

SEAFDEC Annual Report 2016



SEAFDEC Annual Report 2016



Southeast Asian Fisheries Development Center

Preparation and Distribution of this Document

This SEAFDEC Annual Report 2016 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, collaborating agencies and other fisheries-related organizations, and to the public to make them aware of the activities and achievements of SEAFDEC and to promote the visibility of the Center.

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EXECUTIVE SUMMARY

SEAFDEC Annual Report 2016 summarizes the programs of activities undertaken by SEAFDEC throughout the year 2016, in-line with the priority needs and policy directives of the Member Countries conveyed through the SEAFDEC Council and SEAFDEC Program Committee. The programs in 2016 had been categorized into: 1) Programs under the Fisheries Consultative Group of the ASEAN-SEAFDEC Strategic Partnership (FCG/ASSP) (23 projects); Departmental Programs (8 programs); and Other Programs (2 projects). In addition to the development and promotion of technologies to support sustainable development of fisheries, in 2016 SEAFDEC also made significant progress in the formulation and implementation of several regional fisheries policy frameworks in support of the ASEAN Economic Community Building and towards enhancing the capacity of the Member Countries in the implementation of requirements emerged at the international levels. Efforts were also pursued to enhance cooperation among countries at the regional, sub-regional and bilateral levels.

During the year, SEAFDEC also continued to strengthen cooperation and partnership with other international/regional organizations and non-member governments sharing common interest on the sustainable utilization of fishery resources. Specifically, SEAFDEC took part in various fora organized by collaborating partners to ensure that the specificities of fisheries in Southeast Asia are appropriately addressed in such fora, and that the regional policy frameworks of SEAFDEC are harmonized with corresponding international initiatives.

It is envisioned that this Annual Report could provide a better picture on the roles, activities and achievements of SEAFDEC in supporting the Member Countries in their efforts towards achieving sustainable development of fisheries in the Southeast Asian region.

MESSAGE FROM THE CHAIRPERSON OF SEAFDEC COUNCIL



The year 2016 has been another significant year for SEAFDEC as it continues to reap big achievements, especially in terms of its progress in several aspects. Some remarkable achievements during the year could be highlighted by our endorsement of several regional policy frameworks, particularly during the High-level Consultation in August, when we adopted the “Joint ASEAN-SEAFDEC Declaration on Regional Cooperation for Combating IUU Fishing and Enhancing the Competitiveness of ASEAN Fish and Fishery Products.” We are all aware that addressing problems on IUU fishing requires collective efforts among concerned countries. On behalf of all Member Countries, I would therefore like to express my appreciation to SEAFDEC for the efforts in facilitating the development of the Joint Declaration which serves as a guide that provides important regional framework for countries to address one of the very challenging issues in fisheries which is combating IUU fishing in our region.

During the year, several policy frameworks developed by SEAFDEC were acknowledged by high-level authorities of the ASEAN, and endorsed through the 38th AMAF Meeting held in Singapore. Besides the Joint ASEAN-SEAFDEC Declaration, the “ASEAN Regional Plan of Action for the Management of Fishing Capacity” and the “Regional Guidelines on Traceability System for Aquaculture Products in the ASEAN Region” were also endorsed. I therefore would like to take this opportunity to congratulate SEAFDEC for such achievements, and encourage SEAFDEC to continue this momentum of work in the future. During this Forty-eighth Meeting of the SEAFDEC Council in April 2016, we discussed the programs of SEAFDEC and provided the directives that enable SEAFDEC to continue its technical activities that are aimed at addressing the priorities and requirements of the Member Countries. In this Annual Report we could already see the achievements of SEAFDEC, and I would wish to commend SEAFDEC for all its efforts.

At this juncture, let us bear in mind that SEAFDEC is entering the threshold of its 50th Anniversary in December 2017. The year ahead is therefore a remarkable year for SEAFDEC as a leading center for the promotion of sustainable fisheries development in our region. I would therefore encourage the Council Directors to help SEAFDEC celebrate its Golden Anniversary through our commitment toward the SEAFDEC Anniversary Celebration by the end of this year, and in shaping the future direction of SEAFDEC beyond its 50th year to ensure that it fits well with the need for sustainability of fisheries and aquaculture in the Southeast Asian region.

