture**

The regional forum recognized that climate change and climate variability impose great threats to the performance and sustainability of the aquaculture industry in the region. At the same time, some farming systems and practices also contribute significantly to greenhouse gas emissions. The regional forum participants consider that promoting climate-resilient and climate-smart aquaculture farming systems and practices is a pressing need of high relevance to most countries in the region. Based on the experiences and lessons shared by a number of countries in piloting some climate-resilient and climate-smart aquaculture systems and practices through country initiatives, with or without FAO support and working group discussion the participants identified the major challenges and recommended strategies and actions for scaling up climate-resilient and climate-smart aquaculture systems and practices in the region.

### **Major challenges:**

- lack of available scientific knowledge and concrete data on specific impacts of climate change to aquaculture for decision making;
- lack of national action plan on climate change adaptation and mitigation for aquaculture subsector;
- lack of investment to adopt climate-resilient and climate-smart aquaculture technologies including energy-saving technologies and improvement of aquaculture facilities; and
- lack of awareness and acceptability of fish farmers to farming of species and systems that adapt well to climate change impacts or contribute to mitigation of climate change impacts.

### **Recommended regional strategies/actions:**

- document and disseminate successful examples of climate-resilient and climate-smart aquaculture systems, technologies and management practices across the countries; and
- support the member countries in developing and implementing strategies and projects promoting resilient/smart aquaculture.

### **Recommended country strategies/actions:**

- develop and implement major programmes for climate-resilient and climate-smart aquaculture in zones vulnerable to climate change impacts;

- develop and implement conducive policy and incentive measures, for example tax exemption for adopting climate-smart technologies in aquaculture, such as solar energy; and
- strengthen the public support/services to small farm holders in adopting climate-resilient and climate-smart aquaculture systems, technologies and farming practices.

### **(b) Promoting scaling up of innovative aquaculture systems/practices for more sustainable and efficient production**

Aquaculture in the Asia-Pacific region is facing various challenges. Tackling the challenges effectively requires innovation on farming technology, farming systems and farming practices. A number of countries introduced their initiatives and progress in adopting different innovative technologies, farming systems and farm management practices. Although they shared their successes and experiences, the forum participants also recognized some major constraints and challenges in scaling up the innovative aquaculture technology, farming systems and practices and recommended necessary strategies and actions.

#### **Major challenges:**

- lack of financial support to research and development for innovative aquaculture technology; and
- high investment needed for adoption of innovative systems and technology.

#### **Recommended regional strategies/actions:**

- share innovative culture systems, technology and farming practices and economic cooperation across the countries;
- provide some technical assistance to the members that want to develop innovative aquaculture system/practices; and
- support regional/country projects to disseminate innovative systems, technology farming practices, such as energy saving/new energy, pond-based recirculatory aquaculture system, innovative agro-aquaculture and multitrophic culture system, mechanization and automation.

#### **Recommended country strategy/actions:**

- promote private-public partnerships in adopting innovative systems and technology farming practices;
- increase support to R&D and dissemination of innovative systems, technology farming practices; and
- develop and implement appropriate conducive policy and incentive measures to support adoption of innovative systems, technology farming practices.

### **(c) Implementing the Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication (SSF Guidelines)**

The RCFM reiterated the importance and contributions of small-scale fisheries (SSF) to production, livelihoods and food security, and economic growth in the region. The participants agreed on the need to recognize the human/social dimensions in fisheries management and along the value chains. The RCFM also acknowledged the need to approach SSF management through holistic social development, human rights and gender lenses as means to improve the SSF capacity to use, manage and benefit responsibly from fisheries resources and build their resilience to extreme events, crises and climate change. The SSF Guidelines were deemed highly relevant to the region and able to provide excellent guidance to countries and other fisheries stakeholders.

