

SEAFDEC Annual Report

2014



Southeast Asian Fisheries Development Center

SEAFDEC Annual Report 2014



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Preparation and Distribution of this Document

This SEAFDEC Annual Report 2014 was prepared by the Secretariat of the Southeast Asian Fisheries Development Center (SEAFDEC) in collaboration with the SEAFDEC Departments, namely: Training Department (TD), Marine Fisheries Research Department (MFRD), Aquaculture Department (AQD), Marine Fishery Resources Development and Management Department (MFRDMD), and Inland Fishery Resources Development and Management Department (IFRDMD). The Annual Report is distributed to the SEAFDEC Member Countries and Departments, partner agencies and other fisheries-related organizations, and to the public to make them aware of the activities of SEAFDEC and promote the visibility of the Center.

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EXECUTIVE SUMMARY

The programs and activities implemented by SEAFDEC in 2014 were formulated and implemented in line with the priority needs and policy directives of the Member Countries conveyed through the SEAFDEC Council and SEAFDEC Program Committee. Moreover, appropriate provisions in the Resolution and Plan of Action on Sustainable Fisheries for Food Security for the ASEAN Region Towards 2020 also serve as basis for the development of the SEAFDEC programs, which had been categorized into: Programs under the Fisheries Consultative Group of the ASEAN-SEAFDEC Strategic Partnership (FCG/ASSP): 21 programs; Departmental Programs: 8 programs; and Other Programs: 1 program. Specifically, for the Programs under the FCG/ASSP Mechanism, the projects have been grouped under five (5) Program Thrusts, namely: (i) Developing and Promoting Responsible Fisheries for Poverty Alleviation and Food Security; (ii) Enhancing Capacity and Competitiveness to Facilitate International and Intra-regional Trade; (iii) Improving Management Concepts and Approaches for Sustainable Fisheries; (iv) Providing Policy and Advisory Services for Planning and Executing Management of Fisheries; and (v) Addressing International Fisheries-related Issues from a Regional Perspective.

Besides the implementation of several programs, the establishment of the new Inland Fishery Resources Development and Management Department (IFRDMD) in Indonesia, which was proposed in 2011, was officially accomplished with the signing of the National Legitimacy Document and launching of the new Department in September 2014. While the activities of SEAFDEC have been undertaken in collaboration with the Member Countries, cooperation between SEAFDEC and other international/regional organizations and non-member governments sharing common interest on the sustainable utilization of fishery resources was also pursued with a view to enhancing the effectiveness and efficiency in the implementation of our programs and projects.

This SEAFDEC Annual Report 2014 summarizes the results of the activities undertaken by SEAFDEC during the year 2014, as well as briefly introduces the planned activities for 2015. It is envisioned that this Annual Report provides useful information on the programs and activities of SEAFDEC, and presents a better picture on the role of SEAFDEC in supporting the Member Countries in their efforts towards achieving sustainable development of fisheries.

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LIST OF ACRONYMS

AFCF	ASEAN Fisheries Consultative Forum
AMSS	ASEAN Member States
APFIC	Asia-Pacific Fisheries Commission
AQD	SEAFDEC Aquaculture Department
ASEAN	Association of Southeast Asian Nations
ASSP	ASEAN-SEAFDEC Strategic Partnership
ASWGFi	ASEAN Sectoral Working Group on Fisheries
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CTI-CFF	Coral Triangle Initiative on Coral Reefs, Fisheries and Food Security
EAFM	Ecosystem Approach to Fisheries Management
FAO	Food and Agriculture Organization of the United Nations
FCG	ASEAN-SEAFDEC Fisheries Consultative Group
GEF	Global Environmental Facility
IFRDMD	SEAFDEC Inland Fishery Resources Development and Management Department
IUU Fishing	Illegal, Unreported and Unregulated Fishing
JTF	Japanese Trust Fund to SEAFDEC
MCS	Monitoring, Control and Surveillance
MFRD	SEAFDEC Marine Fisheries Research Department
MFRDMD	SEAFDEC Marine Fishery Resources Development and Management Department
NATC	National Agricultural Training Council, Malaysia
PSM	Port State Measure
RFMOs	Regional Fisheries Management Organizations
RFVR	Regional Fishing Vessels Record for Vessels 24 m in Length and Over
RIHN	Research Institute for Humanity and Nature, Japan
SEAFDEC	Southeast Asian Fisheries Development Center
TD	SEAFDEC Training Department
USAID	United States Agency for International Development

ABOUT SEAFDEC

The Southeast Asian Fisheries Development Center (SEAFDEC) is an autonomous inter-governmental body established in 1967. SEAFDEC comprises 11 Member Countries: Brunei Darussalam, Cambodia, Indonesia, Japan, Lao PDR, Malaysia, Myanmar, Philippines, Singapore, Thailand, and Viet Nam. The Center operates through the Secretariat located in Thailand and has five Technical Departments, namely: the Training Department; the Marine Fisheries Research Department; the Aquaculture Department; the Marine Fishery Resources Development and Management Department; and the newly established Inland Fishery Resources Development and Management Department. The mandate of SEAFDEC as endorsed by the 41st Meeting of the SEAFDEC Council is *"to develop and manage the fisheries potential of the region by rational utilization of the resources for providing food security and safety to the people and alleviating poverty through transfer of new technologies, research and information dissemination activities"*.

The Secretariat

The SEAFDEC Secretariat is mandated to coordinate and oversee the general policy and planning of the Center, and acts as focal point for channeling and implementing the decisions and resolutions of the SEAFDEC Council of Directors. In addition, the Secretariat also organizes regular SEAFDEC meetings to obtain directives and guidance from the Member Countries on the operation of the organization, as well as regional technical consultations and meetings to address emerging issues as recommended by the Member Countries.



SEAFDEC Secretariat

The Training Department (TD)

Established in Thailand in 1968, TD has been focusing its efforts on the development of modern fishery techniques to aid regional fisheries in a more sustainable approach through the promotion of responsible fishing technologies and practices, exploration of resources, and advancing the coastal fisheries management approach. Under the new Strategic Plan which was endorsed by the SEAFDEC Council in 2006, the structure and activities of TD have been adjusted to emphasize on the promotion of coastal fisheries management to ensure responsible resource utilization and sustainable livelihoods in coastal communities, and the promotion of off-shore fisheries through the development of best fishing practices and energy optimization technology to ensure stable supply of food fish and reduce fishing pressure in coastal areas.



SEAFDEC/TD

The Marine Fisheries Research Department (MFRD)

MFRD was established in Singapore in 1969 and is responsible for promoting, undertaking, and coordinating research in fisheries post-harvest technology and furthering the development of the fish processing industry in the region. Its tasks include research and

development on fisheries post-harvest technology and practices, such as fish processing technology to optimize the utilization of harvested fish and enhance the quality and safety of fish and fishery products. MFRD also develops technology-based analytical methods to assess seafood safety and quality, and publishes several manuals as reference materials for the Member Countries.



SEAFDEC/MFRD

The Aquaculture Department (AQD)

Established in the Philippines in 1973, AQD has been carrying out research, technology verification, training and information dissemination on a wide range of aquaculture disciplines, including broodstock management and seed quality improvement, promotion of responsible and environment-friendly aquaculture, diagnosis and control of aquatic diseases, aquaculture for stock enhancement, and culture of aquatic species under international concern. The aquaculture commodities covered by AQD include fishes, shrimps, crabs, mollusks, and seaweeds. In addition, AQD also promotes good aquaculture practices and effective management of aquatic resources to support rural development and alleviate poverty.



SEAFDEC/AQD

The Marine Fishery Resources Development and Management Department (MFRDMD)

MFRDMD was established in Malaysia in 1992 to conduct activities on marine fishery resources focusing on biological studies of commercially important fish species, resource assessment and management, and conservation and management of aquatic species under international concern, e.g. sharks and marine turtles. MFRDMD also implements activities that support the Member Countries in collection of information on small pelagic species, and development of indicators that could be used for the sustainable development and management of fisheries.



SEAFDEC/MFRDMD

The Inland Fishery Resources Development and Management Department (IFRDMD)

Recently established in 2014 in Indonesia, IFRDMD is tasked to carry out activities that support the sustainable development and management of inland capture fisheries. Activities of IFRDMD also cover development of methodologies for data collection, as well as monitoring and assessment of inland fishery resources to provide scientific basis for sustainable development and management of inland fisheries in the Southeast Asian region.



SEAFDEC/IFRDMD

SEAFDEC COUNCIL IN 2014

Chairpersons of the SEAFDEC Council

Atty. Asis G. Perez (*until April 2014*)
Mr. Lee Kwong Weng (*April-December 2014*)

SEAFDEC Council and Alternate Council Directors:

Brunei Darussalam

Council Director:	Mr. Abdul Halidi Mohd. Salleh Acting Director, Department of Fisheries
Alternate Council Director:	Ms. Ranimah Haji A. Wahab Acting Deputy Director, Department of Fisheries

Cambodia

Council Director:	H.E. Prof. Dr. Nao Thuok Director-General, Fisheries Administration
Alternate Council Director:	H.E. Dr. Sam Nouv (<i>until May 2014</i>) Deputy Director-General, Fisheries Administration Mr. Ing Try (<i>since May 2014</i>) Deputy Director-General, Fisheries Administration

Indonesia

Council Director:	Dr. Sjarief Widjaja Secretary-General of Ministry of Marine Affairs and Fisheries
Alternate Council Director:	Dr. Achmad Poernomo Advisor to Minister for Public Policy, Ministry of Marine Affairs and Fisheries

Japan

Council Director:	Mr. Masanori Miyahara (<i>until January 2014</i>) Deputy Director-General, Fisheries Agency
	Mr. Kenji Kagawa (<i>since January 2014</i>) Deputy Director-General of Fisheries Agency, Ministry of Agriculture, Forestry and Fisheries
Alternate Council Director:	Mr. Tadayuki Miyashita Director, First Country Assistance Planning Division

Lao PDR

Council Director:	Dr. Bounkhouang Khambounheuang Director-General, Department of Livestock and Fisheries
Alternate Council Director:	Mr. Bounthong Saphakdy Deputy Director-General, Department of Livestock and Fisheries



Malaysia

Council Director:	Dato' Hj. Ahamad Sabki bin Mahmood (<i>until October 2014</i>) Director-General, Department of Fisheries Malaysia Y. Bhg. Datuk Hj. Ismail bin Abu Hassan (<i>since October 2014</i>) Acting Director-General, Department of Fisheries
Alternate Council Director:	Mr. Ismail bin Abu Hassan (<i>until October 2014</i>) Deputy Director-General of Fisheries (Development), Department of Fisheries Mr. Haji Johari bin Ramli (<i>since October 2014</i>) Deputy Director-General of Fisheries (Management), Department of Fisheries

Myanmar

Council Director:	Mr. Khin Maung Maw Director-General, Department of Fisheries
Alternate Council Director:	Mr. Htun Win Deputy Director-General, Department of Fisheries

Philippines

Council Director:	Atty. Asis G. Perez Undersecretary for Fisheries, Department of Agriculture and National Director, Bureau of Fisheries and Aquatic Resources
Alternate Council Director:	Mrs. Drusila Esther E. Bayate Assistant Director for Technical Services, Bureau of Fisheries and Aquatic Resources

Singapore

Council Director:	Mr. Lee Kwong Weng Deputy CEO (Corporate & Technology), Agri-Food & Veterinary Authority of Singapore
Alternate Council Director:	Mrs. Tan-Low Lai Kim Group Director, Food Supply Resilience Group, Agri-Food & Veterinary Authority of Singapore

Thailand

Council Director:	Mr. Niwat Sutemechaikul (<i>until December 2014</i>) Director-General, Department of Fisheries Dr. Joompol Sanguansin (<i>since December 2014</i>) Director-General, Department of Fisheries
Alternate Council Director:	Mr. Chirdsak Vongkamolchoon Deputy Director-General, Department of Fisheries

Viet Nam

Council Director:

Mr. Pham Anh Tuan
Deputy Director-General, Fisheries Administration,
Ministry of Agriculture and Rural Development

Alternate Council Director:

Mr. Nguyen Viet Manh
Director of Science, Technology and International
Cooperation Department, Fisheries Administration,
Ministry of Agriculture and Rural Development



SEAFDEC SENIOR OFFICIALS IN 2014

Secretary-General

Dr. Chumnarn Pongsri

Deputy Secretary-General

Mr. Hajime Kawamura

Training Department (TD)

Chief

Dr. Chumnarn Pongsri

Deputy Chief

Mr. Hajime Kawamura

Marine Fisheries Research Department (MFRD)

Chief, MFRD Programmes

Mr. Yeap Soon Eong

Aquaculture Department (AQD)

Chief

Dr. Felix G. Ayson

Deputy Chief

Dr. Teruo Azuma (*until March 2014*)

Dr. Takuro Shibuno (*since April 2014*)

Marine Fishery Resources Development and Management Department (MFRDMD)

Chief

Ms. Mahyam Mohd. Isa

Deputy Chief

Dr. Masaya Katoh

Inland Fishery Resources Development and Management Department (IFRDMD)

Chief

Mr. Budi Iskandar Prisantoso (*since October 2014*)

MESSAGE FROM THE CHAIRPERSON OF SEAFDEC COUNCIL FOR THE YEAR 2014



It has been an honour and privilege to serve as Chairperson of the SEAFDEC Council for the year 2014.

2014 has been another very significant and eventful year for SEAFDEC. In particular, our continued focus on the sustainable development of fisheries in the region saw us arriving at a number of milestones. These include the development of several regional policy framework in support of combating IUU fishing, such as the Regional Fishing Vessels Record (RFVR) starting with fishing vessels 24 meters in length and over, the Guidelines to Prevent the Entry of Fish and Fishery Products from IUU Fishing Activities into the Supply Chain, and the ASEAN Catch Documentation Scheme. Other activities to ensure the sustainable utilization of fishery resources have also made good progress.

Another key milestone for SEAFDEC was the establishment of the Inland Fishery Resources Development and Management Department (IFRDMD) hosted by the Government of Indonesia in Palembang. On behalf of the SEAFDEC Council, I would like to take this opportunity to once again, express our appreciation to the Government of Indonesia for the kind contributions and strong support extended to this new Department. The establishment of the IFRDMD would be a strong catalyst to address the needs for sustainable development of inland capture fisheries, and help ensure the increased contribution of this sub-sector to food security and well-being of the rural population in the Southeast Asian region.

Since its establishment in 1967, SEAFDEC has served its Member Countries well in tandem with the progress of member states' social and economic developments. Going forward I encourage SEAFDEC to continue to remain relevant amidst a dynamic regional operating environment. In a year's time ASEAN Member States which are also SEAFDEC Member Countries would enter into ASEAN Economic Community. This will bring about opportunities as well as challenges for all of us. It is important that the fisheries sector is prepared to take on the changes that may arise from such circumstances. This will require even closer cooperation among SEAFDEC Member Countries to ensure the sustainable utilization of fishery resources for our peoples in the year to come. In this respect I am confident that SEAFDEC Member Countries would certainly be able to work together to meet expectations as we have done so for the past many years.

I would like to thank my fellow Council Directors and the SEAFDEC Secretary-General for the close cooperation and excellent support throughout the year. They have certainly made my job as Chairperson less taxing than what it could have been. I am also grateful to the many passionate and hardworking staff of the SEAFDEC Secretariat and Departments for their efforts and contributions to realize SEAFDEC's achievements for the year. I wish SEAFDEC continued success ahead.

Lee Kwong Weng

Deputy CEO (Corporate & Technology)
Agri-Food & Veterinary Authority, Singapore



MESSAGE FROM THE SEAFDEC SECRETARY-GENERAL



While responding to the primary concern over sustainability of resources for future generations, the Southeast Asian fisheries have been confronted with emerging challenges. Addressing such concerns therefore calls for collective efforts of countries in the region to promote improved utilization of the fishery resources including conduct of good aquaculture practices, in a more sustainable and responsible manner.

As an inter-governmental organization, SEAFDEC has been supporting the Southeast Asian countries towards such direction through the conduct of several programs of activities. While SEAFDEC continued to implement technical activities towards the sustainable utilization of fishery resources during the past few years, its initiatives have also been expanded to develop policy recommendations for consideration by the Member Countries. Along line with the Resolution and Plan of Action on Sustainable Fisheries for Food Security for the ASEAN Region Towards 2020, several regional guidelines and actions plan have also been developed in collaboration with the Member Countries. In the year 2014, SEAFDEC started to see the fruits from such initiatives that pave the way towards closer regional cooperation for sustainable fisheries and aquaculture development in the light of the ASEAN Economic Community in the very near future.

SEAFDEC would not have been able to achieve its objectives without the full support and cooperation of the Member Countries. I would therefore wish to take this opportunity to express our utmost gratitude to all the Member Countries for providing guidance and cooperation to SEAFDEC throughout the past years. We would also treasure the cooperation from our several partners, especially the Government of Japan through its Fisheries Agency and the Government of Sweden, as well as to the numerous other regional/international partners for extending technical and financial support to SEAFDEC. Your support and assistance enabled SEAFDEC to implement programs and projects that address the priorities and requirements of the countries in the Southeast Asian region.

It is the hope of SEAFDEC that the results from past years' research, training and information activities under our programs and projects in fisheries and aquaculture would contribute to enhancing the technical capacity of the countries in the region. Finally, we also expect that the initiatives that SEAFDEC had undertaken would pave the way towards the sustainable development of fisheries and aquaculture in the Southeast Asian region.

Chumnarn Pongsri, Ph.D.
Secretary-General

OVERVIEW OF SEAFDEC PROGRAMS IN 2014

The activities of SEAFDEC in 2014 were formulated and implemented in line with the policy directives given by the SEAFDEC Member Countries during SEAFDEC annual meetings, *i.e.* the 36th Meeting of the SEAFDEC Program Committee (25-27 November 2013, Penang, Malaysia), 16th Meeting of the Fisheries Consultative Group of the ASEAN-SEAFDEC Strategic Partnership (FCG/ASSP) (28-29 November 2013, Penang, Malaysia), and the 46th Meeting of SEAFDEC Council (1-4 April 2014, Singapore).



Council Directors attending the 46th Meeting of the SEAFDEC Council hosted by the Government of Singapore

Formulation and development of the programs and activities of 2014 had been guided by regional and international fisheries policy frameworks, particularly the Resolution and Plan of Action on Sustainable Fisheries for Food Security for the ASEAN Region Towards 2020, adopted by the ASEAN-SEAFDEC Ministers during the ASEAN-SEAFDEC Millennium Conference in 2011. Moreover, under the ASEAN-SEAFDEC Strategic Partnership (ASSP) established since 2007, SEAFDEC has been implementing activities to support the ASEAN in its efforts towards the realization of the ASEAN Economic Community, particularly the ASEAN Roadmap for Integration of the Fisheries Sector, the ASEAN Integrated Food Security (AIFS) Framework, and the ASEAN Fisheries Consultative Forum (AFCF).

The progress of the programs and activities implemented in 2014 had been approved and endorsed by the 37th SEAFDEC Program Committee Meeting held in Ubon Ratchathani, Thailand on 1-3 December 2014, and the 17th Meeting of the FCG/ASSP on 4-5 December 2013, also in Ubon Ratchathani, Thailand, for subsequent submission to the SEAFDEC Council at its 47th Meeting in 2015.



Participants of the 37th SEAFDEC Program Committee Meeting and the 17th Meeting of the FCG/ASSP held in Ubon Ratchthani, Thailand



Programs and activities implemented by SEAFDEC in 2014:

Program Category/Project Title	Responsible Department	Funding Source
ASEAN-SEAFDEC FCG/ASSP Programs		
Thrust I: Developing and Promoting Responsible Fisheries for Poverty Alleviation and Food Security		
1. Rehabilitation of Fisheries Resources and Habitat/ Fishing Grounds Through Resources Enhancement (<i>Completed in 2014</i>)	TD	JTF
2. Human Resource Development for Sustainable Fisheries	TD	JTF
3. Optimizing Energy Use/Improving Safety Onboard in Fishing Activities	TD	JTF
4. Resource Enhancement of Internationally Threatened and Over-exploited Species in Southeast Asia Through Stock Release (<i>Completed in 2014</i>)	AQD	JTF
5. Promotion of Sustainable and Region-oriented Aquaculture (<i>Completed in 2014</i>)	AQD	JTF
Thrust II: Enhancing Capacity and Competitiveness to Facilitate International and Intra-regional Trade		
6. Chemical and Drug Residues in Fish and Fish Products in Southeast Asia - Biotoxins Monitoring in the ASEAN Region: ASP, AZA & BTX	MFRD	JTF
7. Traceability Systems for Aquaculture Products in Southeast Asian Region (<i>Completed in 2014</i>)	MFRD	JTF
8. Accelerating Awareness and Capacity-building in Fish Health Management in Southeast Asia (<i>Completed in 2014</i>)	AQD	JTF
9. Food Safety of Aquaculture Products in Southeast Asia (<i>Completed in 2014</i>)	AQD	JTF
Thrust III: Improving Management Concepts and Approaches for Sustainable Fisheries		
10. Strategies for Trawl Fisheries By-catch Management	TD	FAO/GEF
11. Promotion of Countermeasures to Reduce IUU Fishing Activities	TD	JTF
12. Combating IUU Fishing in the Southeast Asian Region through Application of EU Catch Certification for International Trading in Fish and Fishery Products	MFRDMD	JTF
Thrust IV: Providing Policy and Advisory Services for Planning and Executing Management of Fisheries		
13. Fisheries Resource Survey and Operational Plan for M.V. SEAFDEC 2	TD	JTF

Program Category/Project Title	Responsible Department	Funding Source
14. Offshore Fisheries Resources Exploration in Southeast Asia	TD	JTF
15. Research and Management of Sea Turtles in Foraging Habitats in the Southeast Asian Waters (<i>Completed in 2014</i>)	MFRDMD	JTF
16. Enhancing the Compilation and Utilization of Fishery Statistics and Information for Sustainable Development and Management of Fisheries in Southeast Asian Region	TD	JTF
17. Comparative Studies for Management of Purse Seine Fisheries in the Southeast Asian Region	MFRDMD	JTF
18. Research and Management of Sharks and Rays in the Southeast Asian Waters (<i>Completed in 2014</i>)	MFRDMD	JTF
Thrust V: Addressing International Fisheries-related Issues from a Regional Perspective		
19. Assistance of Capacity Building in the Region to Address International Trade-related Issues	SEC	JTF
20. Strengthening SEAFDEC Network for Sustainable Fisheries	SEC	JTF
Special Project		
21. Fisheries and Habitat Management, Climate Change and Social Well-being in Southeast Asia	Secretariat	Sweden
Departmental Programs*		
1. Adapting to Climate Change Impacts	AQD	AQD
2. Healthy and Wholesome Aquaculture	AQD	AQD
3. Maintaining Environmental Integrity through Responsible Aquaculture	AQD	AQD
4. Meeting Socio-economic Challenges in Aquaculture	AQD	AQD
5. Quality Seed for Sustainable Aquaculture	AQD	AQD
6. Promotion and Enhancement Fisheries Information	TD	TD
7. Tailor-made Training Programs	TD	TD
8. Improvement of Fisheries Technology and Reduction of the Impacts from Fishing	TD	TD
Other Program		
1. Coastal Area Capability Enhancements in Southeast Asia	TD (in collab. with AQD)	RIHN

* Funding sources for Departmental Programs are mainly the regular contribution from the respective Host Governments.