With the publication of this SEAFDEC Annual Report 2016, I would therefore wish to encourage SEAFDEC to continue its good work in providing support to the Member Countries for the sustainability of our fisheries. I would also wish to express our utmost appreciation to colleagues in the SEAFDEC Council of Directors for extending their utmost support during our term as Chairperson of the SEAFDEC Council. Furthermore, my appreciation is also extended to the organizations and agencies collaborating with SEAFDEC for providing generous support and cooperation throughout the past year, which allowed SEAFDEC to implement activities that are beneficial to the countries in the region.

A handwritten signature in blue ink, appearing to read 'Dinh Luan'.

Dr. Tran Dinh Luan
Deputy Director General
Directorate of Fisheries, Viet Nam

MESSAGE FROM THE SEAFDEC SECRETARY-GENERAL



Throughout the nearly five decades of SEAFDEC establishment, several challenges have been confronted by the Southeast Asian fisheries sector. While in early establishment, the requirements were rather simple, focusing on increasing production to meet with demand from the region's growing population; recent issues have become more and more complicated. The mandate of SEAFDEC has therefore been refocused from improving technologies to increase fishery production to ensuring that the contribution from the fisheries sector could be sustained. Nevertheless, efforts toward achieving the sustainability of fisheries could not be undertaken only by the agency responsible for fisheries, as several issues required close cooperation and collaboration with the other sectors, such as those on international trade of fish and fishery products, conservation of aquatic species and habitat at risks, labor and workers in fisheries, as well as relevant cross-cutting issues, such as adaptation and mitigation to climate change, mainstreaming issue on gender in the fisheries sector, etc.

Furthermore, with challenges as a result of globalization as well as the nature of several fishery resources that could be transboundary and migratory, it has becoming more prominent that efforts in ensuring the sustainability of the fisheries sector could not be undertaken solely by single countries, but close collaborative efforts among countries are required. Addressing such issues and challenges faced by the fisheries sector is the role that SEAFDEC has been trying to strengthen throughout the past decade, and the efforts of SEAFDEC has bear several fruits in 2016 in terms of the development and adoption of several regional policy frameworks and guidelines that aim to enhance collaborative efforts towards sustainable fisheries development.

The works of SEAFDEC however could not be success without the contribution and support from all Member Countries. In my capacity as the Secretary-General of SEAFDEC and on behalf of the SEAFDEC Secretariat and Departments, I wish to take this opportunity to express my sincere appreciation to all the Council Directors for providing guidance and support to SEAFDEC making all initiatives and activities possible. I would also like to thank all donor agencies and collaborating organizations that have been working closely with SEAFDEC in the formulation and implementation of several activities during the year 2016, and I truly wish that such collaborative atmosphere would be continued and strengthened further. For SEAFDEC, we would assure that best efforts would be rendered to the Member Countries towards enhancing the knowledge and capacity in achieving sustainable fisheries development in the years to come.

A handwritten signature in black ink, appearing to read 'K. Silapajarn'.

Dr. Kom Silapajarn
Secretary-General

LIST OF ACRONYMS

ACIAR	Australian Centre for International Agricultural Research
AFCF	ASEAN Fisheries Consultative Forum
AIFS	ASEAN Integrated Food Security
AMSS	ASEAN Member States
AQD	SEAFDEC Aquaculture Department
APFIC	Asia-Pacific Fisheries Commission
ASEAN	Association of Southeast Asian Nations
ASSP	ASEAN-SEAFDEC Strategic Partnership
ASWGF	ASEAN Sectoral Working Group on Fisheries
PHTC/AVA	Post-Harvest Technology Centre of the Agri-Food & Veterinary Authority of Singapore
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
EAFM	Ecosystem Approach to Fisheries Management
FAO	Food and Agriculture Organization of the United Nations
FCG	ASEAN-SEAFDEC Fisheries Consultative Group
GEF	Global Environment Facility
IFRDMD	SEAFDEC Inland Fishery Resources Development and Management Department
IUU Fishing	Illegal, Unreported and Unregulated Fishing
JAIF	Japan-ASEAN Integration Fund
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
PSM	Port State Measures
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
UNEP	United Nations Environment Programme
USAID	United States Agency for International Development