### **Recommended strategies/actions:**

- SSF Guidelines should be applied effectively across the region;
- countries should investigate/implement enabling conditions that would support diversified and risk minimizing livelihoods within SSF, including the provision of technical and soft skills training to support these;
- countries and partners should promote capacity building to support SSF in their moves toward more sustainable fisheries and livelihoods;
- fisheries institutions should engage national human rights institutions and other development institutions to support the holistic implementation of the SSF guidelines;
- fisheries institutions and regional bodies should increase collaboration with CSOs and NGOs in the promotion of SSF;
- countries are encouraged to create working groups/task forces to support the incorporation of SSF Guidelines into national fisheries policies and management plans;
- countries are encouraged to develop and implement National Plans of Action for the application of the SSF Guidelines;
- organize awareness campaigns about the SSF Guidelines at the national and local levels complemented by adaptations of the SSF Guidelines that are more easily absorbed by communities and others supporting the SSF communities;
- conduct information, education and communication activities about the SSF Guidelines as one of the priorities under EAFM in managing municipal/coastal waters;
- there should be a strong engagement of all stakeholders, including the national government, in promoting and implementing SSF; and
- participatory approaches should be encouraged by the countries and capacity built to support effective participation of SSF stakeholders in fisheries management.

### **(d) Innovations in technologies and practices for sustainable fisheries/use of information and communication technology (ICT)**

ICTs have existed for a long-time but the fast rate of development and widespread accessibility to ICTs were recognized as providing opportunities and imperatives to support sustainable fisheries, enhancing safety at sea and early warning systems, fisheries governance, market access, social networking, and so on. Experiences in the region and elsewhere have shown that stakeholder engagement in the design and development of ICT systems is a key element of their success, alongside enabling environments through appropriate policies and information management systems. Government participation in local efforts to introduce ICT is also a key to enabling the long-term sustainability of ICT and ICT-based information systems.

The participants were also kept abreast of current efforts to use artificial reefs and fish enhancement devices (FED) to help create habitats for fish and increase livelihoods for coastal fishing communities. The participants also discussed the monitoring and documentation of long-term effects on the environment and the fisheries.

### **Recommended strategies/actions:**

- regional bodies, such as FAO/APFIC, should support knowledge sharing on ICT tools and experiences related to their use in support of fisheries management and development;
- cost-effective ICT should be implemented to support improved catch documentation and knowledge building for SSF;
- assess the usefulness and economics of ICT as well as their effectiveness as a tool for fisheries management;
- guide fisheries stakeholders on the extent and scope of ICT uses;
- consider addressing data sovereignty, privacy, and key data elements for sharing of data when developing ICT;

- install AR/FAD/FED require supporting management systems;
- consider the installation of artificial reefs where deemed required to support sustainable fisheries in coastal provinces;
- engage local community consultation/participation before the installation of AR/FAD/FED;
- conduct more research to understand effectiveness of FAD/FED/AR in securing food security within ecological limits;
- provide clearer definitions of FAD and FED;
- build capacity for stakeholders with respect to FAD/FED design, use and maintenance; and
- develop a technical report on the use and efficacy on artisanal FAD/FED in the region.

### **Theme 3. Building resilience of fisheries and aquaculture systems in the Asia-Pacific region**

#### **(a) Aquaculture insurance for the resilience of small farm holders**

Small aquaculture farmers in the region are now facing different risks. The increasing climate variability and presence of diseases in cultured animals, and other environmental hazards have caused heavier economic losses to the aquaculture operations in the region. Some countries have made attempts to strengthen the resilience of small farm holders through piloting aquaculture insurance programmes, often with government support. Based on the experiences and lessons shared by some countries, the progress has been limited in most countries. Although they recognized the great challenges in promoting aquaculture insurance, the forum participants believe it is a pressing issue of high relevance to many countries in the region. Some important strategies and actions were identified through working group discussions.

#### **Major challenges:**

- very few economically viable insurance schemes have developed and have been successful for the aquaculture sector in the region;
- few commercial insurance companies have ventured into offering aquaculture insurance because of the high business risk and technical complexity;
- lack of strong interest by aqua-farmers in buying an insurance policy for their crop and facility because of lack of awareness of the role insurance could play in managing the increasing risks to their stock and facility; moreover, they are unwilling to pay the high premium; and
- government lack of financial resource to support the initial development of aquaculture insurance.

#### **Recommended regional strategies/actions:**

- promote regional exchange and cooperation in promoting aquaculture insurance to build resilience for small aquaculture farm holders; and
- develop financially viable and affordable aquaculture insurance for major and high risk aquaculture commodities.