SEAFDEC PROGRAMS OF ACTIVITIES IN 2014

Programs and activities in 2014 have been formulated and undertaken by SEAFDEC in response to the requirements of the Member Countries, taking into consideration the priority issues in line with the “Resolution and Plan of Action on Sustainable Fisheries for Food Security for the ASEAN Region Towards 2020”. The progress of activities in 2014 could be summarized as follows:

THRUST 1. DEVELOPING AND PROMOTING RESPONSIBLE FISHERIES FOR POVERTY ALLEVIATION AND FOOD SECURITY

1.1 Habitat Conservation and Resources Enhancement

The project on “**Rehabilitation of Fisheries Resources and Habitat/Fishing Grounds Through Resources Enhancement**” had been implemented by TD since 2010, and was completed in 2014. This project involved the identification of resource enhancement tools suitable for the region in order to develop management measures, and formulate strategies and guidelines through regional consultative meetings. A series of regional training programs were also conducted to build up the capacity of Member Countries in promoting sustainable fisheries resource enhancement in their respective countries.

In 2014, TD continued to investigate the status of critical fishing grounds in three project sites with different types of habitats, *i.e.* sea grass beds, artificial reefs, freshwater reservoirs. Implementation of activities relevant to rehabilitation and development of conservation measures was carried out, the results of which have been advocated to the communities.

For marine habitat, the **sea grass bed** in Sriboya Island, Krabi Province, Thailand was selected as this had been considered as under the state of “decline” and thus, should be conserved. Harvest of dog conch, an edible sea snail (Family Strombidae) is commonly practiced in the area either by hands and/or labor-saving equipment using motorized boats, dredges and nets. However, such massive collection methods easily led to drastic degradation of



Workshop on Andaman Province Dog Conch Shell Resource Management Measures in Krabi Province, Thailand



Demonstration and hands-on training for local fisheries officers and fishing community on construction and installation of artificial fish shelters in the conservation area in Nam Houm Reservoir, Lao PDR

the sea grass habitat and dog conch population. TD therefore promoted the conservation and optimum utilization of dog conch through public awareness activities. The Workshop on Andaman Province Dog Conch Shell Resource Management Measures on 20 August 2014 in Krabi Province, Thailand, which was participated in by local stakeholders in Krabi and nearby provinces, led to the introduction and subsequent implementation of several management schemes, such as restrictions on dog conch harvestable size and types of fishing gear, as well as banning the use of motorized boats. Furthermore, several types of media that support awareness building, such as posters, stickers, brochures and banners, were produced and distributed to several provinces along the Andaman Sea coast. Through such activities, permanent dog conch conservation areas were established by local fishing communities at Sriboya Island in Krabi Province, and Muk Island in Trang Province. Demarcation of conservation areas at Sarai Island in Satun Province and some other areas had been proposed and under consideration by their respective local fishing communities. For the selected project site for ***artificial reefs***, TD also continued to monitor the present condition of the site, including the abundance and structure of the fishery resources, as well as the means of utilization of such resources by local fishers.

Furthermore, for the inland project site in ***Nam Houm Reservoir***, a man-made reservoir in Lao PDR, TD carried out a survey on 20-26 July 2014 to identify and evaluate the fishery ecosystems in the Reservoir. Based on the survey results, fish conservation areas could be established in the Reservoir to conserve the broodstocks and provide nursing grounds for juvenile fish. Demonstration and hands-on training was subsequently conducted for local fisheries officers and fishing community on the construction and installation of artificial fish shelters in the conservation area. In addition, following-up to the training on Mobile Hatchery Unit for Breeding of Common Silver Barb, *Barbonymus gonionotus* which was previously conducted for the fishing communities around the Reservoir, TD had extended the nursery techniques for such species to the communities in 2014.

1.2 Improving Safety and Optimizing Energy Use in Fishing Activities

The project on “**Optimizing Energy Use/Improving Safety Onboard in Fishing Activities**” had been implemented by TD since 2013 with the objectives of developing appropriate technologies, transferring knowledge, and enhancing awareness on optimizing energy use in fishing activities, and promoting safety at sea for small fishing vessels in the Southeast Asian countries. In 2014, training sessions on Optimizing Energy and Safety at Sea for Small Fishing Vessels were conducted in Indonesia (28-30 January 2014, Semarang, Indonesia) in collaboration with the Department of Balai Besar Pengembangan Penangkapan Ikan (BBPPI) of Indonesia, and in the Philippines (24-28 March 2014, Cebu, Philippines) in collaboration with the Bureau of Fisheries and Aquatic Resources (BFAR) of the Philippine Department of Agriculture and BFAR Regional Office in Cebu. During the training, basic



Demarcation of dog conch conservation areas at Sarai Island in Satun Province



Participants during the training on Optimizing Energy and Safety at Sea for Fishing Vessels



Practice on vessel measure through 3D technique during the Training on Optimizing Energy and Safety at Sea for Small Fishing Vessels

knowledge on energy saving and safety at sea was transferred to the participants, which included extension officers and fisheries managers of coastal provinces of the respective countries, as well as ship owners, ship building authorities, and fisheries officials working on issues related to safety at sea. The Guidelines on Optimizing Energy and Safety at Sea for Small Fishing Vessels, which was translated and printed in their respective national languages, were disseminated and used during the training sessions in Indonesia and the Philippines.

TD in collaboration with FAO also implemented the project on “**Energy Audit for Trawlers in the Gulf of Thailand**” that included activities pertaining to standard energy auditing for shrimp trawlers in the Gulf of Thailand. In May 2014, an experiment on energy audit of trawl design was conducted using the M.V. Plalung; while energy audit for commercial trawlers is planned for 2015. This project is expected to come up with a comprehensive scientific report summarizing the results from field tests onboard trawlers.

Furthermore, TD continued to conduct sea trials in 2014 to verify the reduction of energy consumption using “Low Energy Consumption” trawl net (LEC-trawl net), as well as its catch efficiency. In 2013, TD designed the LEC-trawl with only two-third of its original weight to reduce net dragging force during fishing operations, and initiated sea trials to evaluate the catch efficiency of the LEC-trawl. The data compiled from the sea trials in 2013-2014 would be analyzed, and the results would be published in 2015.



An experiment on energy audit on trawl design in the Gulf of Thailand

1.3 Improvement of Responsible Fisheries Technology

TD, in collaboration with the Research Institute for Humanity and Nature (RIHN) of Japan and other partners, has implemented a research project on “**Coastal Area Capability Enhancement in Southeast Asia**” since 2012. Under this project, the “holistic approach” had been adopted to come up with full understanding of how people utilize the coastal resources and to support the establishment of rational and practical measures for social and ecological sustainability.



Discussion with fishers on the survey of livelihood and socio-economics of fishers

Using set-net fishing as core activity, the project conducted preliminary surveys to examine the present status of the resources, biology, livelihoods, social activities, and the environment to be able to evaluate the area capability of coastal areas in Mae Ram Phueng Beach, Rayong Province. Activities in 2014 included standardization of methods for data collection, conduct of monthly field surveys and relevant tests, development of equipment and system, and collection of environmental data. A series of preliminary monitoring and follow-up surveys on fishing activities, as well as physical and oceanographic conditions were also conducted periodically. However, as set net fishing season is limited to only 7 months from October to April, the data compiled from the monitoring and surveys during such period might not be sufficient to come up with year-round information. Thus, such activities would be continued in 2015 to complete the data. Other land surveys were also undertaken to obtain information related to social and livelihood activities, while fish sampling was also pursued.



Field survey on collection of environment data

1.4 Quality Seeds for Sustainable Aquaculture

Success in the sustainable production of aquatic species for human consumption depends primarily on the availability of quality seed stocks as well as on the optimal husbandry techniques. In 2014, AQD continued various studies under the program on “**Quality Seeds for Sustainable Aquaculture**” to determine the optimal conditions and methods for producing quality seed stocks in sufficient quantities, including methods for stock

improvement such as domestication, broodstock management, strain evaluation, and selective breeding or genetic improvement of traditional and emerging freshwater and marine species.

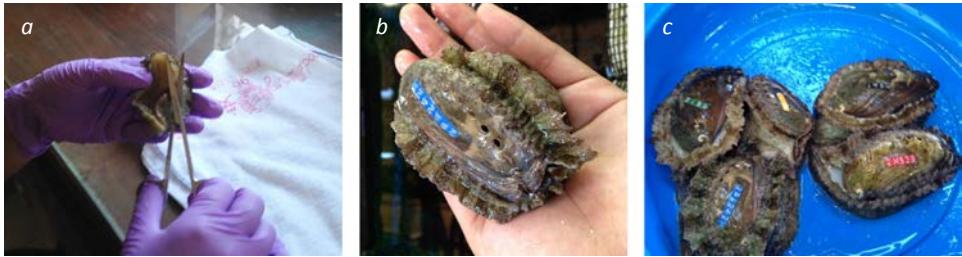
For the ***Development of Good Quality Broodstock and Implementation of Proper Stock Management Protocols***, focus was made on monitoring genetic structures of base populations, establishing husbandry techniques, culturing live food, and developing suitable formulated diets for good reproductive performance of various commodities. On shrimps, two consecutive generations were grown as broodstock to develop techniques for sustainable production of good quality captive *Penaeus monodon* brooders. The result showed that the reproductive performance of both F_1 and F_2 generation broodstocks were not consistent in terms of percentage maturation, successful spawning and fecundity. In rearing shrimps to broodstock size, higher survival was obtained for stocks reared at 0.25 individuals/m² while broodstock size was obtained within 1.5-2.5 months for those stocked at lower densities of 0.5 and 0.25 individuals/m².

Molecular markers for identifying stocks and determining genetic quality as well as for pedigree analyses are being developed for several commercial aquaculture species. Development of quality shrimp, milkfish, abalone and oyster broodstock through conventional stock monitoring and management protocols is being conducted in collaboration with the University of the Philippines and Japan's Tohoku University. Samples of potential shrimp broodstock collected from various Philippine sites have been genetically characterized.



Molecular marker-based broodstock management method is also being adopted for Philippine milkfish *Chanos chanos* stocks. Preliminary screening of genetic diversity in stocks obtained from various Philippine sites showed similar levels of expected heterozygosity (values of 0.678 to 0.703). As for the abalone, stocks from different areas in the Philippines were collected and five families per stock are being produced to assess genetic and production characteristics.

Nutritional methods to improve egg production and quality are also being developed with a maturation diet for grouper (*Epinephelus fuscoguttatus*) formulated using a natural



(a) Excision of foot muscle tissue for DNA analysis; (b) and (c) tagged abalone for selective breeding study

pigment such as paprika, and its effects on seed quality and production were monitored with encouraging results. Efficient low-pollution diets for rearing potential freshwater prawn broodstock are also being developed and tested. Isonitrogenous (35% crude protein) and isocaloric (346-350 kcal/100 g diet) grow-out diets were used in tank and lake-based grow-out culture of giant freshwater prawn *Macrobrachium rosenbergii* post-larvae. Isonitrogenous (38%) and isocaloric (378 kcal/100 g diet) broodstock diets were also formulated, where sardine fishmeal was replaced with cowpea meal at varying levels in both diets. Feeding trials in lake-based cages showed that specific growth and survival rates were not affected by using cowpea meal in test diets. Prawns fed commercial prawn diet had 64% survival rate, mean body weight of 13.98 g, and specific growth rate of 4.73%/day, comparable to the performance of test diets, suggesting that replacing fishmeal with cowpea meal up to 45% level is acceptable to the freshwater prawns. The economic viability of using this alternative protein source is being assessed. Meanwhile, giant freshwater prawns in tanks fed broodstock test diets had highest percentage of berried females in diet with 45% cowpea replacement after 180 days. The number of larvae produced per hatching event ranged from 4,750 to 6,549, the highest of which was in broodstock fed the diet with 45% cowpea replacement.

Sustainable production of marine annelid (*Marpphysa mossambica*) was pursued as important feed for mud crab broodstock. Various feed combinations of live annelid and annelid meal as feed for mud crab broodstock have been evaluated and shown to improve reproductive performance while the response of maturing female crabs to different dietary treatments is being analyzed.

For donkey's ear abalone, maturation diets are currently being assessed to improve reproduction considering the nutrient composition of eggs from wild-sourced abalone and those from hatchery-bred stocks that had been identified. Dietary formulations with varying levels of protein/energy ratios had their effects tested on abalone reproductive performance using wild and hatchery conditioned broodstock. Reproductive performance of hatchery-bred abalone broodstock generally improved with increased dietary protein energy levels from 27% CP/3210 kcal/kg energy to 37% CP/3350 kcal/kg energy. Lower spawning success correlates with the lower amount of protein and lipid in the egg. Shorter time to maturity was noted with broodstock fed formulated diets containing 8% lipid level sourced from combining fish oil and thraustochytrid, while egg hatching rates increased with increased lipid level regardless of the sources of lipids. Higher levels of dietary HUFAs and PUFAs also correlate well with better reproductive performance.

In oysters *Crassostrea iredalei*, protocols for broodstock management and conditioning are being developed to maximize production. Preliminary results showed that broodstock reared in an estuary and in semi-intensive ponds resulted to faster gonadal development. In blue swimming crab *Portunus pelagicus*, non-ovigerous broodstock crabs can be transported at a high loading density of 10 individuals/16 liters seawater for 6-hour duration.

Efforts to develop broodstock of Napoleon wrasse *Cheilinus undulatus* for stock management and enhancement have not been successful due to difficulty in stock collection. Meanwhile, activities are being undertaken to study the giant grouper for broodstock development and genetic stock management.

Refinement of Hatchery and Nursery Management Methods was continued in order to improve seed stock quality and production. Trials were made to determine the appropriate hormone concentrations to induce spawning in spotted scat *Scatophagus argus*. For pompano *Trachinotus blochii*, conditions for breeding and seed production were determined. Adding probiotics to live food improved the growth, survival and resistance to stress such as hypoxia and stimulated digestive enzyme activities in larvae. Protocols for nursery rearing of pompano in cages have also been developed. Using different initial sizes at stocking showed that better growth was observed in fish stocked at <5 g when fed pompano diet. Comparable growth was noted in bigger size fry fed either pompano feed or a generic high value fish feed. When stocked at 1,500 and 2,000 heads/cage, comparable growth, survival and duration of culture to reach 50 g were noted in the two stocking densities. Costs for production under the various interventions are being noted to determine the most suitable, cost-effective nursery production scheme.

For milkfish, feeding trials to compare the reproductive traits of broodstock fed fortified vs non-fortified (control) diets were conducted where fortified diets contain phospholipids, carotenoids, vitamin C, beta carotene, and arachidonic acid. More spawning episodes were observed in young milkfish broodstock fed fortified diets compared to old stocks (17-29 year old). Older stocks fed fortified diets produced longer fry but those produced from young brooders showed higher fry survival. To improve the seed yield of selected high value marine fish species such as grouper, red snapper, sea bass, rabbitfish and pompano, sodium-iodide enriched rotifers and *Artemia* were used as feed for larvae, where metamorphosis and survival of the high value species were noted, while survival rate of



(a) Flow-chart for mass culture of locally isolated benthic diatoms for abalone hatchery; and (b) 10-day-old abalone post larvae

red snapper improved when fed sodium-iodide enriched rotifer (for 16 hours) and *Artemia*. *Cocconeis* sp., *Nitzchia* sp. and *Diploneis* sp. have been used as alternative benthic diatom feed for hatchery rearing of abalone. Feeding preference experiments for abalone juveniles after 48 hours showed that the highest percent incidence of juveniles (20.8% juveniles h^{-1}) was observed in plates with *Nitzchia* sp., followed by *Cocconeis* sp., *N. ramossissima*, *Amphora* and finally *Diploneis* sp. but among the five natural food organisms, gut analysis showed that *Amphora* sp. was highly digestible (27.49%), while significantly higher growth rate was observed in abalones fed *Amphora* sp.

In improving abalone hatchery production, the use of microparticulate diets as alternative feed has been tested. An agar-bound microparticulate diet (MPD) formulated based on nutrient profile of post larval abalone was used in abalone stocked in 2-ton fiberglass tanks where high percent settlement rate (37%) was noted in larvae from wild-sourced broodstock, and 25% for larvae from hatchery-bred broodstock. Feeding frequency trials in big tanks showed that daily feeding is needed to sustain abalone survival in the nursery rearing phase. In another experiment which aimed to increase the survival rate of abalone veliger larvae through improved harvesting, stocking density and incubation protocols, the highest veliger survival (97%) was attained at 5,000 L⁻¹ stocking density. Regardless of the stocking density, larval survival decreased after 16 hours to 18 hours incubation.

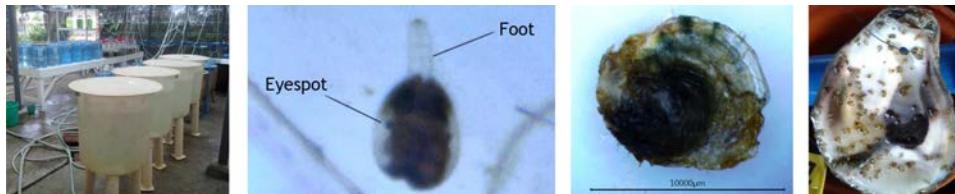


Preparation of microparticulate diet for abalone post larvae

In oysters, different spawning techniques were compared to determine the optimal method that provides steady production of quality oyster seedstocks. All methods (desiccation, thermal shock and exposure to UV-irradiated water) induced oysters to spawn but faster response was noted in thermally-manipulated batch with higher number of eggs released per mass spawning batch. When larval rearing performance in tanks subjected to partial flow-through and/or static water was compared, survival was higher in static water culture. Feeding *Isochrysis galbana* alone to oyster larvae gave better survival compared to combined feed with *Chaetoceros calcitrans* or *Chaetoceros calcitrans* alone.



Oyster broodstock conditioning environments: (a) estuary, (b) semi-intensive fishpond, and (c) hatchery tank with microalgal diet of Isochrysis galbana and Tetraselmis tetrahele



Larval rearing of oysters to produce eyed larvae and spats of oyster

Efforts to improve performance of mud crab larvae in the hatchery were continued, where enhanced larval growth was noted when fed diet composed of 1% squid meal and 1% annelid meal, while molt death syndrome (MDS) was lower in larvae fed formulated diet plus natural food. The influence of stocking density and tryptophan-supplemented diets on survival and growth of mud crab in the nursery phase is also being determined. Crabs reared for 4 weeks at $30/m^2$ had higher survival (59.7%) than those stocked at $50/m^2$ (47.6%), while crabs fed mussels and basal artificial diet survived better than those fed mussels alone or mussels and artificial diet with 0.5 to 0.75% tryptophan. In another experiment, crabs stocked at $5/m^2$ and $10/m^2$ and subjected to the same feeding regimes, survived better in mussel and basal artificial diet combination. Survival was better in lower stocking density of $5/m^2$ than at $10/m^2$. The inclusion of tryptophan in the diet did little to reduce incidence of cannibalism. In determining the optimal feeding ratio of natural food (NF) to artificial diet (AD) to be used during the 1st and 2nd mud crab nursery phases, higher survival rates (80-90%) were attained in stocks given the NF:AD combinations than those stocks fed singly with either NF or AD. Provision of shelters to reduce cannibalism of mud crabs was also explored, where net ribbon shelter was observed to be best in controlling cannibalism compared with zigzag nets, plastic ties and *Gracilaria*. When done at low density of $30/m^2$, higher survival and growth were achieved. When claw-trimmed and autotomized crablets were compared with intact crablets, survival was similar between intact crablets and claw-trimmed ones.