CONTENTS

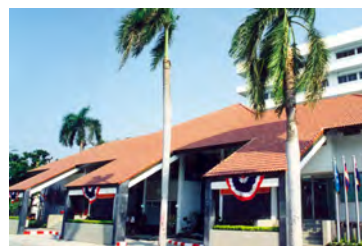
	Page
About SEAFDEC	1
SEAFDEC Council in 2016	3
SEAFDEC Senior Officials in 2016	6
Overview of SEAFDEC Programs in 2016	7
SEAFDEC Programs of Activities in 2016	11
Thrust 1. Developing and Promoting Responsible Fisheries for Poverty Alleviation and Food Security	11
Thrust 2. Enhancing Capacity and Competitiveness to Facilitate International and Intra-regional Trade	35
Thrust 3. Improving Management Concepts and Approaches for Sustainable Fisheries	42
Thrust 4. Providing Policy and Advisory Services for Planning and Executing Management of Fisheries	48
Thrust 5. Addressing International Fisheries-related Issues from a Regional Perspective	57
Special Projects	59
SEAFDEC Programs for 2017	69
Cooperation with Donors and Other Organizations in 2016	73
Enhancing SEAFDEC Visibility in 2016	81
SEAFDEC Revenues and Expenditures in 2016	85

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; Marine Fisheries Research Department; Aquaculture Department; Marine Fishery Resources Development and Management Department; and the 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 organizes the regular SEAFDEC meetings to obtain directives and guidance from the Member Countries on the operations of the Center, 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 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 Southeast Asian 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.

As of 2007, the Post-Harvest Technology Centre of the Agri-Food and Veterinary Authority (AVA), Singapore (PHTC/AVA) has been approved as the Collaborating Centre of SEAFDEC to undertake the activities of MFRD under the SEAFDEC Regional Programmes including those supported by the Japanese Trust Fund.



SEAFDEC/MFRD

The Aquaculture Department (AQD)

Established in the Philippines in 1973, AQD has been carrying out activities in aquaculture 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, mud crab, 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, especially in the compilation of information on small pelagic species, and establishment 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 2016

Chairpersons of the SEAFDEC Council

Dr. Wimol Jantrarotai (until April 2016)

Mr. Nguyen Viet Manh (from April to June 2016)

Mrs. Nguyen Thi Trang Nhung (since July 2016)

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. Eng Cheasan Delegate of the Royal Government of Cambodia, and Director-General, Fisheries Administration
Alternate Council Director:	Dr. Kao Sochivi 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. Shigeto Hase <i>(since January 2016)</i> Deputy Director-General of Fisheries Agency Ministry of Agriculture, Forestry and Fisheries
Alternate Council Director:	Mr. Keiichi Hara Director, First Country Assistance Planning Division, International Cooperation Bureau, Ministry of Foreign Affairs

Lao PDR

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



Malaysia

- Council Director: **Y. Bhg. Datuk Hj. Ismail bin Abu Hassan**
Acting Director-General, Department of Fisheries
- Alternate Council Director: **Y.H. Dato' Haji Johari bin Ramli** (*until May 2016*)
Deputy Director General of Fisheries (Management)
Department of Fisheries
- Mr. Zulkafli bin Rashid** (*since May 2016*)
Deputy Director General of Fisheries (Development)
Department of Fisheries

Myanmar

- Council Director: **Mr. Khin Maung Maw**
Director-General, Department of Fisheries
- Alternate Council Director: **Mr. Myint Zin Htoo** (*since January 2016*)
Deputy Director-General of Department of Fisheries

Philippines

- Council Director: **Atty. Asis G. Perez** (*until November 2016*)
Undersecretary for Fisheries, Department of Agriculture
and National Director, Bureau of Fisheries and Aquatic
Resources
- Comodore Eduardo B. Gongona** (*since November 2016*)
Director of Bureau of Fisheries and Aquatic Resources
and Undersecretary for Fisheries, Department of
Agriculture
- Alternate Council Director: **Mrs. Drusila Esther E. Bayate**
Assistant Director for Technical Services, Bureau of
Fisheries and Aquatic Resources