#### **Recommended country strategies/actions:**

- develop and implement government programmes supporting climate-resilient and climate-smart aquaculture to reduce the business risks of commercial insurance companies engaged in aquaculture insurance;
- develop and implement appropriate strategies in promoting aquaculture insurance such as group insurance based on the implementation of GAQPs and establishing cooperative insurance funds;
- increase awareness and knowledge of aquaculture farmers on the importance of insurance; and
- develop and implement appropriate government policy measures to support commercial aquaculture schemes that cover fully the crops/products in addition to life and fixed assets.

## **(b) Risk of antimicrobial resistance in aquaculture and required coping strategy and actions**

The risk of antimicrobial resistance has attracted increasing attention globally. In Asia, aquaculture is experiencing a worsening disease problem and at the same time, aquaculture farming is becoming more intensive with increasing transboundary movement of live cultured animals. AMR risk associated with aquaculture is thus an emerging issue of great significance to many countries in Asia. Some countries and organizations in the region have started a number of initiatives addressing the problem. Knowledge of these initiatives and an assessment of their progress were shared in the forum. There was general concern over the challenge to the region in addressing the issue effectively. The forum put forward a number of strategies and actions required for tackling the issue effectively.

### **Major challenges:**

- lack of general awareness and understanding of the risk of AMR associated with aquaculture;
- lack of information/data on the use of antimicrobials in aquaculture and a profound lack of information and knowledge on the risks of AMR to human health and to aquaculture itself;
- lack of technical capability to monitor AMR associated with aquaculture effectively; and
- lack of adequate regulations on AMU in aquaculture and effective enforcement of existing regulations.

### **Recommended regional strategies/actions:**

- raise awareness of different stakeholders regarding the risk of AMR to human health and aquaculture;
- promote regional sharing of knowledge and good practices and collaboration through technical networking on AMR and AMU;
- develop regional guidelines to support efforts of member countries to manage AMR and AMU in aquaculture; and
- support member countries to develop required human and laboratory capacity.

### **Recommended country strategies/actions:**

- increase the awareness of stakeholders of AMR and AMU;
- develop and implement AMR and AMU monitoring and surveillance system and mechanism;
- strengthen the control over the production, labelling, sale and use of antibiotics in aquaculture;
- strengthen the implementation of aquatic animal health programmes/national strategies on aquatic animal health; and
- promote good aquaculture practices to include biosecurity measures in the complete production chain.

## **(c) Lessons learned and experiences of risk management, disaster risk management (DRM), and climate change adaptation (CCA) for resilient fisheries**

Although extreme events, climate variability, and climate change are environmental phenomena that are often difficult to control or predict, countries in the region are increasingly developing or improving their DRM and CC adaptation strategies for fisheries. There is, however, much room for learning and potential for further development. The sharing of information, in particular innovative adaptations and lessons learned, is key to moving forward. The current DRM and CC focus not only on the resilience of the aquatic systems but also on the coastal/riparian/fisheries human communities who may be impacted directly or indirectly by extreme events and changes in the aquatic systems.

As experience of DRM and CCA in fisheries grows, the participants noted the value of improved planning, with clear priorities and standard operating procedures, to ensure risk management and vulnerability reduction of fishing communities sustainably and in line with build-back-better approaches in line with

the Paris Accord and Sendai Framework. These factors should also be accounted for when updating existing risk management regulations. Human driven (protracted) crises should also be accounted for in risk management plans within the sector.

The participants recognized the importance of prioritizing those measures that are readily achievable and with high impact because of the urgent need to improve the sector's resilience to extreme events and climate change. Given that extreme events and climate change often arise in situations that are already under stress or in vulnerable contexts because of poverty and overfishing for example, building the general resilience of ecosystems and dependent communities will often be a no regrets option for the fisheries.

The participants discussed how internet-based information and ICT technologies are improving countries' abilities to disseminate weather and environmental early warnings although challenges remain in providing this information to fishers at sea or in isolated areas.

Although awareness of climate change and extreme events impacts and options for fisheries has increased, there still exists a need to increase awareness through knowledge and to support capacity-building activities within artisanal fisheries and vulnerable groups, including special programmes (youth and gender-sensitive) and to develop more fisheries-specific strategies to support national CCA and DRM efforts.