(a) Harvest of mud crab from collaborator's nursery in Silay City, Negros Occidental; and (b) Mud crab juveniles harvested from a collaborator's nursery in EB Magalona, Negros Occidental

Studies were also done for blue swimming crab (BSC) *Portunus pelagicus*, where larvae were fed commercially available shrimp diets. Antibiotics have also been tested to evaluate its impact in BSC larval production. By applying furazolidine daily or every 5 days during hatchery rearing, higher survival was attained compared with those treated with oxytetracycline given every 5 days and daily water change. Megalopae were produced even without antibiotics indicating that these can still be produced depending on the quality of larvae.

For BSC nursery production, bigger crab instars did not survive well at low salinity of 8 ppt, and the optimal stocking densities during two nursery phases were 300 individuals/ton for phase 1 and 200 individuals/ton for phase 2. When reared in net cages, survival was best at stocking density of 30 individuals/m² for phase 1 (54%) and 10 individuals/m² for phase 2 (80%). Concerning seaweeds, nursery rearing techniques for *Kappaphycus* sp. are being refined where cultivars produced in laboratory through tissue culture are reared in land-based nursery tanks and sea cages. Optimization of culture conditions in vitro for *K. alvarezii*, *K. striatum* and *Eucheuma denticulatum* was conducted, and growth rates of explants from different parts of the thallus were also tested. The best size (length) of explant used for micropropagation is 0.5 cm. Efforts to outplant tissue culture explants are currently being undertaken.

For the development of hatchery techniques for indigenous silver therapon *Leiopotherapon plumbeus*, two rotifer strains (*Brachionus rotundiformis* and *B. plicatilis*) were tested as starter food for first feeding larvae. Results suggest that *B. rotundiformis* is a suitable starter food for first-feeding silver therapon larvae, which could define the larval feeding protocol for silver therapon. For sandfish *Holothuria scabra*, improvements in hatchery and nursery production have been undertaken. Refinements in nursery protocol included modifying floating hapa nursery design and determining optimal stocking density. Using PVC pipes instead of bamboo framed modules increased ease of maintenance and monitoring of sandfish in nursery cages, with survival rate highest in lowest stocking density of 30/m². Preliminary nursery runs in different sites showed that a protected cove in Ajuy, Iloilo gave good prospects for nursery rearing.



Larval rearing of silver therapon (L. plumbeus) under laboratory conditions: (a) formulated microparticulate diet (MPD) used in the weaning experiment; and (b) ingestion of MPD (with arrow sign) by 5-day post hatch (dph) larvae

For stock enhancement, the propagation of seahorses *Hippocampus barbouri* and *H. comes*, in the hatchery for possible stock release was continued, while the genetic analysis of different seahorse species was pursued. Tissue samples were analyzed for genetic characterization, where species-specific primers HiSpiF1 and HiBarF1 were found useful for species identification of *H. spinosissimus* and *H. barbouri*. Another marker system (mtDNA RFLP) was also tried and species diagnostic RFLPs were identified mainly for *H. comes*.

Development of Schemes for Production, Management, Maintenance and Dissemination of Genetically Selected and Improved Stocks. Selective breeding programs have commenced in selected crustaceans (mud crab, shrimps and freshwater prawns). In mud crab, stress tests (particularly formalin tolerance and disease challenge response) were done to determine strain level differences to identify stocks with better fitness attributes. For genetic improvement of the giant freshwater prawn, effective broodstock management scheme is assessed to determine enhanced growth and/or reproductive performance. Potential broodstocks from various sites were used to compare growth and reproductive



performance. Broodstock management methods, such as: (i) reciprocal crossing between stocks from the same site but obtained in different periods; and (ii) optimal sex ratio, resulted in improvements in terms of growth in domesticated strains. Reciprocal “hybrids” used as broodstock seem to have positive effect on performance of progenies when tested for growth.

For local commercial abalone species (*Haliotis asinina*), hybridization is currently being done by crossing with other Philippine abalone species, *H. planata* and *H. glabra*, to produce stocks/species with improved traits. After 330 days of culture, survival was highest for the *H. glabra* hybrid followed by pure *H. asinina* and *H. planata* hybrid. In seaweed *Kappaphycus*, methods to develop resistant strains are being applied to address ice-ice disease and reduce epiphytes, where fertilized *Kappaphycus* was found to be less susceptible to ice-ice disease. Plants from tissue culture had higher growth rate and higher gel strength compared with haploids and diploids. During field growth experiments, growth rates of diploids and haploids were not significantly different when grown in land-based facility. Growth rate of diploids in sea-based facility (*i.e.* cage) was significantly higher than that of haploids.

Capacity-building of Fish Farmers and Other Industry Stakeholders on Appropriate Breeding and Larval Rearing Technologies was facilitated through on-site technical assistance on mud crab seed production provided to private hatchery operators from various provinces in the Philippines. Promotion of hatchery and nursery technologies for mud crab was also extended to state universities and colleges as well as local government units through on-the-job or internship training courses. Pilot demonstration hatchery was constructed in Guindulman, Bohol and the technical staff who will operate the hatchery have undergone training at AQD.

Apart from technical assistance on mud crab, several specialized training courses on marine fish, sandfish, abalone, tilapia and the giant freshwater prawn were offered to local government representatives, private sector investors and fisherfolk. In addition, on-the job trainees were also accommodated in the AQD hatcheries while technical assistance was provided to local and international private sector clients through the “Agree-Build-Operate-Transfer” AquaNegosyo Program.

1.5 Maintaining Environmental Integrity Through Responsible Aquaculture

The Program on “**Maintaining Environmental Integrity Through Responsible Aquaculture**” is intended to address issues on the negative impacts of aquaculture on the environment and define strategies on how these impacts could be minimized. Focusing on developing environment friendly-based aquaculture technologies, the program aims to integrate environmental factors in AQD research activities and promote responsible aquaculture. For 2014, studies were continued to assess the impacts of aquaculture on biodiversity, and water and sediment qualities in culture areas and adjacent ecosystems both in marine and freshwater systems; develop and promote efficient and suitable environment-friendly culture systems; and conduct biological and ecological studies on species with potentials for resource enhancement.

Assessment of Impacts of Aquaculture on Biodiversity, and Water and Sediment Qualities was continued through regular monitoring of the different stations of AQD using the established monitoring system for water and substrate quality. In Igang Marine Station (IMS) and surrounding areas, bathymetric profile of the areas and sediment size analyses had been completed. The biodiversity of various ecosystems and near the cage set-up was also determined. For Tigbauan Main Station (TMS), sampling of the shore areas around TMS was continued, where some 543 species in 203 families in 10 major taxa were collected or photographed. Work on a book on the marine biodiversity in Tigbauan, Iloilo for publication was started. In Binangonan Freshwater Station (BFS), a comparison of phytoplankton, zooplankton, fish and other vertebrate diversity in two sites around the station, the East Cove (an aquaculture site) and the West Cove (non-aquaculture site) was continued. Mean diversity indices for phytoplankton were significantly higher in the aquaculture site (EC) than in the non-aquaculture site (WC). Also, significantly higher catch was found from EC than WC. However, higher dominance of native species in WC was noted compared to EC. In another study, a project on biodiversity in milkfish and shrimp fry fishery in the surf zones in southern and western Panay was continued. Similar studies should also be done in other mariculture areas.



Nile tilapia (upper photo) and bighead carp (lower photo) are among the introduced species found in aquaculture site (East Cove) of BFS

On the **Development and Promotion of Efficient and Suitable Environment-friendly Culture Systems**, experiments were conducted to determine optimal conditions for the culture of sandfish *H. scabra*. In previous years, substrate type, salinity, and stocking density experiments were done to assess growth and survival of sandfish juveniles. For 2014, results showed that after 30 days of culture in selected experimental sites, sandy sediment as substrate promoted higher growth and survival. Best growth was also observed when juveniles were stocked at 12 individuals/m² compared to densities of 25 and 50 individuals/m². Survival ranging from 88 to 91.5% was not affected by such stocking densities.

Re-assessment of sea ranching site in Concepcion, Iloilo was done to compare the status of the habitat in terms of suitability for sandfish ranching, substrate quality and biota composition after it was hit by typhoon Haiyan (Yolanda) in 2013. Through an agreement with the local government unit in the area, a pilot sea cucumber sea ranching site at Polopina Island was designated, with trial nursery run which was started to evaluate the suitability of AQD's (Igang Marine Station) nursery design in Concepcion. Baseline information from

local fishers' organization was obtained through survey questionnaire while focused group discussion and mapping exercise were conducted to assess the needs of the community as bases for implementing intervention strategies.

For abalone nursery culture, different types of containers (perforated plastic trays, empty oil containers, polyvinyl chloride tubes and plastic mesh cages) were tested simultaneously in reef flats in Agho Island, Concepcion, Iloilo and in concrete tanks at AQD's Tigbauan Main Station. Highest mean shell length after 90 days of nursery culture was found in abalone reared in polyvinyl chloride tube which was also found to be the most sturdy, suggesting that this is the most appropriate culture container for use in the field.



(a) Abalone juveniles during stocking at the start of experiment in Agho Island, Concepcion, Iloilo; and
(b) Feeding abalone reared in different culture containers in Agho Island, Concepcion, Iloilo

Refinement of grow-out techniques for slipper oyster was also initiated. Preliminary assessment of various oyster farms in Panay Island was conducted, where a farm in New Washington, Aklan was selected and a Memorandum of Agreement with the Local Government Unit of the site was signed. Preliminary grow-out trials using different culture containers (tires, hanging oyster shells, pouches and trays) showed higher mean survival of oysters reared in pouches.



Experimental oyster rafts in New Washington, Aklan

Biological and Ecological Studies on Species with Potentials for Resource Enhancement were conducted for species such as the giant clam *Tridacna gigas* and abalone *H. asinina*. While studies on *T. gigas* were completed, stock enhancement of mud crab, and community-managed sea ranching and stock release of sandfish *H. scabra* are underway.

1.6 Adapting to Climate Change Impacts on Aquaculture

The Program on “**Adapting to Climate Change Impacts on Aquaculture**” aims to identify the accompanying changes in the environment brought about by changing climate that affects the aquaculture sector, prepare the sector to the possible effects that these changes may have on aquaculture operations, minimize and mitigate the adverse impacts of climate in aquaculture, and ensure continued operation of all aquaculture production systems under changing climatic conditions. For 2014, studies focused on generating scientific information on the effects of: (i) increasing temperature on the susceptibilities of different stages of tropical marine invertebrate abalone (*H. asinina*); and (ii) acidic conditions and elevated temperature on corals.

For abalone, experiments were conducted to expose different stages to elevated temperature treatments [control - ambient (28-29°C), 31°C, 33°C], where embryonic stage was significantly affected by very high temperature. When newly fertilized eggs were incubated in 33°C, very few embryos developed and hatching rate was very low (20% in 33°C and 86% in ambient temperature). Survival was significantly lower in larvae reared at 31°C and 33°C compared to ambient temperature. When abalone juveniles (3 cm) were reared in temperatures 31°C and 33°C for one month, growth and survival were not significantly affected, while elevated temperatures had adverse effect on abalone brooders, with mature females found to be very sensitive to very high temperature. After 45 days of exposure to 33°C all female brooders died, while only 10% of the male brooders survived until 60 days. Furthermore, significant reduction in growth and feeding rates of brooders reared at elevated temperature was noted, while their gonads also regressed. Results indicate that developing or early and spawning stages of abalone are very sensitive to the effects of elevated temperatures suggesting that these stages have a narrower thermal tolerance range compared to juvenile stage.

On corals, fragments of *Porites* sp. were collected and kept alive in a tank system equipped with fresh sand-filtered seawater supply via a flow-through system. With treatments, i.e. temperature [ambient: 28-29 (control) and 31°C]; pH [>8.0 (control) and 7.5], low survival and reduction in growth were observed in corals exposed to acidic condition and higher temperature, indicating that climate change can adversely affect the coral reef population which eventually result in reduced coral reef productivity.

1.7 Meeting Social and Economic Challenges in Aquaculture

The Program on “**Meeting Social and Economic Challenges in Aquaculture**” is aimed at developing and implementing social and economic strategies in aquaculture and resource enhancement to secure food and income through stakeholder collaboration.

Prioritizing Collaborative R&D in Aquaculture in the Region was initiated through studies that enhance understanding of the role of aquaculture in poverty alleviation and in formulating relevant policy recommendations. For freshwater aquaculture, the third on-farm demonstration run of grow-out culture of giant freshwater prawn (GFP) *M. rosenbergii*, in polyculture with tilapia in net cages in Laguna Lake was conducted. In view of the continuous consumer demand and modest income derived year-round from tilapia culture, tilapia growers expressed interest in adopting GFP culture in polyculture



On-farm demonstration and verification of giant freshwater prawn (GFP) grow-out with tilapia to fisherfolks in Laguna Lake: (a) researchers and technician guide fisherfolks in their parallel culture run; (b) GFP co-culture with tilapia; and (c) local government representatives, fisherfolks and AQD researchers discuss technology adoption action plans

with tilapia. Results have demonstrated that new aquaculture technologies such as grow-out culture of GFP in cages in Laguna Lake can be integrated either with existing tilapia fingerling or grow-out production that already provide modest incomes to fish farmers.

Stock enhancement of marine species such as abalone *H. asinina* and tiger prawn *P. monodon*, following community-based strategies was also continued. Abalones released in June 2011 were subjected to regulated harvesting since August 2013 following 6 cm shell length catch-size regulation as practiced by local fisherfolks in Barangay (village) Molocaboc within the Sagay Marine Reserve (SMR) in Negros Occidental. In another study conducted in New Washington, Aklan Province in collaboration with fisherfolks of Barangay Pinamukan, the fourth run and release of tiger prawns are on-going. Improvement of survival rates (at 44%) during the intermediate culture phase and reports of catching tagged shrimps have motivated fisherfolks to participate in culture and future release activities. These demonstrated that in both locations in Sagay and New Washington, information, education and communication activities, as well as support fisheries regulations and policies are needed to sustain the benefits from stock enhancement. Moreover, long-term success of abalone and tiger shrimps enhancement is dependent on sustainable supply of juveniles from hatcheries. Hence, future activities should incorporate the establishment of seed production facilities in community-based stock enhancement.

Allocating R&D Resources to Address Emerging Issues focuses on AQD's efforts to promote eco-friendly aquaculture technologies that could provide socio-economic benefits to stakeholders as well as organizational solidarity and commitment among stakeholders. For 2014, potential applications of income-generating but eco-friendly culture technologies



Area capability development through community-based stock enhancement of shrimps in New Washington, Aklan, Philippines: (a) abandoned pond in mangrove area serving as intermediate nursery for shrimps; (b) fishing gears that are likely to catch released shrimps; and (c) fishers and household members participate in mapping local resources in relation to stock enhancement

such as the integrated multi-trophic aquaculture (IMTA) in milkfish mariculture have been evaluated through a survey of milkfish cage and pen owners in three regional sites in the Philippines. Results of the survey showed that the IMTA concept is acceptable among large-scale mariculture operators due to ecological and economic benefits. However, cage design and sources of seeds of co-cultured species such as sea cucumber, oysters, mussels and seaweeds are major concerns. Similarly, a socio-economic assessment of highly threatened ecology such as Napoleon wrasse fishery in central Philippines was initiated to complement a study on seed production of this species.

Multi-agency Collaborations and Sharing of Information and Resources have been enhanced through research initiatives in partnerships with various stakeholder groups. For 2014, AQD collaborated and contributed to the FAO-AFSPAN (Aquaculture for Food Security, Poverty Alleviation and Nutrition) project by conducting the required surveys and desk studies investigating the role of aquaculture in poverty alleviation, food security and nutrition.

Most recently, through cooperation with a local private company, AQD initiated a market, industry and consumption study of selected high-value indigenous species in the Philippines (giant trevally or '*'maliputo'*'; silver therapon or '*'ayungin'*'; lobed river mullet or '*'ludong'*'; and tapiroid grunter or '*'pigek/bulidao'*') to assess the needs and potentials of future R&D investments in seed production and culture of these species. Initial results showed the demand and supply gap for all four species indicating potentials for investments in their culture.



FAO-AFSPAN Project on determining the impacts of aquaculture on food security and livelihoods among poor fishing households in the Philippines: (a) women and children tying the seaweed (*Eucheuma sp.*) for planting while adult males handle seaweed planting and drying; and (b) drying seaweeds in bamboo elevated platforms in the sea or in shorelines



Market and consumption study of high-value indigenous fish in the Philippines: (a) grilled or boiled maliputo is a treat for tourists in Taal Lake; (b) ayungin is a seasonal catch in Laguna Lake and provide income to fish driers; (c) ludong, the Philippines' most expensive fish, is now rarely caught in Cagayan River; and (d) the mouth of Abra River in Ilocos Sur is fishing ground for another rare fish locally called bulidao or pigek

1.8 Resource Enhancement of Internationally Threatened and Over-exploited Species in Southeast Asia Through Stock Release

This project addresses issues related to the listing or proposed listing of several commercially exploited species in CITES Appendices, e.g. seahorse, Napoleon wrasse, sandfish, donkey's ear abalone, and mud crab. On the stock enhancement of seahorse, the viability of Visible Implant Elastomer (VIE) tag was tested on few representative small sized stocks (5-6 cm) to refine the tagging methods for this commodity. In the socio-economic analysis and identification of strategies for managing released stocks, cost-benefit analysis of stock enhancement was conducted by analyzing the project cost profile and value of benefits identified by stakeholders. In developing adaptive measures for coral replenishment, the function of photosynthesis of reef building coral was largely damaged by synergistic effects of acidification and warming.



Community-based strategies for managing released abalone stocks in Sagay Marine Reserve (SMR), Negros Occidental:
 (a) location of release demonstration site in the inter-tidal flats of Barangay Molocaboc (inset, abalone sample);
 (b) stock enhancement signage has remained afloat in 2014 since first release in June 2011 symbolizing resilience of the community-based collaboration;
 (c) meeting among the Sagay City Mayor, SMR and AQD; and (d) actively organized fisherfolks and researchers

AQD convened the 'International Workshop on Resource Enhancement and Sustainable Aquaculture' in March 2014 in Iloilo City, Philippines, where AQD presented the important findings obtained from its resource enhancement project. The participants who included representatives from SEAFDEC Member Countries discussed the important developments, including issues and strategies related to resource enhancement. Proceedings of the meeting will be published during the end of 2015.



(a) Participants of the International Workshop on Resource Enhancement and Sustainable Aquaculture Practices in Southeast Asia held in Iloilo City, Philippines; and (b) The participants during the workshop session.

1.9 Promotion of Sustainable and Region-oriented Aquaculture

Biologically, environmentally and socio-economically acceptable and region-oriented approaches have been promoted by AQD through various studies and capacity building initiatives under the project on “**Promotion of Sustainable and Region-oriented Aquaculture**”. On the **development of hatchery technology of emerging species**, results showed that adding probiotics to live food organism for larval culture of pompano promotes better assimilation of nutrients as indicated by increase in enzyme activities in larvae resulting in better growth, survival and tolerance to hypoxic condition. In another study to develop environment-friendly feeds using regionally available ingredients, results indicated that larval quantity (average number of larvae per hatching event) of giant freshwater prawn *M. rosenbergii* was markedly better when fed diets containing 30% cowpea meal compared to other dietary treatments.



Marine fish hatchery training at SEAFDEC/AQD: Participants during the practical session on sea bass broodstock sampling and hormone injection

Efforts were also made to build the capacity of Member Countries through implementation of various training activities. At the “International Workshop on Resource Enhancement and Sustainable Aquaculture” organized in 2014, the participants had the opportunity to tackle pressing issues that affect aquaculture development in Southeast Asia including experiences and lessons learned by the Member Countries.

1.10 Other R&D Activities

AQD's ABOT (Agree-Build-Operate-Transfer) AquaNegosyo (Aquaculture Business) has continued promoting technology packages for local and international business investors through technical assistance in every phase of on-farm operations. In 2014, the Program received 57 local and 15 foreign inquiries, while six local and one foreign ABOT clients have been served. Of those who inquired about the ABOT AquaNegosyo Program, nine requested for cost estimates to start aquabusiness, while nine other inquiries were on brackishwater polyculture. Other inquiries were on hatchery of milkfish, grouper and sea bass and culture of eel, abalone, giant freshwater prawn, seaweeds, sandfish, shrimps and crabs.

Institutional Capacity Development on Sustainable Aquaculture (ICDSA) is another initiative of AQD that provides effective mechanism to disseminate technologies and science-based approaches it had developed. For the collaborative projects with BFAR, AQD has rendered technical assistance in the construction of multi-species marine fish hatcheries in different parts of the Philippines with those in Baler, Aurora; Sta. Lucia, Palawan; Bongabong, Oriental Mindoro and Sta. Cruz, Davao del Sur already completed and operational, but AQD continues to provide technical assistance in operating the facilities. While construction of hatchery facilities in Lao-ang, Samar and in Sagnay, Camarines Sur is on-going, AQD also provides technical assistance in constructing a multispecies marine fish breeding and research center in Odiongan, Romblon in collaboration with the Provincial Government and BFAR. AQD worked with Winrock International (an NGO) in implementing a development project for improved production efficiency in the CARAGA¹ region, where AQD's role is on capacity building in aquaculture through introduction of technologies that enhance production of economically important aquaculture species of the region.