Singapore

- Council Director: **Dr. Tan Lee Kim**
Deputy CEO (Corporate & Technology), Agri-Food
& Veterinary Authority of Singapore
- Alternate Council Director: **Mr. Lim Huan Sein** (*since January 2016*)
Director of Aquaculture Technology Department,
Agri-Food & Veterinary Authority of Singapore

Thailand

- Council Director: **Dr. Wimol Jantrarotai** (*until April 2016*)
Director-General, Department of Fisheries
- Dr. Adisorn Promthep** (*since May 2016*)
Director-General, Department of Fisheries
- Alternate Council Director: **Dr. Chumnarn Pongsri** (*since January 2016*)
Director, Division of Fisheries Foreign Affairs
Department of Fisheries

Viet Nam

Council Director:

Mr. Nguyen Viet Manh (*until June 2016*)
Director of Science, Technology and International
Cooperation Department, Fisheries Administration,
Ministry of Agriculture and Rural Development

Alternate Council Director:

Mrs. Nguyen Thi Trang Nhung (*since July 2016*)
Deputy Director, Department of Science, Technology
and International Cooperation, Fisheries Administration
Ministry of Agriculture and Rural Development



SEAFDEC SENIOR OFFICIALS IN 2016

Secretary-General

Dr. Kom Silapajarn (*since January 2016*)

Deputy Secretary-General

Mr. Hajime Kawamura (*until April 2016*)

Dr. Kaoru Ishii (*since May 2016*)

Training Department (TD)

Chief

Dr. Kom Silapajarn (*since January 2016*)

Deputy Chief

Mr. Hajime Kawamura (*until April 2016*)

Dr. Kaoru Ishii (*since May 2016*)

Marine Fisheries Research Department (MFRD)

Chief, MFRD Programmes

Mr. Yeap Soon Eong

Aquaculture Department (AQD)

Chief

Dr. Felix G. Ayson (*until May 2016*)

Dr. Chihaya Nakayasu (*Acting, since May 2016*)

Deputy Chief

Dr. Takuro Shibuno (*until March 2016*)

Dr. Chihaya Nakayasu (*since April 2016*)

Marine Fishery Resources Development and Management Department (MFRDMD)

Chief

Mr. Ahmad Adnan bin Nuruddin (*until October 2016*)

Mr. Raja Bidin Raja Hassan (*since October 2016*)

Deputy Chief

Dr. Osamu Abe

Inland Fishery Resources Development and Management Department (IFRDMD)

Chief

Mr. Budi Iskandar Prisantoso (*until March 2016*)

Dr. Satoshi Honda (*Acting, from April to July 2016*)

Dr. Arif Wibowo (*since August 2016*)

Deputy Chief

Dr. Satoshi Honda

OVERVIEW OF SEAFDEC PROGRAMS IN 2016

The activities of SEAFDEC in 2016 were formulated and implemented in line with the policy directives given by the SEAFDEC Member Countries during SEAFDEC annual meetings, *i.e.* the Thirty-eighth Meeting of the SEAFDEC Program Committee (23-25 November 2015, Manila, Philippines), the Eighteenth Meeting of the Fisheries Consultative Group of the ASEAN-SEAFDEC Strategic Partnership (FCG/ASSP) (26-27 November 2015, Manila, Philippines), and the Forty-eighth Meeting of SEAFDEC Council (4-8 April 2016, Nha Trang, Viet Nam).



SEAFDEC Council Directors attending the Forty-eighth Meeting of the SEAFDEC Council hosted by the Government of Viet Nam

The formulation and development of the SEAFDEC programs and activities for 2016 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 Conference on Sustainable Fisheries for Food Security for the ASEAN Region Towards 2020 in June 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).



Participants of the Thirty-ninth SEAFDEC Program Committee Meeting



Participants of the Nineteenth Meeting of the FCG/ASSP

Progress of the programs and activities implemented by SEAFDEC in 2016 had been considered and endorsed by the Thirty-ninth Meeting of the SEAFDEC Program Committee on 28-30 November 2016 in Yogyakarta, Indonesia, and the Nineteenth Meeting of the FCG/ASSP on 1-2 December 2016 also in Yogyakarta, Indonesia, for subsequent submission to the SEAFDEC Council at its Forty-ninth Meeting in 2017.