#### **Recommended strategies/actions:**

- increase and disseminate knowledge of CC and the impacts of extreme events on the aquatic systems, the fisheries sector and dependent communities in the region in appropriate ways for use by fisheries stakeholders, including fisheries agencies;
- involve all relevant stakeholders in strategic action plans to improve cooperation and create co-adapted DRM and CCA plans;
- increase political will and financial and human resources in the areas of CCA and DRM in fisheries;
- incorporate food security and fisheries risks and adaptation opportunities in cross-sectoral CCA strategies and plans;
- support, where lacking in any country, insurance and social protection schemes for artisanal fisheries;
- increase awareness regarding safety at sea in fishing communities and implement programmes to increase safety at sea;
- strengthen regional initiatives to monitor weather and environmental change and to improve coordinated responses — a platform or working group focusing on fisheries could be developed for the region, in collaboration with relevant intergovernmental organizations (such as the International Maritime Organization and the World Meteorological Organization) and other national/regional agencies with an emphasis on partnership on DRM and CCA – and share information such as access to best practices in cyclone preparedness initiatives in fisheries; sharing experiences via regional workshops; enabling access of countries to continuous, real-time data; and sharing access to early warning systems that are applicable to other countries in the region;
- integrate the impact of long-term CC with blue growth policies; and
- make FAO publications and other publications on CC more available to countries and other partners.

## **Theme 4. Gender-sensitive and inclusive fisheries and aquaculture value chains**

### **(a) Enhancing woman's role and benefit sharing along the aquaculture value chain**

With the rapid development of aquaculture and expansion of the value chain, women are playing an increasingly important role in aquaculture production in the region. Although women are contributing to the sectoral development, their engagement, status and share of benefit in the industry has not been adequately investigated and documented. Some countries and organizations in the region have launched some initiatives to enhance the role and benefit sharing in the aquaculture sector. In general, efforts made in this area are still limited. Based on the identification of some major constraints, the forum recommended required strategies/actions for effectively addressing the gender issue in the aquaculture industry for a strengthened gender-sensitive and inclusive aquaculture value chain.

#### **Major challenges:**

- limited initiatives to address gender issues in aquaculture in the region; and
- limited or no gender disaggregation data on women's role and benefit sharing in aquaculture value chain in the region.

#### **Recommended regional strategies/actions:**

- conduct comprehensive baseline study on women's engagement, role and benefit sharing in entire value chain of different aquaculture commodities;
- establish a regional platform for the governments and civil society to promote gender integration in the aquaculture value chain and to share their experiences and lessons; and
- develop regional technical guideline for enhancing the role and benefit sharing in aquaculture in the region.

#### **Recommended country strategies/actions:**

- improve the collection of gender-disaggregated data on women's role and benefit sharing in the aquaculture sector;
- offer government support to women-initiated programmes at the local level;
- develop appropriate aquaculture policy and strategy, which can enhance the role and benefit sharing of women along the aquaculture value chain; and
- implement training courses on aquaculture entrepreneurship and farm management skills for women.

### **(b) Actions, experiences, and lessons on value addition, reducing food loss, improving access to markets and trade, and promoting gender equality in capture fisheries value chains**

The RCFM acknowledged that, with the general declining catch in capture fisheries, there is an increasing need to manage post-harvest losses, improve value addition and ensure better access to markets. Member countries are increasing their knowledge and experiences in the use of improved technologies and processes in the post-harvest sectors from which other countries can adopt and learn.

The participants supported greater attention to issues of gender equity and integration in support of sustainable fisheries development and in line with the SSF Guidelines. In particular, the participants recognized the important role women play across the fisheries value chains and the need for increased recognition of these roles and support for their engagement in decision-making processes in fisheries management. The participants were shown examples in which gender disaggregated data and empirical studies in value chains have proven useful in improving fisheries management and value chains and how existing gender value chain analysis frameworks and tools can be used to complement other data

collection methods or tools to understand value chains and to monitor and evaluate fisheries projects and programmes.

The countries also recognized the growing use of market-based trade measures that affect and will further affect fisheries value chains in the region. Awareness of opportunities and challenges that may arise because of market-based measures will be necessary for the private sector as well as fisheries agencies across the region.

### **Recommended strategies/actions**

- support increased collection of gender-disaggregated data along the value chains and in the implementation of projects and programmes and undertake analyses to guide appropriate policies in support of gender equity and equality;
- incorporate gender equity principles into fisheries legal frameworks and increase implementation of gender-responsive programmes/policies alongside efforts targeting vulnerable groups and minorities;
- enhance women's participation in decision-making processes and value chain activities along the value chains through access to infrastructure/tools, capacity building and enabling frameworks;
- participate in existing networks of gender and fisheries development; and
- support increased awareness of market-based measures and programmes to attain the requirements of markets is required.