Training and Information. The training courses conducted by AQD in 2014 were on marine fish (grouper, snapper, sea bass, pompano, rabbitfish and milkfish), catfish and shrimp hatchery operations; hatchery, nursery and grow-out of tilapia, catfish, giant freshwater prawn, abalone and mud crab; hatchery and nursery of sea cucumber; seaweeds nursery; community-based mangrove rehabilitation, freshwater aquaculture; culture of marine fish, shrimp, abalone, seaweeds; fish health management; formulation and preparation of feeds and feeding management; and information dissemination and data management. A total of 316 trainees participated in the different courses offered by AQD in 2014.

A distance learning course on the principles of health management in aquaculture (Aquahealth online) was started in September 2014 and will run until February 2015 with 14 participants. On-site training course on fish health management was conducted in Lao PDR in early December 2014 while the on-site training on on-farm feed preparation and

¹ Represents 4 provinces in the Philippines – Agusan del Norte, Agusan del Sur, Surigao del Norte and Surigao del Sur



AQD trainee, during laboratory exercise, collects blood and tissue samples from pompano for histological examination

feeding management will be conducted in 2015. On-site training courses on mud crab nursery and grow-out were organized for partner state colleges and universities under the Philippine Department of Science and Technology's National Mud Crab Program. Meanwhile, a total of 21 individuals availed of AQD's internship program and 239 students from 24 schools/universities joined the student on-the-job training program. Overall, AQD's capacity building programs have produced a large number of technical personnel who are now in the aquaculture business themselves or conduct/direct further R&D in their home countries. In view of the emphasis being given by AQD on building the critical mass of experts on aquaculture technologies, a ripple effect is now created when these technologies are promoted and practised.

In information dissemination, apart from scientific publications in international peer-reviewed journals, AQD published and disseminated four new manuals (Hatchery Production of Snubnose Pompano *Trachinotus blochii* Lacepede, Intensive Culture of Milkfish *Chanos chanos* in Polyculture with White Shrimp *Penaeus indicus* or Mud Crab *Scylla serrata* in Brackishwater Earthen Ponds, Milkfish *Chanos chanos* Cage Culture Operations, and Seed Production of Rabbitfish *Siganus guttatus*). Flyers about AQD, its stations, programs and other information materials including the 2013 Highlights and monthly AQD Matters were also produced. AQD's Institutional Repository (SAIR) which was established as the official digital repository of scholarly and research information, has contributed to enhancing the accessibility of AQD publications and visibility of SEAFDEC. From March 2011 to December 2014, SAIR had 674,999 item views, 728,231 downloads and 4,558,874 searches performed.

To further enhance its visibility to various stakeholders, AQD frequently updated its website resulting in significant increase in the number of monthly unique visitors, stories about AQD's events posted in Facebook, press releases facilitated and important AQD events and technological developments aired in the weekly TV program (Mag-Agri Tayo or Let's do Agriculture). AQD also participated in fairs and exhibits.



(a) AQD's participation in Agri-Link held in Pasay City, Philippines, the Philippine's biggest agriculture-aquaculture business exhibition or fair; AQD Chief and scientists explain to booth visitors the AQD technologies; and (b) Visitors consulting with AQD scientists

THRUST 2. ENHANCING CAPACITY AND COMPETITIVENESS TO FACILITATE INTERNATIONAL AND INTRA-REGIONAL TRADE

2.1 Biotoxins Monitoring in the ASEAN Region

Consumption of a variety of shellfish and fish has led to an increasing number of human intoxications around the world. About 400 poisonous fish species exist and, by definition, substances responsible for the toxicity of these species are known as biotoxins, and marine biotoxins represent a significant and expanding threat to human health in many parts of the world. The Codex Alimentarius Code of Practice for Fish and Fishery Products (CAC/RCP 52-2003) defined biotoxins as poisonous substances naturally present in fish and fishery products or accumulated by animals feeding on toxin-producing algae or in water containing toxins produced by such organisms. Impact from biotoxins is visible in terms of human poisoning or even death following consumption of contaminated shellfish or fish as well as mass killings of fish and shellfish, and death of marine animals and birds. Monitoring seafood for toxicity is essential to manage the risks. However, there are several limitations in monitoring toxicity such as variations in toxin contents between individual shellfish, different detection and even extraction methods for various toxins requiring a decision which toxins one is testing for, and the frequency of sampling to ensure that toxicity does not rise to dangerous levels in temporal or spatial gap between sampling times or locations.

MFRD implemented the project on “**Chemical and Drug Residues in Fish and Fish Products in Southeast Asia - Biotoxins Monitoring in the ASEAN Region**” from 2009 to 2012 to increase attention in expanding and improving initiatives to monitor, detect and share information on marine biotoxins and reduce public health risks associated with the consumption of contaminated shellfish and fish. The project covered training in analytical methods for Diarrhoeic Shellfish Poisoning (DSP) toxins, lipophilic toxins, Paralytic Shellfish Poisoning (PSP) toxins, and Tetrodotoxin (TTX), and monitoring survey on PSP toxin in the ASEAN Member States.

Starting 2013, the project was extended to cover other biotoxins like Amnesic Shellfish Poisoning (ASP) toxin and Azaspiracids (AZA), which were raised by the Member Countries during the Regional Technical Consultation in 2009 as part of their training needs. This extended project aims to develop methodologies on analysis of biotoxins (ASP, AZA and BTX) and gain understanding of the levels of occurrences and incidences of these biotoxins in fish and shellfish in the ASEAN region.

MFRD organized a 5-day Regional Training Course in Biotoxins Analysis: AZA, ASP & BTX from 2-6 June 2014 in Singapore jointly with the Veterinary Public Health Laboratory, Agri-Food & Veterinary Authority (AVA) of Singapore, with two biotoxins experts from the National Research Institute of Fisheries Science, Fisheries Research Agency of Japan and the Institute of Oceanography of Viet Nam, as resource persons. Attended by 21 participants from ten SEAFDEC Member Countries, the training course covered a series of lectures on general introduction of marine toxins, analytical tools for detection, characterization and quantification of ASP, AZA or BTX biotoxins via instrumental analysis, as well as practical sessions on sample preparation and the use of High Performance Liquid Chromatography Tandem Mass Spectrometer (LC/MS/MS) method and High Performance Liquid Chromatography method for detecting ASP, AZA or BTX biotoxins. The participants gained knowledge and skills in analyzing these biotoxins and are expected to be able to set up these methods in their own laboratories for the conduct of biotoxins analyses. Moreover, the training course is anticipated to help the Member Countries upgrade their laboratory capabilities and credibility in testing of ASP, AZA and BTX biotoxins for fish and fish products and to establish biotoxins monitoring programs for routine surveillance in the Member Countries.



Participants and Expert Trainers of the Regional Training Course on Biotoxins Analyses



Laboratory session during the Regional Training Course on Biotoxins Analyses

2.2 Traceability Systems for Aquaculture Products

Traceability has become a major concern of the aquaculture industry, especially since it has become a legitimate requirement in major international markets such as the EU and the US. Furthermore, as aquaculture production becomes more market and consumer driven, the greatest pressure for product traceability has been coming from the general public. Consumers are getting more and more concerned on what they eat – whether the food comes from a safe and sustainable source, and whether production, transportation, and storage conditions can guarantee food safety.

The Codex Alimentarius Commission (2004) defines traceability or product tracing as “the ability to follow the movement of a food through specified stage(s) of production, processing and distribution”. In an increasingly competitive food system, traceability has become a major tool in dealing with concerns of food safety, quality assurance, risk prevention, and gaining consumer trust. Traceability can be used to achieve different purposes or objectives, such as for food safety, bio-security and regulatory requirements or to ensure quality and other contractual requirements. For instance, external traceability allows the tracking of a product and/or its attribute(s) through successive stages of the distribution chain (from farm to fork), while internal traceability (or enterprise traceability) aims for productivity improvement and cost reduction within a production unit (e.g. fish processing plant). Governments and organizations around the world have also been developing different systems on seafood traceability, e.g. TraceFish (EU), TraceShrimp (Thailand).

In view of these developments, MFRD implemented the project on “**Traceability Systems for Aquaculture Products in the ASEAN Region**” since 2010 to enable the regional aquaculture industries to implement appropriate traceability systems for aquaculture products and to meet international traceability requirements in the network of aquaculture production, marketing, and trade. The objectives of the project are to provide a platform for the sharing of information and experiences among ASEAN Member States on implementation of traceability systems for aquaculture products in the region and to promote the implementation of traceability systems for aquaculture products in the ASEAN region.

In 2014 which was the final year of this project, MFRD focused on preparation of the Technical Compilation and Regional Guidelines on Traceability System for Aquaculture Products in Southeast Asia, to include country reports on the implementation of traceability for aquaculture products in SEAFDEC Member Countries, challenges faced and benefits of implementing traceability systems for aquaculture products as well as relevant information and data from two on-site workshops conducted under the project in 2011 and 2013. For the Regional Guidelines, the 1st draft was prepared and circulated to all Member Countries in mid 2014, of which feedback and comments had been incorporated in the 2nd draft for circulation and confirmation by the Member Countries. As such, the publication of the Technical Compilation and Regional Guidelines would be finalized at the End-of-Project Meeting-cum-Regional Technical Consultation on the Regional Guidelines scheduled in the 3rd quarter of 2015. To be published in 2015, both the Technical Compilation and Regional Guidelines are envisioned to serve as a useful resource for Member Countries in their efforts to implement traceability systems for aquaculture products.

2.3 Accelerating Awareness on Fish Health Management in Southeast Asia

Under the project on “**Accelerating Awareness on Fish Health Management in Southeast Asia**”, capacity building is being carried out in Member Countries, especially resource-deprived countries emphasizing in innovative research to guarantee food safety and sustainable production. The *Molecular diagnosis and prevention of economically important viruses in fish and shrimp*, promoted the loop mediated isothermal amplification (LAMP) assay optimization for TSV and IMNV. Efforts were also continued to establish the management technology for improving disease tolerance in shrimps. Results showed that survival of shrimps improved when reared in greenwater culture system and using the designed rearing scheme which was developed based on results of interview with shrimp

farmers and previous reports. For a study that aimed to establish novel prophylactic and therapeutic methods for prevention of viral infections in commercially important mariculture fish, crude ethanolic extracts of *Ulva pertussa* showed potent antibacterial activity against freshwater bacterial pathogens. On commercially important freshwater fishes, tissue samples of freshwater fish species collected from selected provinces in the Philippines were examined for presence of fish-borne zoonotic parasites, metacercariae. In another study on abalone *H. asinina*, continued screening of live hatchery stocks from AQD for parasites and shell diseases was done. To examine the infectivity of shell-boring polychaetes present in naturally-infected to healthy abalone, cohabitation experiment was conducted, where results showed that polychaetes from infected abalones could be transmitted to healthy ones within 48-72 hours post-cohabitation, the infectivity rate of shell-boring polychaetes from naturally-infected to healthy abalone was 60%.

To assist the Member Countries in addressing issues on aquatic animal health, AQD continued to conduct on-site training sessions apart from the regular training programs. In Lao PDR, a follow-up on-site training on freshwater fish health management was conducted by AQD in collaboration with Department of Livestock and Fisheries on 5-8 December 2014, to provide local government workers and farmers with theoretical and practical knowledge on signs and occurrence of economically important freshwater fish diseases, preparation and submission of diseased fish samples for diagnosis, and basic laboratory skills for detection of parasitic pathogen with emphasis on zoonotic parasites (fish-borne diseases).



Trainees prepare tissue samples for zoonotic parasite detection and identification as part of practical session of the “On-site Training on Freshwater Fish Health Management with Emphasis on Detection of Fish-borne Zoonotic Parasites” in Namxouang Aquaculture Development Center, Lao PDR in December 2014

2.4 Food Safety of Aquaculture Products

The Program on “Food Safety of Aquaculture Products in Southeast Asia” focused on: (i) determining withdrawal period of antibiotics in some fish species cultured in the tropics; (ii) surveillance of chemical contaminants in aquaculture products and feeds; (iii) investigation of the situation of antibiotics/chemicals usage and regulations in aquaculture; and (iv) development of guidelines on appropriate administration and regulation of antibiotics/other chemicals. The microorganism method of oxytetracycline (OTC) and

oxolinic acid (OXA) detection was developed and its sensitivity was determined, instead of the high performance liquid chromatography (HPLC) method. AQD has already drafted the “Important Findings and Recommendations on Chemical Use in Aquaculture in Southeast Asia”, with final preparations being made for its publication which is expected to complement the existing ASEAN Guidelines prepared for the ASEAN Member States.

2.5 Healthy and Wholesome Aquaculture

This Program on “**Healthy and Wholesome Aquaculture**” is aimed at improving aquaculture production through innovations in nutrition and feeding as well as fish health management, and in preserving the environmental integrity of aquaculture areas. It is expected that best management strategies and good aquaculture practices would be developed, and in the long term could lead to optimization of production yield with least impact on the environment.

Investigation on the Efficacy of Probiotics and Rationalization of the Needs and Application of Diagnostics to Ensure Biosecurity in Culture Systems aims to determine the effects of different levels of intracellular polyhydrobutyric acid (PHB) on the probiotic capacity of *Bacillus* sp. by establishing suitable growth conditions that allow the bacteria to accumulate different levels of intracellular PHB. The highest PHB accumulation was observed at 48 hours in Luria Bertani (LB) + 2% glucose. In addition, the effects of application and mode of action of PHB in larviculture of *Penaeus* spp. and the practical applications of PHB bioplastics as shrimp shelter and as substrate for microbial colonization/biofilm formation, as well as its biodegradability are currently being investigated.

On the Promotion for Wider Use of Conventional Diagnostic and New Methods for Newly-reported Emerging Diseases, activities were undertaken using selected commercially important commodities. The emerging disease of tilapia in the Philippines was investigated through biochemical characterization of dominant bacteria isolated from the water, sediment, as well as gills and intestines of the fish using conventional methods and commercial kits. A total 19 bacterial genera and 31 species were identified, and the data indicated that bacterial composition in pond water and sediment accordingly reflects the bacterial composition in the gills and intestines of tilapia. In another study initiated in 2014, sanitary quality of oysters cultured in major oyster producing areas in the Philippines’ Visayas region is currently being investigated.



An oyster farm using stake culture method. The farm is located in the Municipality of Ivisan, Province of Capiz

On the epidemiological study which aims to elucidate on the spread route of shrimp and viral diseases, *P. monodon* tissue samples were collected from shrimp farms in the Philippines and analyzed for the presence of shrimp viruses (WSSV, YHV). In a related study on wild and farmed mud crab, diseases affecting farmed and wild mud crab in 17 mud crab producing provinces in the Philippines have been identified and described. A total of 767 mud crab samples collected from different environments (poly/monocultured pond, aquasilviculture and natural bodies of water) of the 17 provinces were processed for bacterial, fungal, parasite, and viral detection.



Mud crab samples showing discoloration of abdominal region

Another initiative continued in 2014 was the establishment of the Philippine shrimp pathogen bio-bank and online bio-surveillance information resource, where prototype database software was developed using diagnostic data compiled from 2013 to 2014. Pertinent literatures concerning each pathogen are being compiled from available sources, and for the compilation of epidemiological information including genetic, phenotypic, ecological, spatial and temporal characteristics of aquatic pathogens, 40 sampling sites in 9 provinces in the Philippines were investigated.

In another study which focuses on molecular diagnosis and prevention of important viruses in fish and shrimps, plasmids to be used as positive control for shrimp (WSSV, IMNV, and TSV) and fish viruses (viral nervous necrosis [VNN], koi herpes virus [KHV], and red sea bream iridovirus [RSIV]) were generated. Conventional PCR for testing stocked plasmids was done for all viruses, demonstrating its viability for use as standard positives.

Finding Effective Alternative Safe Drugs/Chemicals to Manage Aquaculture Diseases in lieu of Harmful Chemicals and Drugs is being pursued by examining the host response to pathogens and developing control methods such as using natural immunostimulants for marine fishes as an approach to counter epizootics. For commercially important mariculture fish, studies were implemented to establish novel prophylactic and therapeutic methods for preventing bacterial and viral infections. *Ulva pertusa* crude ethanolic extract was found to possess potent antibacterial activity against known fish pathogens *Aeromonas hydrophila* and *A. sobria*. The pathogenicity of *A. hydrophila* isolated from intestines of tilapia, to be used as fish pathogen to study the efficacy of *U. pertusa*, was also examined. In another study, immunization regimen is being established to prevent the onset of viral nervous necrosis (VNN) in high-value marine broodfish. Current data corroborate with the supposition that annual booster vaccination of pompano broodstocks reared in floating net cages could immunogenically mount the production of VNN-neutralizing antibodies in the fish, giving protection against horizontal and vertical transmission of the VNN to

their offsprings. This finding demonstrates the practicality of maintaining VNN-specific-free pompano broodstocks reared in floating net cages in open sea through vaccination regimen.

Another activity involves developing novel strategies to reduce disease incidence in mud crab hatchery and grow-out. Experiments in 2013 showed that crude extracts obtained from terrestrial plants *Nephelium lappaceum* (rambutan) and *Terminalia catappa* (tropical almond tree) had significant *in vitro* antibacterial activity against *V. harveyi* and *E. coli* in agar disc diffusion test. In 2014, extracts obtained from *T. catappa* and *N. lappaceum* were tested for toxicity to determine the proper dose for *in vivo* administration to different larval stages of crab. In another study, bacterial isolates obtained in 2013 are being tested for pathogenicity to screen for potential probiotics. Pathogenicity tests were conducted for different stages and sizes of mud crab *Scylla serrata*. The efficacy of *Bacillus subtilis* strain in preventing/alleviating bacterial infection in crab instar was subsequently determined. Results showed that *Bacillus subtilis* strain was able to protect crab instar from *Vibrio harveyi* challenge when added at 10^7 - 10^8 cfu/ml. Experiments were also continued to examine the practical applications of developed techniques for vaccinating crabs and other crustaceans to reduce incidence of diseases during hatchery and grow-out.



In vivo efficacy testing of probiotics by immersion and oral administration to mud crab instar

In **Finding Different Sources of Fish Meal Substitutes and Development of Effective Feed Management Schemes**, studies were continued to reduce dependence on fish meal as source of protein in formulated feeds. Experiments done on milkfish reared in floating net cages and brackishwater ponds using improved milkfish practical feed with inclusion of soybean meal and soy protein concentrate as alternatives to fish meal in the diets resulted in higher average body weight gain (2,295%) after 147 days feeding, compared to those given the commercial-fed diet (1,682%). In another experiment, the use of feeds where fish meal is partially replaced with cowpea or mung bean gave higher growth rate compared to those given commercial diet. Another experiment tested the use of distillers dried grain with soluble (DDGS) as protein source for milkfish diets, the result indicated that DDGS can replace soybean meal with as much as 45% in milkfish diet without deleterious effects on growth, feed efficiency and survival. As an ingredient, DDGS has digestibility of 91% protein, 85% lipid and 50% dry matter, which are criteria for excellent feed ingredient.

Efforts were also continued to improve the nutritional value of locally available feed resources by fermentation. Growth experiments showed best growth and survival rates in milkfish fed control diet and diets with fermented cowpea. Experiments were also done to evaluate milkfish by-product hydrolysate as ingredient in feed for juvenile grouper, *Epinephelus coioides* diets. Milkfish offals hydrolyzed using a commercially available enzyme (AP-10 *Bacillus subtilis*) resulted in crude protein content of 61% and yield of 21%. Growth experiments showed higher weight gain with grouper fed diets with hydrolysate incorporation.

On mud crab, testing of various attractants to improve feeds and management practices for grow-out culture gave positive results for marine-based attractants such as acetates, squid meal, shrimp paste and spoiled fish flesh. Test diets with marine-based attractants had the least time required for detection compared with the test diets with purified attractants. For giant freshwater prawn *M. rosenbergii*, the effects of feed management strategies and periphyton-based production on giant freshwater prawn cultured in cages in Laguna lake were assessed. Production parameters were significantly best with prawns stocked at 5 individuals/m² in a purely periphyton-based production system.

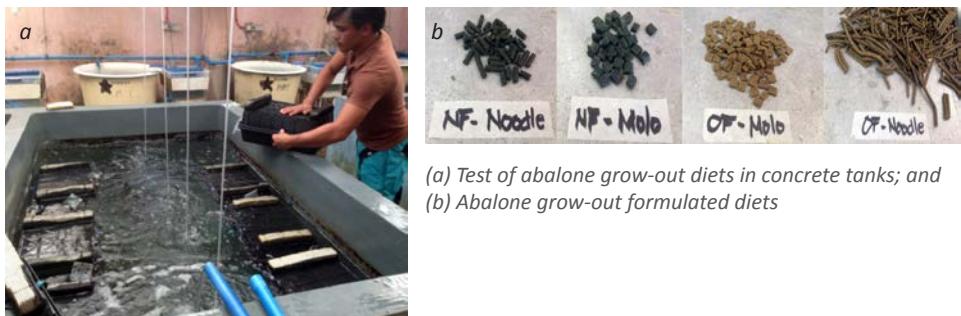
Recognizing the need for concerted action to follow-up on the issues and challenges related to aquaculture feeds in the Southeast Asian region, AQD with SEAFDEC Secretariat and the Government of Myanmar as partners, convened the "Regional Technical Consultation on Development and Use of Alternatives Dietary Ingredients or Fish Meal Substitutes in Aquaculture Feed Formulations". With financial support from the ASEAN Foundation under the Japan-ASEAN Solidarity Fund, the meeting was held in Nay Pyi Taw, Myanmar on 9-11 December 2014 and was attended by over 50 participants, representing SEAFDEC Member Countries, regional organizations, and the private sector. The meeting provided a forum for the participants to discuss key issues, gaps and define regional policy recommendations and immediate actions to reduce dependence of aquaculture on feed ingredients from marine animal origin. Preparations are in-progress for publication of the proceedings.



Participants of the ASEAN-SEAFDEC RTC on Development and Use of Alternative Dietary Ingredients or Fish Meal Substitutes in Aquaculture Feed Formulation

The **Development of Aquafeeds for Selected Species at Specific Growth Stages especially for Species or Stages for which no Artificial Feed has been Formulated** made use of golden pompano *Trachinotus blochii*, as one of the test species. Highest percent weight gain, specific growth rate, and lowest feed conversion ratio were noted in pompano given feed with highest crude protein level (55%) and supplemented with amino acids. In addition, the

existing feed formulation for grow-out of mud crab is being evaluated where formulated feed containing 48% protein was tested to replace 50% or more of its natural food (trash fish). Moreover, digestibility analysis of test diets showed increased level of crude protein with diets containing synthetic binders despite the use of the same formulation. Another species tested was the tropical abalone *H. asinina*, where the efficacy of the old (original) and improved/refined diet formulations for grow-out stage was evaluated. Results showed that after the 3rd month sampling, highest shell length increase of 31-34% was obtained with the refined formulations. The same diets when fed to abalone showed highest weight gain at 76-82%.



(a) Test of abalone grow-out diets in concrete tanks; and
(b) Abalone grow-out formulated diets

Promotion of Better Understanding of the Concept of Feed Conversion Ratio aims to assess the adequate nutrition and efficient feeding practices of fish farmers to promote fish health. Separate semi-intensive grow-out experiments were continued to assess the economic feasibility of rearing grouper and rabbit fish in brackishwater ponds using either commercial diet or AQD-formulated diets. With regard to mud crab, pond trials were done to develop protocols for production of hatchery-reared mud crab juveniles for soft-shell crab farming. On shrimp *P. indicus*, the performance of hatchery-bred and wild stocks during grow-out was compared.



Harvest of *Penaeus indicus* at 60 and 90 days of culture

Another demonstration trial was on Nile tilapia in cages in Laguna de Bay where practical and eco-friendly supplemental feeding schedules were evaluated. The best feeding scheme observed was full feeding after 160 days of culture followed by those fed from day 45 onward and from day 75 onward. For culture of seaweed *Gracilaria heteroclada*

in pond and intertidal area, results of optimizing the fertilization scheme showed that *G. heteroclada* enriched with 250 ppm NH₄Cl (26-0-0) had the highest thallus nitrogen content. The possible effect of water motion on the growth of *G. heteroclada* was monitored and correlation analysis showed that the relationship between growth and water movement was not significant.

THRUST 3. IMPROVING MANAGEMENT CONCEPTS AND APPROACHES FOR SUSTAINABLE FISHERIES

3.1 Promotion of Fisheries Management and Combating IUU Fishing

TD continued the promotion of innovative fisheries management applicable and effective for small-scale, tropical multi-species fisheries. Community-based resources management is one of the approaches promoted by TD through a series of training courses, to enhance the capacity of local communities in gathering information on small-scale fisheries (*see also 4.7*). With support from the ASEAN Foundation under the Japan-ASEAN Solidarity Fund, TD and the Government of Cambodia convened the “ASEAN Regional Workshop for Facilitating Community-based Resource Management (CBRM) in Coastal and Inland Fisheries” on 18-21 February 2014 in Phnom Penh, Cambodia. The Workshop came up with ways of promoting CBRM in the respective ASEAN Member States, and identifying key factors for successful implementation of CBRM for coastal and inland fisheries in collaboration with community fishery groups. Also with support from the ASEAN Foundation, TD partnered with Lao PDR in conducting the “ASEAN Regional Workshop for Enhancement of National Support Officer System to Improvement of Autonomous Resources Management and Fisheries Communities” on 11-13 March 2014 in Vientiane, Lao PDR, where key factors and means for successful implementation of capacity building for fisheries community through support officer system were discussed and identified.

In 2014, TD through the project on “**Human Resource Development for Sustainable Fisheries**” also started introducing the Ecosystem Approach to Fisheries Management (EAFM) concept through a series of training courses. The first was the Regional Training Course on Essential Ecosystem Approaches for Fisheries Management (EAFM) and Training of Trainers for EAFM (20-30 January 2014, Samut Prakan, Thailand) to introduce the



Discussion during the Regional Workshop on RFVR Database Development and Management in Pattaya, Thailand



Group discussion during the Essential EAFM Training

concept of EAFM to regional participants and staff of SEAFDEC who would serve as future trainers on EAFM. This was followed by in-house events to enhance the skills of staff in conducting training and develop training materials on EAFM. The Regional Training Course on Essential EAFM and Extension Methodologies was subsequently conducted on 15-29 September 2014 in Samut Prakan, Thailand to embed knowledge and skills to participants on the process and application of EAFM with particular focus on marine environment, as well as extension concept, methodologies and communication skills required for extension works.

On combating Illegal, Unreported and Unregulated (IUU) fishing, TD continued to implement the project on “**Promotion of Countermeasures to Reduce IUU Fishing**” which specifically aims to develop Regional Fishing Vessels Record (RFVR) for fishing vessels 24 meter in length and over. Currently, the Southeast Asian countries that have vessels under this category include Brunei Darussalam, Indonesia, Malaysia, Myanmar, Philippines, Thailand, and Viet Nam. As the development of the RFVR has been endorsed in 2013 by the SEAFDEC Council at its 45th Meeting and subsequently by ASEAN through the Special SOM-34th AMAF, TD pursued this initiative in 2014 by obtaining agreement from respective countries to provide information required for the RFVR. Database system was also developed so that records could be stored and retrieved by countries to be referred to in combating IUU fishing. Specifically, TD conducted the Regional Workshop on RFVR Database Development and Management on 20-21 August 2014 in Pattaya, Thailand to discuss data requirements and come up with ways for development and effective application of the database. TD also extended support to countries that expressed difficulties in providing data as required for the RFVR, *i.e.* the On-site Training for Standard Measurement of Fishing Vessels in Viet Nam (17-21 March 2014, Viet Nam), which aimed to enhance the capacity of national officers on measurement of vessels’ dimensions and estimation to gross tonnage (GT) for the RFVR database.

TD also supported national initiatives related to combating IUU fishing. In 2014, TD convened the “On-site Training Workshops on Offshore and High Sea Fisheries Management and Reducing IUU Fishing Activities” on 4-6 February 2014 in Perlis, Malaysia, and on 4-6 March 2014 in Myanmar. TD also participated and provided technical support to the “Consultation on National Plan of Action (NPOA) to Combat Illegal, Unreported and Unregulated (IUU) Fishing for Cambodia” (20-21 March 2014, Phnom Penh, Cambodia).

A project on “**Combating IUU Fishing in the Southeast Asian Region through Application of Catch Certification for International Trade in Fish and Fishery Products**” was also implemented by MFRDMD to address concerns on IUU fishing. Under this project, problems encountered by the ASEAN Member States (AMSSs) in complying with the requirements of the EC Regulation 1005/2008 were reviewed and based on information compiled, a series of meetings were conducted by MFRDMD in cooperation with the SEAFDEC Secretariat to develop the “Regional Guidelines for Preventing the Entry of Fish and Fishery Products from IUU Fishing Activities into the Supply Chain” and the “ASEAN Catch Documentation Scheme”.

With the cooperation of Singapore as the ASEAN Lead Country for this project and with the SEAFDEC Secretariat, MFRDMD convened the “Regional Consultation on Developing



Participants in the Regional Technical Consultation on Developing the Guidelines for Preventing the Entry of Fish and Fishery Product from IUU Fishing Activities into the Supply Chain on 23-25 September 2014

the Guidelines for Preventing the Entry of Fish and Fishery Product from IUU Fishing Activities into the Supply Chain" on 23-25 September 2014 in Kota Kinabalu, Malaysia. The adopted draft Guidelines was subsequently submitted to the 17th Meeting of the FCG/ASSP in December 2014, where the Meeting suggested that the draft Guidelines should be submitted through the ASEAN channel for endorsement by AMAF in order that this could be implemented by the respective AMSSs.

For the ASEAN Catch Documentation Scheme, its development was first discussed in a small group meeting on 14-16 October 2014 in Malaysia with the participation of staff from MFRDMD and SEAFDEC Secretariat, as well as with few experts from Indonesia, Malaysia, Singapore and Thailand. The Meeting came up with the initial draft of the ASEAN Catch Documentation Scheme (ACDS) which was reported during the 17th Meeting of the FCG/ASSP where the Meeting expressed views for improving the ACDS, such as the ACDS should be able to help countries that do not directly export fishery products to the EU by providing information on their raw materials, and the ACDS should be simplified so that it could be applied by small-scale fisheries. A Regional Technical Consultation on the ASEAN Catch Documentation Scheme was subsequently conducted on 16-18 December 2014 in Langkawi, Malaysia, where the draft ACDS was refined taking into consideration the views from the respective countries. During the RTC, it was also suggested that the ACDS should be verified with the involvement of the private sector to ensure its applicability in actual practice.



Participants of the Regional Technical Consultation on the ASEAN Catch Documentation Scheme on 16-18 December 2014

3.2 Management of By-catch from Fisheries

Trawl fisheries, one of the most common fishing operations of the Southeast Asian region, targets multi-species resulting in concerns on by-catch, discards and sustainability of fishery resources. The project on “**Strategies for Trawl Fisheries By-catch Management**” (REBYC-II CTI Project) was therefore initiated in 2012 with TD serving as Regional Facilitation Unit (RFU) to work closely with FAO Project Regional Coordinator in the project implementation. Participating countries for this project are countries bordering the Coral Triangle, namely: Indonesia, Papua New Guinea, Philippines, Thailand, and Viet Nam. This project aims to come up with more sustainable use of fisheries resources and healthier marine ecosystems in the Coral Triangle and Southeast Asian waters by reducing by-catch, discards and fishing impact from trawl fisheries as well as enhance participation and partnership of public and private sector for improving trawl and by-catch management.



*Group discussion during the
Regional Workshop on Project Planning
2014-2015 in Bangkok, Thailand*

In 2014, a series of training courses were conducted to extend knowledge and skills to participating countries for the Project implementation. This include the Regional Training Course on Essential Ecosystem Approach for Fisheries Management with a Special Focus on Southeast Asian Trawl Fisheries (24-30 April, Prachuap Khiri Khan, Thailand); Regional Training on Project Planning, Monitoring and Evaluation (1-3 May 2014, Bangkok, Thailand); Regional Workshop on Project Planning 2014-2015 (5-7 May 2014, Bangkok, Thailand); FAO/GEF Regional Workshop on Incentives in Trawl Fisheries (26-27 May 2014, Ho

Chi Minh, Viet Nam); and Regional Workshop and Training on Application of Resources Mapping and Geographic Information System (GIS) (29 September – 3 October, Semarang, Indonesia). Moreover, the Steering Committee Meeting for the Project was also organized on 29 May 2014 in Viet Nam. In addition to the participation of officers from authorities responsible for fisheries, the project also supported the involvement in relevant activities of a wide range of stakeholders including national and regional policy makers, fishing and fishmeal industry, and NGOs.

THRUST 4. PROVIDING POLICY AND ADVISORY SERVICES FOR PLANNING AND EXECUTING MANAGEMENT OF FISHERIES

4.1 Improving Understanding on the Status of Fishery Resources in Southeast Asia

Since 2004, TD has been utilizing the M.V. SEAFDEC 2 to support the Southeast Asian countries in conducting fishery resource surveys for better understanding of marine fishery resources in their respective waters. Specifically for 2014, through the projects on “**Fisheries Resource Survey and Operational Plan for M.V. SEAFDEC 2**” and “**Offshore Fisheries Resources Exploration in Southeast Asia**”, the M.V. SEAFDEC 2 was utilized for

the conduct of collaborative tuna resources and oceanographic surveys in Sulu-Sulawesi Seas in close collaboration with Malaysia, Philippines and Indonesia. In preparation for the survey, the “Sub-regional Technical Working Group Meeting of SEAFDEC Joint Program for Tuna Research in Sulu-Sulawesi Seas” was conducted on 27-28 May 2014 in Sarawak, Malaysia followed by the “Sub-Regional Technical Meeting for Finalizing Work Plan of Activities of SEAFDEC Joint Program for Tuna Research in Sulu and Sulawesi Seas” on 19-21 August 2014 in Tawau, Malaysia. The actual survey was conducted from 17 October to 8 December 2014, covering scopes on: (i) Research on tuna early life history using fish larvae sampling net and Bongo net in near-shore and off-shore of Sulu and Sulawesi Seas; (ii) Oceanographic survey using the Integrated Conductivity-Temperature and Depth (ICTD) attached with other sensors, *i.e.* pH, DO, fluorescence, among others; (iii) Scientific hydro-acoustic study during the track survey; and (iv) Scanning sonar survey on FADs and fish sampling by specific sampling gears (*e.g.* data collection by hook and line/hand lines and long-line) for echo verification.

This collaborative survey intends to come up with updated scientific findings on the status and trends of important oceanic tunas, particularly yellow-fin, big-eye and skipjack in Sulu-Sulawesi Seas, where such findings could serve as basis for coming up with sustainable exploitation and management measures for these resources for benefit of the region as a whole.



Discussion during the Sub-regional Technical Meeting on Tuna Research in Sulu and Sulawesi Seas



Oceanographic surveys in the Sulu-Sulawesi Seas by the M.V.SEAFDEC 2



4.2 Regional Cooperation for Tunas Fisheries Management

Results of previous works of TD to assess the status and trends of tuna fishery resources indicated increasing trends of total tuna production from the region’s important tuna producers, namely: Indonesia, Malaysia, Philippines, Thailand, and Viet Nam from 0.87 metric tons (MT) in 2001 to 1.5 million MT in 2006, comprising not only oceanic but also neritic tuna resources. During the 45th Meeting of the SEAFDEC Council in 2013, the SEAFDEC Council expressed the need to establish a regional cooperation for management of tuna fisheries considering the transboundary nature of the resources. Nevertheless, recognizing that the management of oceanic tunas has already been covered by relevant RFMOs, the regional cooperation could focus on neritic tunas, which are abundant in Southeast Asian waters.

Following the directives of the SEAFDEC Council, SEAFDEC Secretariat in collaboration with the Member Countries organized a series of events to identify prioritized issues to



Experts Group Meeting on the Development of Regional Plan of Action on Sustainable Utilization of Neritic Tuna Resources in Southeast Asian Waters

be addressed at national and regional levels that could provide basis for developing the **Regional Plan of Action on Sustainable Utilization of Neritic Tunas in the ASEAN Region (RPOA-Neritic Tunas)**. In 2014, SEAFDEC convened the Experts Group Meeting on the Development of Regional Plan of Action on Sustainable Utilization of Neritic Tuna Resources in Southeast Asian Waters (18-20 June 2014, Krabi Province, Thailand), and came up with the final draft RPOA-Neritic Tunas.

The RPOA-Neritic Tunas aims to: (i) determine available data and information, improve data collection and develop key indicators; (ii) improve sustainable fisheries management; (iii) improve sustainable interaction between fisheries and marine ecosystem; (iv) improve compliance to rules and regulations and access to markets; (v) address social issues; and (vi) enhance regional cooperation. Under the action plan, the Scientific Working Group was established to develop the strategic plan as well as relevant Standard Operating Procedures (SOPs) and tools to support data collection and stock assessment, and conduct of HRD programs to enhance the capacity of countries in the implementation of the RPOA-Neritic Tunas in the future.

The final draft RPOA-Neritic Tunas was submitted to the 17th Meeting of the FCG/ASSP (4-5 December 2014, Ubon Ratchathani, Thailand) and after accommodating their comments, this was considered adopted for submission and endorsement by the 47th Meeting of the SEAFDEC Council and the 23rd Meeting of the ASWGFi in 2015. The RPOA-Neritic Tunas is expected to provide regional framework and platform for cooperation among countries in the region and in coming up with better data and information on status of neritic tuna resources as basis for sustainable utilization of neritic tuna resources in the future.

4.3 Small Pelagic Fisheries Management

MFRDMD continued the project on “**Comparative Studies for Management of Purse Seine Fisheries in the Southeast Asian Region**” which has been implemented since 2013 to compile and compare data on Catch Per Unit Effort (CPUE) available in the Southeast Asian region through the past three decades to examine the trends of stock status for purse seine fisheries. Under the project, MFRDMD also reviewed purse seine fishery management systems including Total Allowable Catch (TAC) systems and other management measures to examine the applicability of such systems/measures for management of small pelagic fisheries in the region. Toward this end, an in-house meeting was conducted in March 2014 to facilitate discussion between the project staff and invited Japanese expert on the development and evaluation of TAC systems in the world, as well as analysis of the available CPUE data. MFRDMD also convened a “Core Experts Meeting for Comparative Study on



*Participants of the Core Experts Meeting for Comparative Study on Purse Seine Fishery
in the Southeast Asian Region on 26-28 August 2014*

"Purse Seine Fishery in the Southeast Asian Region" on 26-28 August 2014, in Kuala Lumpur, Malaysia, which was attended by project participating Member Countries, namely Brunei Darussalam, Cambodia, Indonesia, Malaysia, Myanmar, Philippines, Thailand, and Viet Nam. Based on information presented during the Core Experts Meeting, MFRDMD would prepare a regional synthesis for pelagic fisheries in the region. The project also noted the recommendation made during the 37th Meeting of the SEAFDEC Program Committee in December 2014 for MFRDMD to explore the applicability of "Total Effort Allowance System" being applied in Japan in the region.

For genetic data collection and analysis of small pelagic species, *Amblygaster sirm* was chosen for the genetic study of pelagic species in South China Sea and Andaman Sea. To facilitate the collection of specimens of *A. sirm*, MFRDMD requested all participating Member Countries to nominate their respective focal points for carrying out the genetic study including collecting tissue samples of *A. sirm* for analysis at MFRDMD using Mitochondrial DNA markers. Necessary equipment and budget were allocated to countries for sample collection for genetic study. As MFRDMD had earlier conducted genetic studies for *Rastrelliger kanagurta* and *Decapterus maruadsi*, results from the genetic study of

A. sirm would fill-up additional information to provide better understanding on genetic structure of commercially important pelagic species in the region which could be useful for effective purse seine fishery management in the future.



Amblygaster sirm

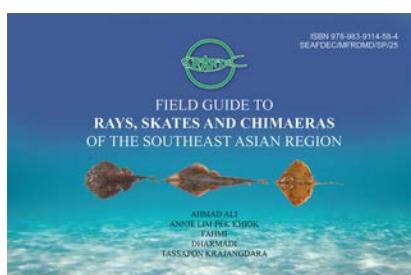
4.4 Research and Management of Sharks and Rays

During the past decades, several species of marine animals had been considered under international concern that need to be conserved which include sharks and rays, resulting at the onset in the development of the International Plan of Action for the Conservation and Management of Sharks by FAO in 1998, and subsequently the proposals for listing of several shark and ray species under the CITES Appendices. It has therefore become necessary for the Southeast Asian region to come up with justification in order that the proposals to list shark and ray species in the CITES Appendices could be averted. As such effort requires the Southeast Asian countries to continue enhancing their capacities and to

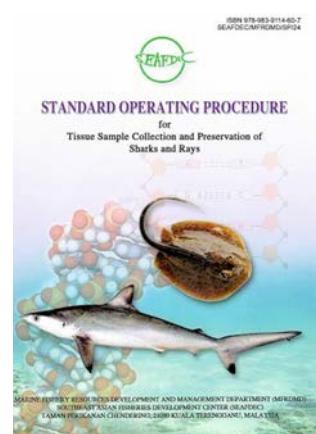
come up with data and information on sharks and rays, specifically on the conservation and sustainable utilization of these species, MFRDMD implemented the project on “**Research and Management of Sharks and Rays in the Southeast Asian Waters**”. The project aims to support data collection of shark and ray species in the region as well as enhance the capacity of countries in data collection and identification of the species.

During the final phase of the project in 2014, activities were continued with the collection of shark and ray specimens at landing sites in Pahang, Terengganu, Perak and Sarawak in Malaysia, where biological data, including sex and number of embryos/eggs if any, were recorded. In the process, MFRDMD compiled information for a total of 27 species of sharks (141 specimens) and 41 species of rays (144 specimens) at six landing sites in Kuantan, Dungun, Kuala Terengganu, Mukah, Brunei Island (Malaysia), and in Phuket Island (Thailand). The specimens had been preserved for biological study and compilation of DNA barcode at the Genetic Conservation Laboratory of MFRDMD which has been successful in optimizing the methodology to run samples for DNA barcode analysis for various conditions of samples. As a result, total of 18 shark species (66 specimens) and 18 ray species (60 specimens) were sequenced using the *cytochrome oxidase I* (COI) gene code for their DNA barcodes. Based on the results of this project, MFRDMD published the “Standard Operating Procedure (SOP) for Tissue Sample Collection and Preservation of Sharks and Rays”, and the “Field Guide to Rays, Skates and Chimaeras of the Southeast Asian Region”, and disseminated to serve as reference guide for the Member Countries. Moreover, two research papers were presented during the “Asian Fish Biodiversity Conference” on 12-13 February 2014 in Penang, Malaysia; another two at the “Regional Technical Working Group Meeting on Data Collection for Sharks in Southeast Asian Region” organized by TD on 22-24 April 2014 in Phuket, Thailand; and another paper on “Habitat preferences of chondrichthyans in Malaysia, Indonesia and Thailand” on 15-16 November 2014 in Odawara, Japan.