### **(c) Promoting responsible production and use of feed and ingredients for sustainable aquaculture growth**

Along with the general trend of aquaculture intensification and commercialization in the region, there has been increasing use of compound feed in the culturing of most commodities. Because of the rapid increase in demand and limited production capacity, some important feed ingredients such as fishmeal, fish oil and soybean are outsourced largely from other regions. This imposes great uncertainty on the sustainability of the aquaculture industry in the region. Meanwhile, increasing demand for low-value fish as direct food for fish or for processing into fishmeal has led to increasing fish pressure on the natural fish population. In order to reduce the dependence on fishmeal for aquaculture, many countries and regional organizations have been making efforts to develop sustainable alternative feed ingredients for aquaculture. Although significant progress has been achieved, the translation of research outputs to commercial production has been slow. The forum identified the major challenges and recommended strategies/actions for promoting responsible production and use of feed and feed ingredients in the region.

#### **Major challenges:**

- available information and knowledge on sustainable alternative aquaculture feed ingredients not effectively shared;
- existing technological breakthrough and research results are not effectively translated into commercial production;
- limited investment in R&D has held back the development of sustainable alternative feed ingredients, such as optimum combination of alternative feed ingredients for different species/life stages and related manufacturing technology; and
- there is a lack of technical support to small farmers on how to best manage feeding for efficiency.

#### **Recommended regional strategies/actions:**

- increase the awareness of governments and other stakeholders on responsible production and use of feed and ingredients;

- establish a regional standard and database on cost-effective feed ingredients available in the region; and
- promote knowledge sharing between different players, such as R&D agency, private feed companies and governments on alternative feed ingredients and related feed technology.

**Recommended country strategies/actions:**

- continue support to R&D on new sustainable alternatives for key feed ingredients and their effective use in feed formulation and related feed technology;
- strengthen partnership between public research institutes and private feed companies for effective translation of research breakthroughs in the use of alternative feed ingredients into commercialized feed production;
- strengthen the technical support to farmers on good practices for best efficiency of feed use;
- develop appropriate policy and strategy to support scaled up production of alternative feed ingredients; and
- support local small feed mills in remote areas to produce quality and cost-effective feed following established feed standards and standard operating procedures.

## **Closing of the Regional Consultative Forum Meeting (RCFM)**

In closing, the APFIC Secretary thanked the hosts, the Bureau of Fisheries and Aquatic Resources, for their generous support and excellent facilitation of the Seventh APFIC RCFM. The Secretary also thanked all the participants from APFIC member countries and other organizations for their active participation.

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## Appendix B. Agenda of the Seventh APFIC Regional Consultative Forum Meeting

Day 1	7 May 2018	
08.00–09.00	<b>Registration</b>	
09.00–10.15	<b>Opening Ceremony</b> <ul style="list-style-type: none"> <li>– Welcome remarks by the APFIC Chairman and Director of the Bureau of Fisheries and Aquatic Resources, Department of Agriculture, Philippines</li> <li>– Address by the FAO Representative to Philippines</li> <li>– Opening speech by the Secretary, Department of Agriculture, Philippines</li> <li>– Introductions and RCFM arrangements by APFIC Secretary</li> </ul>	
10.15–10.45	<b>Morning tea/coffee and group photo</b>	
<b>Plenary Session I</b>	<b>Fisheries and aquaculture regional overview</b>	
10.45–11.15	<b>Keynote address: Sustainable development for resilient blue growth of fisheries and aquaculture</b> Assistant Director-General, FAO Fisheries and Aquaculture Department	
11.15–12.00	<b>Regional overview of fisheries and aquaculture in Asia</b> APFIC Secretariat, FAO Regional Office for Asia and the Pacific	
12.00–13.30	<b>Lunch</b>	
<b>Thematic session I</b>	<b>Improvements in fisheries and aquaculture governance – Parallel sessions</b>	
	<b>Aquaculture</b>	<b>Fisheries</b>
13.30–14.30	Strengthening aquaculture planning and management through adoption of relevant tools	Experiences and lessons of combating illegal, unreported and unregulated (IUU) fishing
14.30–15.30	Strengthening aquaculture regulation, EAA and zonal development	Experiences and lessons of combating illegal, unreported and unregulated (IUU) fishing (continued)  Promoting and implementing ecosystem approach to fisheries (EAF), co-management approaches
15.30–16.00	<b>Afternoon tea/coffee</b>	
16.00–17.00	Strengthening aquaculture regulation, EAA and zonal development	Promoting and implementing ecosystem approach to fisheries (EAF), co-management approaches (continued)
17.00–17.30	Recommendations for APFIC	Recommendations for APFIC