While this project has been completed in 2014, MFRDMD would continue working on sharks and rays under the new project on “**Research for Enhancement of Sustainable Utilization And Management of Sharks and Rays in the Southeast Asian Region**” starting in 2015. This project is aimed at compiling information on the utilization of sharks and rays in the region as basis for proper management and sustainable utilization of the species.



Publications produced in 2014: “Field Guide to Rays, Skates and Chimaeras of the Southeast Asian Region” and “Standard Operating Procedure (SOP) for Tissue Sample Collection and Preservation of Sharks and Rays”

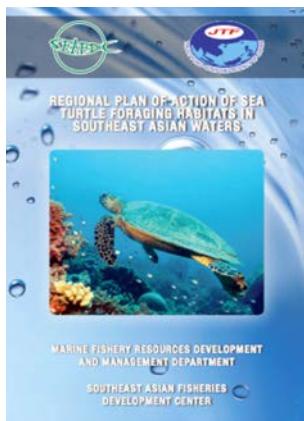


TD and MFRDMD developed the project proposal on “Data Collection on Catch Landing of Sharks in Southeast Asian Countries: Sharks and Manta Rays Landing Stock Data Collection towards Sharks NDF” for possible financial support from the EU through the CITES Secretariat. The Project aims to collect sharks landing data from all ASEAN Member States and come up with regional picture that could serve as basis for issuance of NDF document by the respective governments thus, facilitate international trade of sharks and rays in the future.

4.5 Research and Management of Sea Turtles

Considering their migratory nature, sea turtles are also considered under international concern and have been continuously at risks from several threats including fishing mortality making all species of sea turtles now being classified as endangered. MFRDMD has therefore undertaken several projects that aimed to conserve and enhance these species. The five-year project on **“Research and Management of Sea Turtles in Foraging Habitats in the Southeast Asian Waters”** which was completed in 2014, collected and compiled ecological and biological information on sea turtles, their foraging habitats and feeding behaviors. The information was used to develop plans for the conservation and management of sea turtles, as well as promote mitigation measures to reduce incidental catch of sea turtles by fishing activities. Since 2010, MFRDMD had collaborated with the Member Countries in conducting scientific surveys to compile information on ecological parameters in pilot foraging habitats in Lawas, Sipadan-Mabul Islands, and collected tissue samplings of sea turtles for genetic studies. Tagging of sea turtles using Inconel tags and satellite telemetry were also undertaken, the results of which were used to analyze sea turtles population and migration, and reported during a regional meeting in 2013. Furthermore, the **“Draft Regional Plan of Action of Sea Turtles Foraging Habitats in Southeast Asian Waters”** was also prepared in 2013.

In 2014, MFRDMD continued to finalize the **“Regional Plan of Action of Sea Turtles Foraging Habitats in Southeast Asian Waters”**, which outlined the need to manage fishing activities that threaten adult sea turtles, as well as reduce incidence of poaching sea turtle eggs in nesting areas. The Regional Plan of Action was published and subsequently submitted to the 17th Meeting of the FCG/ASSP in December 2014.



*The Regional Plan of Action
of Sea Turtles Foraging Habitats
in Southeast Asian Waters*

4.6 Conservation and Management of Eel Resources

In response to the emerging concerns raised by the Member Countries on the possibility that catadromous eels (*Anguilla* spp.) could be proposed for listing under the Appendices of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) at its forthcoming Conference of the Parties (CoP), SEAFDEC undertook a series of activities to address such concerns. Two regional meetings were convened by SEAFDEC Secretariat in 2014: the *Ad hoc* Regional Technical Meeting on Data/Information Gathering for Eel Fisheries and Aquaculture in the Southeast Asian Region (27 February 2014, Bangkok, Thailand) and the 2nd Regional Consultation on Sustainable Management of Eel Fisheries Resources and Aquaculture Production in the Region (31 August – 1 September 2014, Palembang, Indonesia) to review existing data and information on catadromous eels, and come up with Policy Recommendations as frame for SEAFDEC to undertake technical activities that support data collection as well as information on the status of catadromous eels in the region, appropriate measures for conservation and management of eels, and R&D related to aquaculture of the species.

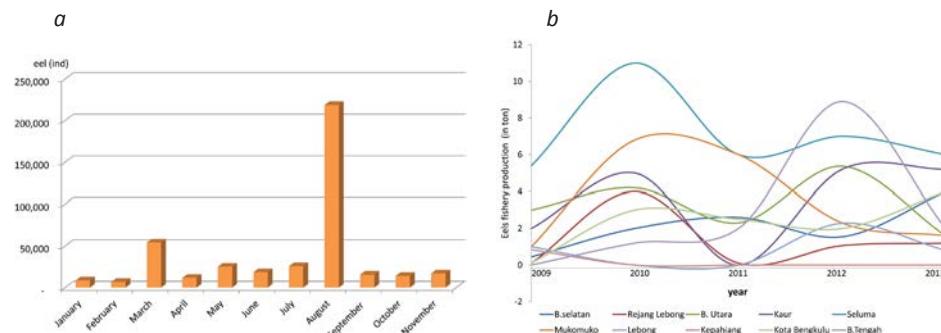


Participants of the Ad hoc Regional Technical Meeting on Data/Information Gathering for Eel Fisheries and Aquaculture in the Southeast Asian Region (above); and the 2nd Regional Consultation on Sustainable Management of Eel Fisheries Resources and Aquaculture Production in the Region (below)



Following the recommendations during the Consultation, IFRDMD conducted initial research in Bengkulu Province of Indonesia which revealed that eels are abundant in the west coast of Sumatra especially in Bengkulu Province including Enggano Island. The preliminary survey collected eel samples and information on the status of eel fisheries in several rivers in Bengkulu Province through field observation and interview of eel collectors. Secondary data on eel fishery production were also gathered from relevant national authorities. Results of the initial study in 2014 showed the highest peak of eel

production from Bengkulu Province was in August, and the variation of eel production among regencies in the Province with Seluma having the highest production. This could be related to the characteristic of Seluma, which has wide river mouth and open contact between sea and river areas.



(a) Total eel production from Bengkulu Province in 2014 showing the highest peak in August during the change from dry to rainy season and slight peak in March at the end of rainy season (data from Provincial Fishery Extension); and (b) Eel fishery production (MT) in different regencies of Bengkulu Province

4.7 Improving Information and Statistics Collection for Management of Fisheries

The project on “**Enhancing the Compilation and Utilization of Fishery Statistics and Information for Sustainable Development and Management of Fisheries in Southeast Asian Region**” has been carried out by TD since 2013 to compile quality fisheries data and information to support policy planning and management of fisheries. This project comprises three sub-projects, namely: (i) facilitating fisheries activity information gathering through the introduction of community-based management; (ii) improvement of data collection of the commercially exploited aquatic and threatened species; and (iii) harmonization of fishery statistics in the Southeast Asian region. While the first sub-project focuses on the collection of information on small-scale inland and coastal fisheries through community-based management and enhance the capacity of Member Countries in fisheries statistics and data collection, the second sub-project specifically intends to improve data collection of commercially exploited aquatic and threatened species. The third sub-project emphasizes on coordination and support for statistics reporting systems of Member Countries to be able to generate timely regional fishery statistics.

For “**facilitating fisheries activity information gathering through the introduction of community-based management**”, TD conducted training of trainers (ToT) and on-site-training for some Member Countries. Through ToT, participants could enhance their knowledge and skills on community-based resources management including the methodologies for gathering information on fisheries activity. The participants would continue to serve as trainers for on-site training to be subsequently conducted by

respective countries and extend the knowledge to community fishers. Training sessions convened in 2014 included: Training of Trainers (ToT) on Facilitating Fisheries Information Gathering Through Introduction of Community-based Fisheries Management: Legislative and Institutional Aspects of Rights-based Fisheries Management (13-15 August 2014, Da Nang, Viet Nam); On-site Training Course on Facilitating Fisheries Information Gathering Through Introduction of Community-based Fisheries Management (14-16 January 2014, Selangor, Malaysia); Mobile On-site Training on Facilitating Fisheries Information Gathering Through Introduction of Community-based Fisheries Management in Thailand (1-10 July 2014, Thailand); and On-site Training Course on Practical Approach to Co-management in Marine and Inland Fisheries of Cambodia (28 July – 1 August 2014, Cambodia). Improved fisheries data through community involvement would in the long run contribute to better understanding and knowledge on the status and conditions of coastal small-scale and inland capture fisheries at national and regional levels.

For "***improvement of data collection of the commercially exploited aquatic and threatened species***", activities were implemented by TD in collaboration with MFRDMD with specific focus on "sharks" emphasizing on alleviating problems of shark data collection by improving capacity of relevant officers of the Member Countries on species identification. The "Regional Technical Working Group Meeting on Data Collection for Sharks in Southeast Asian Region" was convened on 22-24 April 2014 in Phuket, Thailand, and came up with the contents and format for shark data collection as well as identified landing sites for data collection in pilot countries, namely Cambodia, Indonesia, Malaysia, Myanmar, Philippines, Thailand and Viet Nam. This was followed by the "Regional Training of the Trainers on Elasmobranch Taxonomy" on 18-22 May 2014 at MFRDMD in Kuala Terengganu, Malaysia, where knowledge and skills on shark identification were imparted to participants to enable them to extend the knowledge to local shark landing operators in the respective pilot countries allowing them to take up data collection.

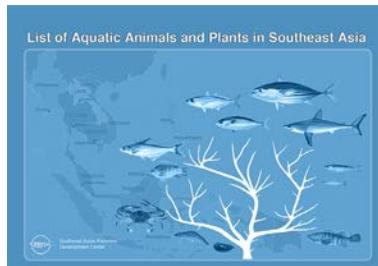


Group discussion during the Training of Trainers (ToT) on Facilitating Fisheries Information Gathering Through Introduction of Community-based Fisheries Management



Practical session during the training of trainers on taxonomy of elasmobranch including sharks and rays

While supporting the Member Countries in improving their respective fisheries data collection systems, SEAFDEC pursued its on-going mandate of compiling regional fishery statistics. In 2014, SEAFDEC published the "Fishery Statistics Bulletin of Southeast Asia 2012" using the statistics and data submitted by the Member Countries. The "List of Aquatic Animals and Plants in Southeast Asia", which was updated based on statistics that could be provided by countries in the region by species or species groups, was also published



Publications on "Fishery Statistics Bulletin of Southeast Asia 2012" and "List of Aquatic Animals and Plants in Southeast Asia"

and disseminated to statistics-related agencies of the Member Countries to facilitate compilation of statistics data for submission to SEAFDEC.

THRUST 5. ADDRESSING INTERNATIONAL FISHERIES-RELATED ISSUES FROM A REGIONAL PERSPECTIVE

5.1 Addressing International Fisheries-related Issues

Issues related to trade of fish and fishery products have been importantly discussed at international/regional levels over the past decades, with a number of international instruments including market-driven measures agreed upon and applied by relevant organizations/countries, *e.g.* measures issued by CITES related to commercially exploited aquatic species, the EC Regulation 1005/2008 establishing a community system to prevent, deter and eliminate IUU fishing, the need for ensuring sustainable utilization of aquatic species under international concerns, creating impacts on the development of the fisheries sector particularly for developing countries where fisheries production is derived from small-scale fisheries sub-sector. While countries in the region should comply with emerging requirements and measures in order that their fish and fishery products could be traded internationally, it is also necessary to enhance the understanding and capacity of countries in addressing such requirements. Furthermore, the participation of countries in relevant international fora related to development of fisheries-related instruments need to be improved in order that regional specificity of fisheries would be appropriately considered in the development of such instruments and related measures in the future.

Thus, under the project on "**Assistance for Capacity Building in the Region to Address International Fish Trade-related Issues**", SEAFDEC developed an Executive Report on International Fisheries-related Issues which was submitted to the 22nd Meeting of the ASEAN Sectoral Working Group on Fisheries (ASWGFi) in 2014. Such Report focused on the progress undertaken by SEAFDEC in addressing emerging needs to combat IUU fishing, *i.e.* the RFVR as a tool to combat IUU fishing; development of the Regional Catch Documentation Scheme; and the results of the listing of commercially exploited aquatic species in CITES Appendices concluded at the 16th Session of the CITES Conference of the Parties (CITES-COP16) in 2013.

MFRDMD in collaboration of the SEAFDEC Secretariat promoted awareness building and the development of high-level policies on the need to combat IUU fishing (*see also 3.1*). In particular, the development of the ASEAN Guidelines for Preventing the Entry of Fish and Fishery Products from IUU Fishing Activities into the Supply Chain was pursued. The final draft was prepared through the Regional Consultation on Developing the Guidelines for Preventing the Entry of Fish and Fishery Products from IUU Fishing Activities into the Supply Chain (23-25 September 2014, Kota Kinabalu, Malaysia) for submission to the 47th Meeting of the SEAFDEC Council and the 23rd Meeting of the ASWGFi in 2015 for consideration and endorsement. The Draft ASEAN Catch Documentation Scheme (ACDS) was also prepared through the Experts Group Meeting on Drafting of Catch Documentation Scheme (14-16 October 2014, Malaysia), and the 1st Regional Technical Consultation on ASEAN Catch Documentation Scheme (16-18 December 2014, Langkawi, Malaysia)

Another important issue addressed by SEAFDEC in 2014 was the need to promote sustainable utilization of catadromous eels, where preliminary study on conservation and management of eel resources in the Southeast Asian region was conducted, and the *Ad hoc* Regional Technical Meeting on Data/Information Gathering for Eel Fisheries and Aquaculture in the Southeast Asian Region (27 February, Bangkok, Thailand), and 2nd Regional Consultation on Sustainable Management of Eel Fisheries Resources and Aquaculture Production in the Region (31 August - 1 September 2014, Palembang, Indonesia) convened. As a result, "Policy Recommendations for the Conservation and Management of Catadromous Eel Resources in Southeast Asia and Sustainable Development of Catadromous Eel Aquaculture in Southeast Asia", which was subsequently endorsed by the SEAFDEC Council by *ad referendum* (*see also 4.6*).



Discussion at the 2nd Regional Consultation on Sustainable Management of Eel Fisheries Resources and Aquaculture Production in the Region, held in Palembang, Indonesia



During the Resumed Session of the Technical Consultation on International Guidelines on Securing Sustainable Small-scale Fisheries



Furthermore, SEAFDEC also participated in international discussions that intended to come up with global policy framework and guidelines related to fisheries to ensure that the regional specificity would be raised and appropriately addressed during the process of developing such policies and guidelines. Important event attended by SEAFDEC in 2014 was the Resumed Session of the Technical Consultation on International Guidelines on Securing Sustainable Small-scale Fisheries (3-7 February 2014, Rome, Italy) convened by FAO to develop the “Voluntary Guidelines for Securing Sustainable Small-scale Fisheries in the Context of Food Security and Poverty Eradication”.

SPECIAL PROJECT

6.1 **Fisheries and Habitat Management, Climate Change and Social Well-being in Southeast Asia**

“**Fisheries and Habitat Management, Climate Change and Social Well-being in Southeast Asia**” is a five-year collaborative project (January 2013-December 2017) funded by the Government of Sweden which aims to achieve sustainable use of aquatic resources and reduce vulnerability of coastal/rural (fishing) communities in the ASEAN region to climate change, by building-up the capacity of the ASEAN Member States in the areas of: (i) integrating habitat and fisheries management and adapting to climate change; (ii) managing and improving of systems for fishing capacity (monitoring, record and control); and (iii) drafting and implementing regional and sub-regional agreements, and improving policy development processes. The project also aims to enhance the social well-being, improve working conditions and promote alternative livelihoods by seeking commitment from the ASEAN Member States in following-up on the development and implementation of sub-regional and regional agreements with special focus on four sub-regions, namely: the Gulf of Thailand, the Andaman Sea, the Sulu-Sulawesi Seas, and the Mekong River Basin.

The highlight of achievements of the SEAFDEC-Sweden project in 2014 could be summarized as follows:

- **Promotion of sub-regional cooperation in Southeast Asia and strengthening regional and sub-regional programs and organizations**

In 2014, series of bilateral meetings and workshops between neighboring countries were organized for each sub-region to facilitate discussion and explore effective ways and means of improving fisheries management for sustainability of fisheries resources and fisheries/habitat management in the respective sub-regions:

- **Gulf of Thailand Sub-region:** In following-up to the 4th Meeting of the Gulf of Thailand Sub-region (in 2013), bilateral dialogues were arranged for countries bordering the Gulf of Thailand, namely: Thailand-Malaysia (5-7 March 2014, in Penang, Malaysia), and Cambodia-Viet Nam (5-7 March 2014 in Phu Quoc, Viet Nam and 6-7 October 2014 in Bangkok, Thailand, respectively).
- **Andaman Sea Sub-region:** Sub-regional consultative meeting was organized on 27-28 May 2014 in Phuket, Thailand to facilitate Thailand-Myanmar sub-regional

cooperation for fisheries management around the North Andaman Sea/Myeik Archipelago. Cooperation in this sub-region was built upon the working model for a collaborative management structure initiated by CORIN-Asia (with support from BOBLME project), as well as the progress of actions being implemented by BOBLME, SEAFDEC and other relevant partners.

- **Mekong River Basin Sub-region:** Bilateral dialogues were arranged for Cambodia-Lao PDR on 4-6 June 2014 in Siem Reap and on 8-9 October 2014 in Bangkok, Thailand. Through such dialogues, it was agreed that a series of workshops and trainings would be convened in 2015 to review legal frameworks of the two countries, particularly for specific areas of Preah Vihear (Cambodia) and Champasak Province (Lao PDR) to promote sharing of information and raise awareness among concerned officers.



*Bilateral dialogue
between Cambodia and
Viet Nam, 6-7 October
2014 in Bangkok,
Thailand*



*Bilateral dialogue
between Cambodia and
Lao PDR, 8-9 October
2014 in Bangkok
Thailand*

During the aforementioned bilateral events, the respective countries provided and shared knowledge and experiences on the current status of fisheries and existing legal frameworks, and came up with action plans focusing on fisheries and habitat management, particularly for critical habitats, transboundary stocks and economically important species (e.g. *Rastrelliger* spp., neritic tunas), habitats and protected areas around transboundary waters. Furthermore, the events also facilitated the formulation of joint work plans that address problems on IUU fishing and encroachment of foreign fishing vessels, and improve records of catch/landing at ports for the management of fishing capacity (monitoring, record and control).



For the Cambodia-Viet Nam cooperation, significant progress was made through the signing of the Memorandum of Agreement (MOA) between the two countries in April 2014. Such MOA aims to enhance communication and cooperation between Kien Giang Province of Viet Nam, and Kampot and Kep Provinces of Cambodia, and support the fisheries sector by implementing joint actions in the areas of common interest of these coastal provinces. For Cambodia-Lao PDR, a draft MOA has been prepared to enhance communication and cooperation in the areas of common concern between Stung Treng and Preah Vihear Provinces of Cambodia, and Champasak Province of Lao PDR.

As part of the efforts in strengthening Thailand-Malaysia cooperation, TD conducted a one and a half year (2014-2015) study on “Strengthening Malaysian and Thai Partnership in support of Joint Fisheries Planning and Management in the Western Gulf of Thailand”, which aimed to gather preliminary information on fishing efforts (fishing vessels, fishing gears, and people engaged in fishing activities) and landing of catches. Such information could be used to improve monitoring and control of fishing activities as well as strengthen the cooperation between Malaysia and Thailand in the future.

At field level, the project also provided local capacity building to local organizations with the objectives of improving livelihood opportunities, undertaking poverty alleviation activities, and restoring important fishery resources and habitats. In 2014, SEAFDEC established sub-contract agreements with the Learning Institute of Cambodia to undertake the activity on “Strengthening Community Fisheries Management and Livelihoods Diversification in Cambodia”; and CORIN-Asia Cambodia to carry out activities that aim to: (i) strengthen relevant local institutions’ capacity to enable them to address natural resource degradation and climate change vulnerability of target coastal communities; (ii) improve local people’s capacity to effectively cope with the challenges of climate change and other changes brought about by development through enhanced family livelihoods, sustainable use of natural resources and understanding of risks; and (iii) strengthen the existing approaches at the local level developed through WAP for sustainable resource management of target coastal communities.

Also under the sub-contract agreements, CORIN-Asia Myanmar implemented activities that aim to build capacity of local level government agencies and local authorities towards sustainable management of fisheries resources and important coastal habitat to protect coastal resources; while the Prince of Songkla University (PSU), Hat Yai, Thailand conducted the study on “Local ecological knowledge and benefit sharing approaches for small-island fishery/tourism management in Lipe Island, Andaman Sea, Thailand”. The establishment of such linkages with local organizations and on-going projects would be an important factor to ensure adequate support and sustainability of the project outcomes.

- Promotion of the regional cooperation on sustainable management of neritic tuna resources in Southeast Asia**

In a region-wide perspective, the SEAFDEC-Sweden project had advanced the regional dialogue among government agencies, NGOs and private sector to develop a regional plan of action to ensure sustainable utilization of neritic tunas. The Experts Group Meeting on Regional Plan of Action on Sustainable Utilization of Neritic Tunas in the ASEAN Region was held on 18-20 June 2014, in Krabi Province, Thailand. The Experts Group Meeting developed

the draft “Regional Plan of Action on Sustainable Utilization of Neritic Tunas in the ASEAN Region” (RPOA-Neritic Tunas), established the Scientific Working Group for obtaining better information on status and trends of neritic tunas, and crafted capacity building program to support future implementation of the RPOA-Neritic Tunas. The Project also hosted the 1st Meeting of the Scientific Working Group on Neritic Tuna Stock Assessment in the Southeast Asian Waters on 18-20 November 2014 in Shah Alam, Malaysia (*see also 4.2*).