<b>Day 2</b>	<b>8 May 2018</b>	
<b>Thematic session II</b>	<b>Innovative aquaculture and fisheries production and management systems and practices for more efficient and sustainable production – Parallel sessions</b>	
	<b>Aquaculture</b>	<b>Fisheries</b>
08.30–9.30	Promoting climate resilient/smart aquaculture	Using information and communication technology (ICT) for small-scale fisheries
9.30–10.30	Promoting scaling up of innovative aquaculture systems/practices for more sustainable and efficient production	Innovations in technologies and practices for sustainable fisheries (e.g. FADs, fish refugia, fish passes, BRDs)
10.30–11.00	<b>Morning tea/coffee</b> <b>Poster session – country posters or exhibits on key issues that are being addressed by the member countries</b>	
11.00–11.30	Recommendations for APFIC	Recommendations for APFIC
<b>Thematic session III</b>	<b>Building resilience of fisheries and aquaculture systems in the Asia-Pacific region – Parallel sessions</b>	
	<b>Aquaculture</b>	<b>Fisheries</b>
11.30–12.30	Aquaculture insurance for resilience of small farm holders	Implementing the Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication (SSF Guidelines)
12.30–14.00	<b>Lunch</b>	
14.00–15.00	Risk of antimicrobial resistance in aquaculture and required coping strategy and actions	Lessons and experiences of risk management, disaster risk management (DRM), and climate change adaptation (CCA) for resilient fisheries
15.00–16.00	Risk of antimicrobial resistance in aquaculture and required coping strategy and actions (continued)	Lessons and experiences of risk management, disaster risk management (DRM), and climate change adaptation (CCA) for resilient fisheries (continued)
16.00–16.30	<b>Afternoon tea/coffee</b>	
16.30–17.00	Recommendations for APFIC	Recommendations for APFIC

<b>Day 3</b>	<b>9 May 2018</b>	
<b>Thematic session IV</b>	<b>Gender-sensitive and inclusive fisheries and aquaculture value chains – Parallel sessions</b>	
	<b>Aquaculture</b>	<b>Fisheries</b>
08.30–09.30	Promoting responsible production and use of feed and ingredients for sustainable aquaculture growth	Actions, experiences, and lessons of value addition, reducing food loss, improving access to markets and trade, and promoting gender equality
09.30–10.30	Enhancing woman’s role and benefit sharing along the aquaculture value chain	Actions, experiences, and lessons of value addition, reducing food loss, improving access to markets and trade, and promoting gender equality (continued)
10.30–11.00	Recommendations for APFIC	Recommendations for APFIC
11.00–11.30	<b>Morning tea/coffee</b>	
<b>Plenary Session II</b>	<b>Summary and recommendations for reporting to APFIC</b>	
11.30–12.30	<b>Parallel sessions feedback to plenary</b> <b>Capture fisheries</b> <b>Theme 1</b> <b>Theme 2</b> <b>Theme 3</b> <b>Theme 4</b> <b>Discussion</b>	
12.30–13.30	<b>Lunch</b>	
13.30–14.30	<b>Parallel sessions feedback to plenary session</b> (continued) <b>Aquaculture</b> <b>Theme 1</b> <b>Theme 2</b> <b>Theme 3</b> <b>Theme 4</b> <b>Discussion</b>	
14.30–15.00	<b>Afternoon tea/coffee</b>	
15.00–15.30	<b>Plenary discussion</b> Summary and recommendations for APFIC	
15.30–16.00	<b>Closing session</b>	

## Appendix C. Opening statements

### Welcome to the Seventh APFIC Regional Consultative Forum Meeting

Cebu, Philippines | 7–9 May 2018

#### Sustainable Development for Resilient Growth of Fisheries and Aquaculture

By

**Commodore Eduardo Gongona**

**Undersecretary for Fisheries, Director of the Department of Agriculture-Bureau of Fisheries and Aquatic Resources, and current Asia-Pacific Fishery Commission (APFIC) Chairman.**

Guests, friends and partners from the Asia-Pacific and beyond

Good morning!