Experts Group Meeting on Regional Plan of Action on Sustainable Utilization of Neritic Tunas in the ASEAN Region

- **Facilitating the sharing of experiences in the management of fisheries, aquatic resources and wetlands in the Lower Mekong River Basin**

Since the establishment of Mekong River Commission (MRC) in 1995, Lao PDR, Thailand, Cambodia, and Viet Nam have been worked jointly on aquatic resources management and coordinated use of Mekong River resources. The year 2014 was therefore an opportune time for an “Experts Meeting on Mekong Cooperation on Fisheries, Aquatic Resources and Wetlands: 20 years lessons learnt”. Convened on 12-14 November 2014 in Phnom Penh, Cambodia, the Meeting was a collaborative effort of SEAFDEC, MRC and the Fisheries Administration of Cambodia. From the various projects and initiatives that had been implemented in Lower Mekong River Basin (LMB) during the past two decades, opportunities and challenges were gained through a broad range of knowledge, while several lessons (successes and failures) were learnt and could be mobilized as basis for future activities in enhancing the sustainable use of Mekong River’s living aquatic resources for the benefit of people who are dependent on fish and other aquatic resources from the LMB.

As SEAFDEC has recently established the Inland Fishery Resources Development and Management Department (IFRDMD) as its fifth Department in Palembang, Indonesia, the experiences of MRC and other agencies working in the LMB could be mobilized as basis for the development of future programs and activities for sustainable utilization of inland aquatic resources, not only for the Mekong River Basin but also for the Southeast Asian region as a whole.

Important outputs from the Meeting included recommendations that elaborate the areas where countries, concerned agencies and organizations could collaborate to ensure the

sustainability of inland capture fisheries, and its contribution to livelihood, food security and economic development of the LMB as well as other inland fisheries habitats of the Southeast Asian region. Specifically, SEAFDEC was requested to: consider accommodating the concept of MRC's Basin-wide Fisheries Management Strategy into the SEAFDEC framework on inland fisheries management and development; sustain its cooperation and dialogues with MRC and FAO as well as with relevant organizations; and provide inputs to relevant upcoming meetings in order to support sustainable development and management of inland capture fisheries in the LMB and Southeast Asia. SEAFDEC was also tasked to collaborate with concerned organizations and agencies in the promotion of the EAFM concept in inland fisheries management; and extract the methodologies and tools that have been used for various studies in the LMB in order that these tools could be applied in other inland aquatic areas of Southeast Asia with similar conditions as those of the LMB.



Participants at the Experts Meeting on Mekong Cooperation on Fisheries, Aquatic Resources and Wetlands



H.E. Prof. Dr. Nao Thuok delivering his speech to open the Experts Meeting

- **Addressing issues related to labor in fisheries**

On 12 February 2014, SEAFDEC-Sweden project conducted an In-house Seminar on issues requiring increased attention for “Work in Fisheries”, working conditions, employment and the need to rely on migratory labor, and the roles and responsibilities of fisheries agencies, regional organizations (ASEAN) and SEAFDEC. Information was provided on the status of safety and labor standards that are being developed for various types of fishing operations. The Seminar also aims to give participating SEAFDEC staff an opportunity to exchange views with the International Labour Organization (ILO) and the Department of Fisheries of Thailand on aspects related to labor and working conditions, the role expected from SEAFDEC, and on how to cooperate with agencies responsible for labor aspects (such as the ILO).



Participants of the In-house Seminar on Work in Fisheries: Working Conditions, Employment and Migratory Labor

- **Cooperation with regional and international organizations**

The SEAFDEC-Sweden project gave strong emphasis in cooperation with other international/regional organizations on issues of common interest. The links and cooperation with ASEAN is of special importance through the ASEAN-SEAFDEC Strategic Partnership (ASSP). The project also maintained dialogues with FAO/APFIC, ILO, IUCN/MFF, RPOA-IUU, MRC as well as with local/national organizations.

In 2014, efforts have been built upon the work implemented by other organizations as well as the earlier interventions facilitated through the past SEAFDEC-Sweden cooperation. Through the processes of regional consultations that involved all ASEAN-SEAFDEC Member Countries, dialogues were also initiated with non-ASEAN Countries (Australia, Timor-Leste, Papua New Guinea, and India) in cooperation with the RPOA-IUU, BOBLME and others as appropriate and applicable. Results and outcomes as well as indicators on positive achievements and impacts from such dialogues would, to a large extent, be reflected in indications and reports from bodies, and individuals outside of the project, e.g. ASEAN, FAO/APFIC, RPOA-IUU, BOBLME in recognition of the steps being taken and the impacts achieved.

- **Strengthening the networking through the Regional Fisheries Policy Network Program**

The Regional Fisheries Policy Network (RFPN) Program has been supported by SEAFDEC from 2007 until the present. In 2014, representatives from Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, Philippines, Thailand, and Viet Nam had been nominated to serve as the RFPN members and work at the SEAFDEC Secretariat in Bangkok, Thailand for a period of one year . The RFPN members played active role in enhancing coordination and communication between SEAFDEC and their respective countries while also given the opportunity to attend and provide technical contributions in various events of SEAFDEC.

¹ RFPN members for Indonesia, Malaysia, Myanmar, Philippines and Thailand were supported by the SEAFDEC-Sweden project; while those from Cambodia, Lao PDR and Viet Nam were supported by the Japanese Trust Fund.



(From left to right) RFPN members of 2014 from Indonesia, Cambodia, Thailand, Malaysia, Myanmar, Lao PDR, Philippines and Viet Nam

Such opportunity has enhanced their knowledge and experiences, and allowed them to obtain better understanding of major global and regional fisheries issues confronting the region. Meanwhile, the RFPN also supported the efforts of SEAFDEC in developing strategies to promote fisheries policy dialogues, promoting regional and sub-regional cooperation among the Member Countries, and following-up on the commitments for the implementation of policies under the ASEAN framework.

SEAFDEC PROGRAMS FOR 2015

As scrutinized and endorsed during the 37th Meeting of the SEAFDEC Program Committee in 2014, the **on-going projects** implemented in 2014 and would be continued in 2015 are shown below:

Program Category/Project Title	Responsible Department	Funding Source
ASEAN-SEAFDEC FCG/ASSP Programs		
Thrust I: Developing and Promoting Responsible Fisheries for Poverty Alleviation and Food Security		
1. Human Resource Development for Sustainable Fisheries	TD	JTF
2. Optimizing Energy Use/Improving Safety Onboard in Fishing Activities	TD	JTF
Thrust II: Enhancing Capacity and Competitiveness to Facilitate International and Intra-regional Trade		
3. Chemical and Drug Residues in Fish and Fish Products in Southeast Asia - Biotoxins Monitoring in the ASEAN Region: ASP, AZA, BTX and Harmful Algal Blooms (HABs) in the ASEAN Region	MFRD	JTF
Thrust III: Improving Management Concepts and Approaches for Sustainable Fisheries		
4. Strategies for Trawl Fisheries By-catch Management	TD	FAO/GEF
5. Promotion of Countermeasures to Reduce IUU Fishing Activities	TD	JTF
6. Combating IUU Fishing in the Southeast Asian Region through Application of EU Catch Certification for International Trading in Fish and Fishery Products	MFRDMD	JTF
Thrust IV: Providing Policy and Advisory Services for Planning and Executing Management of Fisheries		
7. Fisheries Resource Survey and Operational Plan for M.V. SEAFDEC 2	TD	JTF
8. Offshore Fisheries Resources Exploration in Southeast Asia	TD	JTF
9. Enhancing the Compilation and Utilization of Fishery Statistics and Information for Sustainable Development and Management of Fisheries in Southeast Asian Region	TD	JTF
10. Comparative Studies for Management of Purse Seine Fisheries in the Southeast Asian Region	MFRDMD	JTF
Thrust V: Addressing International Fisheries-related Issues from a Regional Perspective		
11. Assistance of Capacity Building in the Region to Address International Trade-related Issues	SEC	JTF



Program Category/Project Title	Responsible Department	Funding Sources
12. Strengthening SEAFDEC Network for Sustainable Fisheries	SEC	JTF
Special Projects		
13. Fisheries and Habitat Management, Climate Change and Social Well-being in Southeast Asia	SEC	Sweden
Departmental Programs*		
1. Adapting to Climate Change Impacts	AQD	AQD
2. Healthy and Wholesome Aquaculture	AQD	AQD
3. Maintaining Environmental Integrity through Responsible Aquaculture	AQD	AQD
4. Meeting Socio-economic Challenges in Aquaculture	AQD	AQD
5. Quality Seed for Sustainable Aquaculture	AQD	AQD
6. Tailor-made Training Programs	TD	TD
7. Promotion and Enhancement Fisheries Information	TD	TD
8. Improvement of Fisheries Technology and Reduction of the Impact from Fishing	TD	TD
Other Programs		
1. Coastal Area Capability Enhancements in Southeast Asia	TD (in collab. with AQD)	RIHN

* Funding sources for Departmental Programs are mainly the regular contribution from Host Government of the respective Departments.

In addition to on-going projects, seven **new projects** are proposed to be implemented under the ASEAN-SEAFDEC FCG/ASSP mechanism starting 2015. These include the following projects:

Program Category/Project Title	Responsible Department	Funding Source
ASEAN-SEAFDEC FCG/ASSP Programs		
1. Reinforcement and Optimization of Fish Health Management and the Effective Dissemination in the Southeast Asian Region	AQD	JTF
2. Environment-friendly, Sustainable Utilization and Management of Fisheries and Aquaculture Resources	AQD	JTF
3. Research for Enhancement of Sustainable Utilization and Management of Sharks and Rays in the Southeast Asian Region	MFRDMD & TD	JTF
4. Promotion of Sustainable Fisheries Resources Enhancement Measures in Critical Habitats/Fishing Grounds in Southeast Asia	TD	JTF

Program Category/Project Title	Responsible Department	Funding Source
5. Enhancement of Sustainability of Catadromous Eel Resources in Southeast Asia	IFRDMD	JTF
6. Promotion of Responsible Utilization of Inland Fisheries in Southeast Asia	IFRDMD	JTF
7. Cold Chain Management of Seafood	MFRD	Singapore

There were also three **pipeline projects** of which the proposals are prepared in consultation with respective donor agencies. These include:

Program Category/Project Title	Responsible Department	Funding Source
1. Establishment and Operation of a Regional System of Fisheries <i>Refugia</i> in the South China Sea and Gulf of Thailand	TD	UNEP/GEF
2. Enhancing Coastal Community Resilience for Sustainable Livelihood and Coastal Resources Management	MFRDMD	ASEAN Sec/ IDB
3. Ocean and Fisheries Partnership Project	Secretariat	USAID

ESTABLISHMENT OF THE INLAND FISHERY RESOURCES DEVELOPMENT AND MANAGEMENT DEPARTMENT (IFRDMD)

Being aware of the importance of inland fisheries for food security, livelihood and well-being of peoples not only in Indonesia but also in the whole Southeast Asian region, the Government of Indonesia expressed its intention to host a regional center for inland fisheries through a statement put forward by *His Excellency Dr. Fadel Muhammad*, the former Minister of Marine Affairs and Fisheries during the ASEAN-SEAFDEC Conference on Sustainable Fisheries for Food Security for the ASEAN Region “Fish for the People 2020: Adaptation to a Changing Environment” held in June 2011. The proposal which was unanimously supported by the SEAFDEC Council of Directors in the subsequent year, came into fruition two years later when the Government of Indonesia represented by *Prof. Syarief Widjaja*, the Secretary-General of the Ministry of Marine Affairs and Fisheries (MMAF) and SEAFDEC Council Director for Indonesia, signed the National Legitimacy Document on 2 September 2014 to officially launch the establishment of the Inland Fishery Resources Development and Management Department (IFRDMD) as the fifth Department of SEAFDEC.

The signing of the Legitimacy Document therefore gives due recognition to IFRDMD as an inter-governmental organization under the SEAFDEC framework and accordingly confirms the necessary privileges for IFRDMD. This development also gives the assurance that more focus of SEAFDEC activities would be given on inland fisheries, as well as on inland fishery resources conservation and management.



Although it is expected that the new Department would only be operational by 2015 considering that the construction of buildings, laboratories, and other facilities is still ongoing, the activities of IFRDMD had been initiated even before the end of 2014, at its temporary site in the compound of Indonesia’s Research Institute for Inland Fisheries (RIIF) also based in Palembang. This arrangement enabled the IFRDMD to promptly address regionally important and relevant issues at the soonest time possible.



The IFRDMD building, during construction and before its operation

Inland Capture Fisheries in the Southeast Asian Region at a Glance

The total production from inland capture fisheries of the Southeast Asian region as of 2012 was reported to be approximately 2.8 million metric tons (MT), accounting for more than 7% of the region's total fisheries production (from all sectors) or more than 15% of the total production from capture fisheries. The top-producing Southeast Asian country is Myanmar, followed by Cambodia and Indonesia. Other countries are also closing in, such as the Philippines, Thailand and Viet Nam which have also been reported to consistently produce considerable amount of inland fisheries products during the past decade. For the region's only landlocked country Lao PDR, its production may not be very high but this is derived mainly from inland fisheries. The establishment of IFRDMD therefore signifies the importance and significance of developing the inland fisheries in the Southeast Asian region for food security of future generations.

Characteristics of the Region's Inland Capture Fisheries

The most common characteristics of inland capture fisheries in Southeast Asia include the followings:

- Inland capture fisheries comprises large number of small-scale fishers, mostly subsistent and engaged in only part time fishing activities;
- Activities related to inland capture fisheries are highly seasonal, with the highest peak during flood receding periods or at the end of the rainy season;
- Production from inland capture fisheries is highly diversified, where catch could be large in number and quantity, but small in size with high species diversity;
- Inland fishery resources could be freely accessed at any time, and production could be landed anywhere without proper recording; and
- Inland fisheries production goes to various channels, for direct household consumption, sold in local markets, or exported to markets within the region.

Challenges Confronting Inland Fisheries Development

Taking into consideration the characteristics of inland capture fisheries of the Southeast Asian region, the challenges confronting the countries in ensuring the sustainability of inland capture fisheries development include the need to:

Address the low priority that planners and policy makers give to inland fisheries by

- Improving the methodologies for collecting statistics on production from inland capture fisheries to address the concerns on inadequacy of data and other relevant information;
- Boosting the development of non-conventional data collection and model for inland ecosystem valuation using existing data and information to advocate the importance of inland fisheries; and
- Synthesizing and packaging meaningful information for policy makers and public by integrating data available from various sources, e.g. censuses and statistics, research studies, local/traditional knowledge.

***Apply the ecosystem approach to fisheries in inland fisheries management by***

- Promoting the “catchment approach” to ensure consistency in management levels (local, national or regional levels) and ecosystem boundary; and
- Strengthening the “holistic approach” by taking into consideration the activities of other sectors involved and sharing the same inland resources/ecosystems.

Secure ecosystem functions and improve R&D on mitigation measures by

- Raising the awareness of other sectors as well as planners/policy makers on the importance of inland fisheries and its ecosystem functions, by generating and disseminating relevant and credible information; and
- Establishing and advocating measures to mitigate the impacts of development projects, e.g. incorporation of fish passage in cross-river barrier construction, stock enhancement programs, integration of underpasses in road construction and development.

Maximize the utilization of inland fishery resources by

- Developing and upholding responsible fishing gears/practices that promote species selectivity; and
- Enhancing preservation and post-harvest technologies to ensure that fish is utilized for year-round consumption, improve safety and quality of traditional fish products for local consumption, and generate value-added products.

Develop appropriate resources enhancement programs by

- Enhancing the yield from inland capture fisheries by stocking hatchery-bred seeds (focusing on low trophic and indigenous species) in closed ecosystem;
- Strengthening conservation measures through the use of indigenous species with seeds produced specifically for stock enhancement purposes;
- Promoting habitat conservation and improvement by making the habitats favorable for enhancing natural reproduction of aquatic species;
- Developing indicators for evaluating the successes of resource enhancement programs; and
- Promoting culture-based fisheries.

Improve the capacity of inland fisheries to adapt to climate change by

- Promoting the “precautionary approach” by acting decisively in the absence of certainty; and
- Enhancing the preparedness of inland fisheries communities in responding to anticipated changes and variability of the climate.

IFRDMD is tasked to manage and coordinate project activities that aim to promote the sustainable development and management of the region’s inland capture fisheries. At the onset, IFRDMD has initiated the implementation of the project on the “Promotion of Sustainable Development in Inland Fisheries” which aims to review activities and methodologies for promoting inland fisheries in the ASEAN Member States (AMSS) and finding ways and means for the sustainable development of inland fisheries, promoting effective inland fisheries management measures in AMSS, and conducting studies on the development of habitat conservation/resources enhancement measures suitable for Southeast Asia.

COOPERATION WITH DONORS AND PARTNER ORGANIZATIONS IN 2014

Association of Southeast Asian Nations

Cooperation between SEAFDEC and the Association of Southeast Asian Nations (ASEAN) has been pursued since 1998 with the establishment of the Fisheries Consultative Group (FCG) Mechanism. The cooperation was formalized in 2007 with the signing of the Letter of Understanding on the ASEAN-SEAFDEC Strategic Partnership (ASSP), where SEAFDEC serves as a technical arm to implement fisheries programs/projects for the benefit of the ASEAN Member States. In 2014, twenty-one (21) programs were implemented by SEAFDEC under the FCG/ASSP Mechanism. SEAFDEC also continued to support the ASEAN Member States in the implementation of activities in line with the "Resolution and Plan of Action on Sustainable Fisheries for Food Security for the ASEAN Region Towards 2020" adopted in 2011.

In 2014, SEAFDEC participated in the 22nd Meeting of the ASEAN Sectoral Working Group on Fisheries (ASWGFi) (25-27 June 2014, Kuala Lumpur, Malaysia), to report on the progress in the implementation of projects under the FCG/ASSP Mechanism in 2013, and the projects proposed for 2014. SEAFDEC was also involved in providing technical inputs to the ASEAN Public-Private Taskforce for Sustainable Fisheries and Aquaculture. SEAFDEC also attended the 2nd Meeting of the ASEAN Public-Private Taskforce for Sustainable Fisheries and Aquaculture (3-4 March 2014, Hanoi, Viet Nam); the 3rd Steering Committee Meeting of the ASEAN Multi-sectoral Framework on Climate Change (AFCC): Forestry and Agriculture for Food Security (1-2 July 2014, Jakarta, Indonesia); the 2nd Steering Committee Meeting for the Fisheries Improvement Project (FIP) Protocol for the ASEAN Region (11-12 July 2014, Ho Chi Minh City, Viet Nam); the 1st Meeting of a Public-Private Working Group on Aquatic Animal Health and ASEAN Workshop on Minimizing Risks Associated with Transboundary Aquatic Animal Disease (13-14 August 2014, Pattaya, Thailand); and the 3rd Meeting of the ASEAN Public-Private Taskforce for Sustainable Fisheries and Aquaculture (19-20 November 2014, Penang, Malaysia). SEAFDEC also provided technical inputs to the ASEAN-Australia Development Cooperation Program (ADCCP) Phase II, under the project that aimed to establish ASEAN Good Aquaculture Practices.

SEAFDEC supported ASEAN in the development of regional fisheries policies while several regional initiatives were underway, *i.e.* Regional Fishing Vessels Record (RFVR) for vessels 24 meters in length and over; ASEAN Catch Documentation Scheme (ACDS); Regional Guidelines to Prevent the Entry of Fish and Fishery Products from IUU Fishing Activities into the Supply Chain; the Guidelines for Managing Fishing Capacity for the ASEAN Region; Regional Plan of Action on Conservation and Management of Neritic Tunas; the Regional Guidelines on Traceability System for Aquaculture Products; Action Plan for Managing Foraging Habitats of Sea Turtles; and the Regional Policy Recommendations on Conservation and Management of the Eel Resources.



Ateneo de Manila University

AQD entered into a Memorandum of Understanding (MOU) with Ateneo de Manila University (ADMU), a private academic institution in the Philippines with capability on research and applied sciences. Both institutions have agreed to promote and develop academic cooperation in the following areas: (i) exchange and training of academic staff and students; (ii) cooperation in research and development including use of materials and facilities; and (iii) exchange of academic materials, publications and other scientific information. Under this MOU is a collaboration agreement between AQD and ADMU for a joint research project on “Development of shrimp pathogen diagnostic tools using nested PCR and lateral flow strip biosensors coupled with a mobile app and cloud-based information management” with funds from the Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development (PCAARRD) of the Philippine Department of Science and Technology (DOST).

Bohol Island State University

A Memorandum of Agreement was forged between AQD and Bohol Island State University, an institution of higher learning in Bohol Province, Philippines, to conduct collaborative research and extension efforts in the identified component areas on fisheries. Through its Research, Development and Extension Program, the University has agreed to cooperate with AQD on some activities related to implementation of the Resource Enhancement Project on Napoleon wrasse *Cheilinus undulatus*. The activities include research on biological and socio-economic characteristics of Napoleon wrasse fishery in the Province of Bohol, as vital part of the project implementation.