Today, we open our doors to partner states and organizations as we hold this Seventh Regional Consultative Forum Meeting (RCFM) of the Asia-Pacific Fisheries Commission (APFIC).

Philippines' Department of Agriculture – Bureau of Fisheries and Aquatic Resources (DA-BFAR) takes it as a wonderful privilege to contribute to the Commission by hosting this very important forum to gather country-specific insights and recommendations to foster a more resilient and sustainable blue economy in the Asia-Pacific region.

We recognize the challenges presented to us by climate change and other environment-related problems, and we respond by bringing our heads together to come up with sound, science-based policies and measures that will holistically address growing concerns in the region's fisheries and aquaculture industries.

We will be learning from each other, from our individual experiences in implementing various fisheries programmes and of course, from our reflections and takeaways in what counts as the most effective approaches in sustainable fisheries management.

Philippines, for its part, has taken great leaps in ensuring the renewability of the country's fisheries resources. Our Five-Year Work Plan for Fish Sufficiency is a comprehensive strategy towards developing the country's fisheries production, law enforcement, and post-harvest facilities, among others.

A central element of the plan is our commitment to promote good Coastal Resource Management (CRM) practices continuously. As such, for the past two years, we have been implementing the Malinis at Masaganang Karagatan or Clean and Abundant Seas programme, our national search for the most outstanding coastal community in the country.

The programme has already awarded millions of pesos fisheries communities in coastal towns based on the following five criteria: no illegal fishing; observance of a closed fishing season; declaration of a protected marine area; clean and trash-free coastal waters; and an effective mangrove protection and rehabilitation programme.

We have seen this to be the best way to incentivize good CRM practices and recruit community members toward taking care of their municipal waters and the nutrient-rich hub of mangroves, seagrass and coral reefs that provide food and life to the whole marine water ecosystem.

In terms of law enforcement, we have been upgrading our floating assets by acquiring more patrol vessels aimed at boosting our capacity to guard Philippine seas, and monitoring fishing operations. Like many of you, Philippines recognizes the threat illegal, unreported, and unregulated (IUU) fishing poses for the sustainability of fishing in the Asia-Pacific region. We have since the start of our term been implementing traceability measures, such as developing an electronic catch documentation system, to keep our markets free from any illegally-sourced fish.

We have also steered our attention to our inland waters, particularly in bringing back native, non-invasive and commercially viable fishes to our lakes and rivers. Project BASIL or the National Inland Fisheries Enhancement Program (NIFEP) aims to rehabilitate major bodies of freshwater across the country. This in turn helps the government alleviate poverty in many fishing communities by providing them with alternative sources of food and livelihood.

By and large, our fisherfolk stakeholders remain our greatest asset. By providing them with the right tools to build their own boats and pursue their own agri-fishery projects, we effectively ensure the development of the fisheries industry from the ground up. Our various livelihood development programmes reach even the farthest island provinces of the country, with our Agriculture Secretary Emmanuel Piñol at the helm of each provincial sortie or *Biyaheng Bukid* as we call it.

These efforts are what Philippines wants to share in promoting sustainable fishing in the Asia-Pacific region, and we are eager to hear about other practices and strategies from our fellow member states and partner organizations. We hope that this forum becomes a platform for all of us to pool together our knowledge and resources towards a better region-wide understanding of our common waters and oceans.

As host of this meeting, we are deeply grateful to the leadership of the APFIC for the incredible trust and confidence given to us. Rest assured that the Government of Philippines is always ready to cooperate with our partner states and organizations in advancing the resilient and sustainable growth of the blue economy in the region.

With that, we thank everyone for your time. And with much pride, we warmly welcome you all to our proud city in the south, Cebu.

## **Welcome remarks to the Seventh APFIC Regional Consultative Forum Meeting (RCFM)**

Cebu, Philippines | 7–9 May 2018

### **Sustainable Development for Resilient Growth of Fisheries and Aquaculture**

By

**Allan Poquita**

#### **Regional Director of BFAR Central Visayas**

Good morning!