Coral Triangle Initiatives on Coral Reefs, Fisheries and Food Security

In 2014, SEAFDEC pursued cooperation with the Coral Triangle Initiative on Coral Reefs, Fisheries and Food Security (CTI-CFF). Specifically, SEAFDEC attended the Inauguration of the CTI-CFF Building in Manado, Indonesia on 16 May 2014, and participated in the 10th Senior Officials Meeting of CTI-CFF (5-7 November 2014, Timor Leste) where discussion was made on the formalization of the CTI-CFF Secretariat, and the establishment of MOU between the CTI-CFF and SEAFDEC. In line with the decision of the 45th Meeting of the SEAFDEC Council in 2013 for SEAFDEC to enter into collaborative arrangement with the CTI-CFF, the draft Memorandum of Understanding between SEAFDEC and CTI-CFF has been prepared and endorsed by the SEAFDEC Council.

Faculty of Fisheries, Kagoshima University (KUFF), Japan

The Faculty of Fisheries, Kagoshima University (KUFF), Japan and SEAFDEC signed the Extension of Arrangement for Academic and Educational Cooperation between the two institutions in May 2014. The collaboration between KUFF and SEAFDEC was first established in 2003 focusing on academic and educational cooperation that aimed to support sustainable development of fisheries in the Southeast Asian region. Scopes of cooperation under the Arrangement covers: (i) Collaboration of faculty and staff members for research, symposia and other academic pursuits; (ii) Exchange of staff members and

students for education, training and research; and (iii) Exchange of data, documentation and research materials in fields of mutual interest, taking cognizance of existing policies of both institutions. The extended Arrangement would cover a period of five years.

Fisheries Research Agency, Japan

SEAFDEC and the Fisheries Research Agency (FRA) of Japan signed on 23 January 2014 the Renewed Memorandum of Understanding (MOU) for Scientific & Technical Cooperation to extend the collaborative arrangements between the two agencies for another five years. Cooperation between SEAFDEC and FRA was first established in 2004, with areas for cooperation on: development of scientific and technical cooperation in various fields of mutual interest; exchanging of information and expertise; and conduct of detailed discussions between SEAFDEC and FRA on matters practical to both organizations.

Within the MOU framework, FRA provided the services of two experts to serve as resource persons during the “SEAFDEC In-house Training Session to Cultivate Better Understanding of Key Concepts and Policies for Promotion of Sustainable Fisheries in Southeast Asia” on 4-7 November 2014, which enhanced the knowledge and capacity of SEAFDEC staff on the recent key issues related to sustainable development of fisheries in the Southeast Asian region.

Food and Agriculture Organization of the United Nations

SEAFDEC in 2014 continued its cooperation with the Food and Agriculture Organization of the United Nations (FAO) on various priority issues, e.g. by-catch management, energy efficiency in fisheries, human capacity development for the implementation of Ecosystem Approach to Fisheries Management (EAFM), measures to combat Illegal, Unreported and Unregulated (IUU) fishing, including the application of port State measures and the development of Regional Fishing Vessels Record (RFVR) for vessels 24 meters in length and over.

TD continued to serve as Regional Facilitation Unit (RFU) of FAO in the implementation of the project on “Strategies for Trawl Fisheries By-catch Management (REBYC-II CTI)” with funding support from the Global Environment Facility (GEF). The four-year project which started in 2011 is aimed at addressing issues in bottom trawling which target multi-species of catch by promoting sustainable fishing practices and improving trawl management. Besides the REBYC-II CTI Project, TD also collaborated with FAO in the implementation of a pilot project on “Fishing Vessel Energy Audit” which aimed to determine fuel saving potentials of different energy efficiency practices for trawlers in the Gulf of Thailand.

SEAFDEC also provided technical inputs to regional and international events organized by FAO, namely: the Resumed Session of the Technical Consultation on International Guidelines on Securing Sustainable Small-scale Fisheries (3-7 February 2014, Rome, Italy); the 25th Session of the Asia and Pacific Commission on Agricultural Statistics (18-21 February 2014, Vientiane, Lao PDR); the Regional Consultative Workshop on Capacity Assessment for the Implementation of New CITES Listings of Sharks and Manta Rays (13-15 May 2014, Fujian Province, China); the 31st Session of Committee on Fisheries (COFI) (9-13 June 2014, Rome, Italy); the 5th Session of the Regional Secretariat Network (RSN) (13 June 2014, Rome, Italy);



the 5th APFIC Regional Consultative Forum Meeting (RCFM) (19-21 June 2014, Hyderabad, India; the Regional Consultation on Strategy and Action Plan for Sustainable Intensification of Aquaculture in Asia-Pacific (27-28 November 2014, Bangkok, Thailand); and the FAO Workshop on Prioritization of Asia Regional Aquaculture Development and Management (29 November 2014, Bangkok, Thailand).

Government of Sweden

The Government of Sweden continued to extend cooperation with SEAFDEC and provided funding support for the 5-year project on “Fisheries and Habitat Management, Climate Change and Social Well-being in Southeast Asia” starting 2013, with geographical scope focusing on four sub-regions, namely: the Gulf of Thailand, Andaman Sea, Sulu-Sulawesi Seas, and the Lower Mekong River Basin. During the implementation of this project, SEAFDEC would cooperate with key partners in the region and sub-regions, NGOs as well as agencies at national levels, in sharing good practices and resources for the implementation of activities.

Mekong River Commission

The cooperation between SEAFDEC and the Mekong River Commission (MRC) was strengthened in 2014 with the implementation of SEAFDEC programs related to inland fisheries development, e.g. activities supported by SEAFDEC-Sweden project focusing on the Lower Mekong Basin sub-region, and those related to the establishment of the new SEAFDEC Inland Fishery Resources Development and Management Department (IFRDMD). MRC also provided the services of resource persons to share their knowledge and experiences during the Experts Meeting on Mekong Cooperation on Fisheries, Aquatic Resources and Wetlands: 20 years lessons learnt (12-14 November 2014, Phnom Penh, Cambodia).

National Fisheries University (NFU), Japan

SEAFDEC and the National Fisheries University (NFU) of Japan signed an agreement on 10 November 2014 to re-extend the academic and educational cooperation, which was established between the two agencies under the “Arrangement for Academic and Educational Cooperation” since 2005. Throughout the past decade, such collaboration had served as platform for collaborative activities, particularly the conduct of marine resources survey in the waters of several SEAFDEC Member Countries using the “Tenyo Maru” and “Koyo Maru”. Right after the re-extension of the MOU, the “Koyo Maru” which was docked at TD piers sailed for the waters of Cambodia to conduct resources survey in collaboration with the Fisheries Administration of Cambodia, with staff of SEAFDEC providing technical support during the said survey.

Network of Aquaculture Centres in Asia and the Pacific (NACA)

The cooperation of SEAFDEC and Network of Aquaculture Centres in Asia and the Pacific (NACA) had been established with SEAFDEC Aquaculture Department serving as one of the NACA regional lead centers. Collaborative activities focused on development of

aquaculture technologies and sharing of knowledge and experiences through various regional and international events. In 2014, SEAFDEC attended the Meetings convened by NACA, namely: the 25th Meeting of NACA Governing Council (24-28 March 2014, Lao PDR), and the Regional Workshop on Culture-based Fisheries (21-23 October 2014, Siem Reap, Cambodia).

Petroleum Authority of Thailand, Exploration and Production Public Company Limited

TD together with other academes in Thailand including King Mongkut's University of Technology North Bangkok, Kasetsart University Research and Development Institute, and Marine Sciences Institute of Burapa University, signed an MOU for technical cooperation with the Petroleum Authority of Thailand, Exploration and Production Public Company Limited (PTT/EP) on 16 June 2014. The MOU aimed to facilitate the development and improvement of a Remotely Operated Vehicle (ROV) to monitor underwater conditions and environment. While it is anticipated that the ROV could be useful to facilitate monitoring of oilrigs, and decommissioning of oilrigs to reefs, such technology could also enhance effectiveness in the conduct of other underwater researches in the future.

Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development

AQD continued its collaboration with the Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development (PCAARRD) through Memoranda of Agreement executed in 2014 for the following projects: (i) Development of the broodstock and hatchery technologies for the tropical oyster, *Crassostrea iredalei*, in the Philippines; (ii) Improvement of the performance of captive *Penaeus monodon* broodstock; and (iii) Development of diagnostic tools through genomics and establishment of the Philippine Shrimp Pathogen Bio-Bank and Online Biosurveillance Information Resource. The project on oysters is aimed at: (i) establishing a small-scale hatchery for broodstock conditioning/management and refinement of the larval, post-larval and nursery rearing techniques; and (ii) conducting genetic characterization and selective breeding through identification of molecular markers for best performance. For the shrimps, the 1st project is expected to refine the techniques on the domestication of *P. monodon*, a prerequisite to a selective breeding program. Another project on shrimps seeks to: (i) establish an online Philippine shrimp pathogen database resource; (ii) compile epidemiological information including genetic, phenotypic, ecological: spatial, and temporal characteristics of aquatic pathogens; and (iii) establish a Philippine aquatic pathogen bio-bank.

Post-Harvest Technology Centre, Singapore

The Post-harvest Technology Center (PHTC) of the Agri-Food & Veterinary Authority (AVA), Singapore serves as Collaborating Center of SEAFDEC to take over the activities of MFRD under the SEAFDEC regional programs, as approved by the SEAFDEC Council during its 39th Meeting in 2007. In 2014, the PHTC supported MFRD in enhancing the development of fisheries post-harvest technology in the Southeast Asian region through two regional projects, namely: (i) Chemical and Drug Residues in Fish and Fish Products in Southeast



Asia - Biotoxins Monitoring in the ASEAN Region: ASP, AZA & BTX; and (ii) Traceability Systems for Aquaculture Products. For 2015, new component on monitoring of Harmful Algal Blooms (HABs) would also be included in the biotoxins project. In addition, a new program on Cold Chain Management of Seafood was also proposed to be implemented starting 2015 with support from the Government of Singapore.

Research Institute for Humanity and Nature (RIHN)

TD continued to collaborate with the Research Institute for Humanity and Nature (RIHN) of Japan under the MOU which was signed in 2013 for the implementation of activities under the project on “Coastal Area Capability Enhancement in Southeast Asia” from 1 April 2012 to 31 March 2017. This project aimed to create new development concept on “Area Capability” that can demonstrate how the ecosystem health could be harmonized with people’s welfare. The project has been implemented in three main sites, namely Panay Island (Philippines), Rayong and Prachuap Khiri Khan Provinces (Thailand), and Ishigaki Island (Japan); and three sub-sites, namely Guimaras Island (Philippines), Trang and Surat Thani Provinces (Thailand); and Mikawa Bay (Japan).

United Nations Environmental Program

SEAFDEC is developing the project proposal on “Establishment and Operation of a Regional System of Fisheries *Refugia* in the South China Sea and Gulf of Thailand” for funding support from the Global Environmental Facilities (GEF) through the United Nations Environmental Program (UNEP). The Project would focus on establishing a regional system of fisheries *refugia* by expanding the network of fisheries *refugia* in the South China Sea and Gulf of Thailand for improved management of fisheries and critical marine habitats, with Cambodia, Indonesia, Malaysia, Philippines, Thailand and Viet Nam as participating countries.

SEAFDEC in cooperation with participating countries facilitated the development of the proposal, through the 1st Regional Focal Points Meeting on Development of the Full Program of the SEAFDEC/UNEP/GEF/SCS on Establishment of the Fishery *Refugia* System in the South China Sea and the Gulf of Thailand (20-22 January 2014, Bangkok, Thailand), which was followed by the Regional Validation Workshop for the Preparatory Phase of the UNEP/GEF *Refugia* Project (28 April – 1 May 2014, Indonesia).

United States Agency for International Development (USAID)

The Memorandum of Understanding was signed on 16 June 2014 for SEAFDEC and the United States Agency for International Development (USAID) to collaborate in the design and implement activities for enhancing food security and biodiversity conservation in Asia and the Pacific. Under the said MOU, USAID and SEAFDEC would engage other U.S. Government agencies, including the National Oceanic and Atmospheric Administration and the Department of Interior, to identify and provide technical experts to assist in the facilitation of the envisioned activities.

Following the areas of cooperation as agreed in the MOU, SEAFDEC and USAID developed a new five-year program on “Oceans and Fisheries Partnership” with the main objectives of combating IUU fishing and seafood fraud, and promoting sustainable fisheries management, food security, and biodiversity conservation in Southeast Asia. The project aimed to come up with a catch documentation and traceability (CDT) system for living marine resources, with particular focus on the Sulu-Celebes Seas as the project demonstration site. Furthermore, the “Oceans and Fisheries Partnership” is anticipated to strengthen partnerships with the private sector for long-term sustainable fisheries management.

Vocational Education Commission, Thailand

The re-extension of the Memorandum of Understanding between TD and Office of Vocational Education Commission on Development of Manpower for Operation of Fishing Vessels was signed on 10 November 2014. The collaboration between SEAFDEC and Office of Vocational Education Commission was established in 2011, and under this renewed MOU, TD will conduct the Training Course on Operation of Fishing Vessels which cover six subjects: (i) construction and stability of fishing vessels; (ii) marine communication, (iii) laws and regulations of navigation, (iv) navigation technology practices, (v) marine machinery technology and practices, and (vi) fishing gear technology and practices for students from the Tinsulanonda Fisheries College in Songkhla Province, Thailand.



ENHANCING SEAFDEC VISIBILITY

Since its establishment, SEAFDEC has been implementing fisheries-related programs/projects that cover wide aspects of research, training and information. Starting in 2007, the SEAFDEC Secretariat and Departments made full use of the Information Strategies as guiding principles in formulating and implementing information-related activities that aim to enhance the Center's image and visibility. The Information Strategies have been developed to enhance the effectiveness of the implementation, monitoring, and reporting of the progress of SEAFDEC information-related activities.

In 2014, the progress and achievements made by SEAFDEC in the implementation of the information activities during the year were monitored and discussed during the 15th Meeting of the Information Staff Program (ISP) on 28 to 30 October 2014 in Manila, Philippines, corresponding to the five Information Strategies, as follows:

Strategy 1: Production of relevant, timely, and useful information materials to meet the requirements of the target audience

- Produced and disseminated 54 titles/issues of technical/scientific materials (8,813 copies produced, 5,301 copies distributed);
- Produced and disseminated 66 titles of technical/scientific articles (20 titles published in SEAFDEC publications and 46 titles published in non-SEAFDEC publications); and
- Recorded 479 queries for information through the SEAFDEC libraries, and 705 materials sold.

Strategy 2: Raising SEAFDEC image at national, regional and international levels

- Produced and disseminated 47 titles/issues of promotional materials (30,263 copies produced, 28,796 copies distributed);
- Established and administered SEAFDEC websites and web blocks: SEAFDEC Departmental websites received a total of 79,749 unique visitors, made 6,695 links from other websites, and recorded 67,959 annual downloads;
- Took part in eight (8) exhibitions and related events with 92,036 visitors recorded at SEAFDEC exhibition booths and displays; and
- Officially released two (2) press statements, and recorded 44 appearances of SEAFDEC in public media and websites.

Strategy 3: Enhancing communication and information sharing both within SEAFDEC and with Member and non-Member Countries, other international/regional organizations, and public

- Continued to maintain the libraries of the SEAFDEC Secretariat and Departments, and provide library services;
- The SEAFDEC libraries acquired a total of 2,810 issues of newsletters/serial publications, 563 titles of technical publications and 30 items of audio-visual materials;
- Sustained cooperation and exchange of materials with 397 network libraries within and outside the region;

- Disseminated 177 titles (with 5,926 copies) of technical materials, and 173 titles (with 29,506 copies) of promotional materials to target groups;
- Made accessible 1,603 downloadable materials and 16 databases in SEAFDEC websites;
- Enhanced the use of e-mail systems (including e-groups) to facilitate communications both among SEAFDEC staffs and with other concerned personalities;
- Recorded a total number of 21,324 direct visitors to SEAFDEC Secretariat and Departments;
- Dispatched 394 SEAFDEC officials to participate in 205 events organized by other organizations (137 officials in events at regional/international levels, and 257 at national local levels);
- Organized SEAFDEC events, which include:
 - International/regional meetings, seminars, workshops (32 meetings with a total of 1,463 participants)
 - National/local meeting, seminars, workshops, consultations (14 meetings with a total of 516 participants)
 - International/regional training courses (25 courses with a total of 306 trainees)
 - National, on-site training courses (35 courses with a total of 856 trainees)
 - Study tours (2 programs with a total of 145 trainees)
 - Internships (4 groups with 34 persons)
 - On-the-job training (33 colleges with a total of 300 students)
 - Internal meetings (14 meetings with a total of 891 participants);
- Facilitated the participation of officials from Member Countries to events organized by SEAFDEC:
 - International/regional meetings, seminars, workshops (766 participants)
 - National/local meetings, seminars, workshops, consultations (138 participants)
 - International/regional training courses (217 trainees)
 - National, On-site training courses (8000 trainees)
 - Study tours (220 trainees)
 - Internships (31 persons)
 - On-the-Job training (230 students);
- Established the networking and cooperation mechanisms with 80 fisheries-related organizations for the implementation of collaborative activities at national, regional and international levels; and
- Received support from other organizations and donor agencies for relevant activities in the total amount of US\$ 4,983,228 representing the non-regular sources of funds for the activities of SEAFDEC.

Strategy 4: Strengthening SEAFDEC capability in information-related activities

- Enhanced the capabilities of the staff in information-related offices through HRD taking into account the scope and requirements of the staff, and during the annual ISP Meeting; and
- Enhanced the financial sustainability of the publication and information activities through intensified selling of technical publications and souvenir items on cost-recovery basis.



Strategy 5: Regular monitoring and evaluation of information activities

- Obtaining feedback on materials produced by SEAFDEC were established for the training, research, and development transfer through communication channel, e.g. dedicated e-mail, etc.; and
- Organized the Fifteenth Meeting of the SEAFDEC Information Staff Program (ISP) to monitor the implementation of information-related activities, in accordance with the Information Strategies for Enhance SEAFDEC Visibility and Communication.

SEAFDEC REVENUES AND EXPENDITURES IN 2014

Un-audited Abridged Consolidated Financial Statements (In US\$)

	2014 (Un-audited)	2013 (Audited)
REVENUES		
Contributions from :-		
Member governments	8,106,589	7,800,490
Other sources	3,689,253	2,724,100
Total Revenues	11,795,842	10,524,590
EXPENDITURES		
Operating and Capital Expenditures		
Research	4,245,590	3,723,779
Training	1,023,449	723,813
Information	643,058	569,536
Collaborative	188,710	86,236
Others	938,891	700,134
Administrative	4,640,878	3,252,299
Total Expenditures	11,680,576	9,055,797
SURPLUS (DEFICIT), For the year	115,266	1,468,793
FUND BALANCE, Beginning of year	7,390,537	^{1/} 5,937,813
FUND ADJUSTMENT	-13,790	2,507
FUND BALANCE, End of year	7,492,013	^{1/} 7,409,113
REPRESENTED BY:		
Cash and cash equivalents	9,674,773	7,944,280
Other receivables and Advances	861,308	424,448
Supplies Inventory	53,063	71,824
Fuel for vessels	94,326	102,768
Prepayments	18,939	25,729
Total current assets	10,702,409	8,569,049
Reserved budget for vessel periodic maintenance	746	102,889
Termination indemnity fund	2,100,028	1,949,619
Other assets-Net	451,391	554,795
Total Assets	13,254,574	11,176,352
Less : Liabilities		
Accrued payable	1,957,072	617,700
Contribution received in advance	1,336,718	856,351
Funds held in trust	368,947	329,689
Unrealized gain on Available for Financial Assets		13,880
Provision for termination indemnity	2,099,824	1,949,619
Total Liabilities	5,762,561	3,767,239
NET ASSETS	7,492,013	7,409,113

Remark: ^{1/} Difference of US\$ 18,576 is a result of change of rate in US\$ transaction



Un-audited Contribution Received by SEAFDEC from Member Countries and Other Sources of Funds for the Year 2014 (In US\$)

Sources	Secretariat	TD	MFRD	AQD	MFRDMD	Total	
						In US\$	%
Brunei Darussalam	7,000					7,000	0.06
Cambodia	11,000					11,000	0.09
Indonesia	26,000					26,000	0.22
Japan	280,000					280,000	2.37
Lao PDR	5,000					5,000	0.04
Malaysia	21,000				1,206,957	1,227,957	10.41
Myanmar	21,000					21,000	0.18
Philippines	25,000			3,804,170		3,829,170	32.46
Singapore	13,000					13,000	0.11
Thailand	33,000	2,639,462				2,672,462	22.66
Viet Nam	14,000					14,000	0.12
Sub-total	456,000	2,639,462	0	3,804,170	1,206,957	8,106,589	68.72
Other Sources ^{2/}	69,049	1,552,664		2,067,540		3,689,253	31.28
Total	525,049	4,192,126	0	5,871,710	1,206,957	11,795,842	100

Remark:

^{2/} Other sources of contributions include bank interests, gain/loss from varying exchange rates, contributions from donors directly given to Departments and miscellaneous receipts.

Other Contributions Received by SEAFDEC in 2014 (In US\$)

Sources	Amount in US\$ ^{3/}
Fisheries Agency-Japan (TF-V)	511,713
Fisheries Agency-Japan (TF-VI) (excluded: Japan-MRC=US\$280,000)	902,969
Sweden	1,242,500
Total	2,657,182

Remark:

^{3/} Other sources of contribution, which are not reported in the SEAFDEC Financial Statement.

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