It is my honour as Regional Director of BFAR Central Visayas to welcome you all to the Seventh APFIC Regional Consultative Forum Meeting (RCFM) here in Cebu.

We consider it a great privilege to host this meeting in Philippines. We see this gathering as a special and meaningful way to forge links between and among the APFIC's partner states and regional organizations.

This Seventh forum meeting will have us share our ideas towards a better region-wide understanding of the Asia-Pacific blue economy, our interconnected web of fisheries and aquaculture industries that continue to provide the bulk of the world's fish production.

We are expected to collaborate, to listen and contribute to each other's thoughts and suggestions, as we deliver updates on the progress we have made in our own endeavours in sustainably managing our fisheries resources.

I hope that as representatives we have come to this meeting prepared, ready to contribute new knowledge and information that will help us achieve resilient fisheries growth in this ever-changing world full of environmental and climate-related challenges.

I ask that, throughout the meeting, we remain steadfast in our goal of promoting and developing more productive, sustainable and mutually-reinforcing ocean-based economies.

So may we in the spirit of camaraderie have a fruitful and pleasant three-day discussions.

Thank you. Mabuhay po tayong lahat!

## Opening remarks to the Seventh APFIC Regional Consultative Forum meeting

Cebu, Philippines | 7–9 May 2018

### Sustainable Development for Resilient Growth of Fisheries and Aquaculture

By

**Mr José Luis Fernandez**

#### FAO Representative to Philippines

Good morning. Magandang Umaga.

On behalf of Ms Kundhavi Kadiresan, 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 Seventh Asia-Pacific Fishery Commission (APFIC) Regional Consultative Forum Meeting (RCFM). We recognize the valuable support of the Department of Agriculture-Bureau of Fisheries and Aquatic Resources (DA-BFAR) to organize this event.

Despite the good performance of the region, producing more than 50 percent of the world's catch of marine and river fish and 89 percent of global aquaculture, Asia-Pacific is still faced with various challenges. Some of these challenges relate to the declining fisheries resources, over-exploitation of aquatic habitats, negative impacts of climate change, and the competition for access to fisheries and aquatic resources among small-scale fishing communities. We recognize that each member country has been extending support to address these problems, however, there is still a lot of work that needs to be done.

The international community's call for multilateral cooperation to address the above-mentioned challenges led to the convening of member countries and regional partners in the RCFM. The forum, with the theme Sustainable Development for Resilient Blue Growth of Fisheries and Aquaculture, allows a biennial stock take of the work of APFIC. It therefore provides a venue for information exchange to discuss emerging issues and to explore and promote new and emerging ideas related to fisheries and aquaculture. The theme for this year reflects the aspirations of the APFIC members to contribute to increasing the regional pace of sustainable and responsible fisheries and aquaculture development, while considering the Regional Blue Growth Initiative, FAO Code of Conduct for Responsible Fisheries, and Sustainable Development Goals, among others.

The forum will have a full agenda for the next three days, which will include presentations from all the participating member countries and regional organization partners. The topics are diverse, spanning fisheries and aquaculture, both marine and freshwater, among others. These will facilitate understanding on how APFIC member countries are implementing different strategies to develop the subsectors, which can improve our knowledge, awareness and cooperation in the region.

The recommendations to be generated from this meeting will be presented in the Thirty-fifth Session of APFIC for further deliberation. These are important and will highlight key priorities and areas for action in the region. With this, I am positive that everyone will take full advantage of this occasion to continue collaborative work on the focus subsectors, while taking into account the national priorities of each member country. As most of you will stay on for the Thirty-fifth Session of APFIC, we hope that it will be an opportunity to reflect on the concerns and recommendations to be raised by the Commission.

In its role as a neutral regional advisory body, APFIC continues to strive to forge links between member countries, regional governmental organizations, non-state organizations, and other relevant stakeholders in order to have one voice in fisheries and aquaculture. In this regard, it is very encouraging to see all of you today and I am certain that your cooperation and insights during the forum will be valuable especially considering your critical role in fisheries and aquaculture development in the region.

On behalf of FAO, I would like to thank you for your participation and we look forward to your contributions in the next few days. We hope that this meeting will foster more interventions and partnerships that will benefit the small-scale fishers and other vulnerable groups.

I wish you all a productive day ahead, and may you also enjoy your stay here in Philippines.

Thank you, Maraming Salamat at Mabuhay.



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