Programs and projects implemented by SEAFDEC in 2016:

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
3. Promotion of Sustainable Fisheries Resources Enhancement Measures in Critical Habitats/Fishing Grounds in Southeast Asia	TD	JTF
4. Environment-friendly, Sustainable Utilization and Management of Fisheries and Aquaculture Resources	AQD	JTF
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. Enhancing Coastal Community Resilience for Sustainable Livelihood and Coastal Resources Management	MFRDMD	JTF

Program Category/Project Title	Responsible Department	Funding Source
Thrust II: Enhancing Capacity and Competitiveness to Facilitate International and Intra-regional Trade		
8. Chemical and Drug Residues in Fish and Fish Products in Southeast Asia - Biotxin (ASP, AZA and BTX) and Harmful Algal Blooms (HABs) in the ASEAN region	MFRD	JTF
9. Cold Chain Management for Seafood	MFRD	Singapore
10. Reinforcement and Optimization of Fish Health Management and the Effective Dissemination in the Southeast Asian Region	AQD	JTF
Thrust III: Improving Management Concepts and Approaches for Sustainable Fisheries		
11. Strategies for Trawl Fisheries By-catch Management	TD	FAO/GEF
12. Promotion of Countermeasures to Reduce IUU Fishing Activities	TD	JTF
13. Combating IUU Fishing in the Southeast Asian Region through Application of Catch Certification for International Trading in Fish and Fishery Products	MFRDMD	JTF
14. Establishment and Operation of a Regional System of Fisheries <i>Refugia</i> in the South China Sea and Gulf of Thailand	TD	UNEP/GEF
Thrust IV: Providing Policy and Advisory Services for Planning and Executing Management of Fisheries		
15. Fisheries Resource Survey and Operational Plan for M.V. SEAFDEC 2	TD	JTF
16. Offshore Fisheries Resources Exploration in Southeast Asia	TD	JTF
17. Enhancing the Compilation and Utilization of Fishery Statistics and Information for Sustainable Development and Management of Fisheries in Southeast Asian Region	TD/SEC	JTF
18. Comparative Studies for Management of Purse Seine Fisheries in the Southeast Asian Region	MFRDMD	JTF
19. Research for Enhancement of Sustainable Utilization and Management of Sharks and Rays in the Southeast Asian Region	MFRDMD	JTF
Thrust V: Addressing International Fisheries-related Issues from a Regional Perspective		
20. Assistance of Capacity Building in the Region to Address International Trade-related Issues	SEC	JTF
21. Strengthening SEAFDEC Network for Sustainable Fisheries	SEC	JTF
Special Projects		
22. Fisheries and Habitat Management, Climate Change and Social Well-being in Southeast Asia	SEC	Sweden
23. USAID-SEAFDEC "Oceans and Fisheries Partnership"	SEC	USAID



Program Category/Project Title	Responsible Department	Funding Source
Departmental Programs*		
1. Quality Seed for Sustainable Aquaculture	AQD	AQD
2. Healthy and Wholesome Aquaculture	AQD	AQD
3. Maintaining Environmental Integrity through Responsible Aquaculture	AQD	AQD
4. Adapting to Climate Change Impacts	AQD	AQD
5. Meeting Social and Economic Challenges in Aquaculture	AQD	AQD
6. Promotion on Strengthening of SEAFDEC Visibility and Image	TD	TD
7. Tailor-made Training Programs	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	RIHN
2. Application of Fish Passage Design Principles to Enhance Sustainability of Inland Fishery Resources in the Southeast Asian Region	SEC/TD	ACIAR

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

SEAFDEC PROGRAMS OF ACTIVITIES IN 2016

The programs and projects of SEAFDEC in 2016 had been formulated and undertaken in response to the requirements of the Member Countries, taking into consideration the priority issues stipulated in the “Resolution and Plan of Action on Sustainable Fisheries for Food Security for the ASEAN Region Towards 2020” adopted in 2011. The results and progress of the implementation of programs and activities carried out in 2016 are summarized in this Annual Report.

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

1.1 Habitat Conservation and Resources Enhancement

SEAFDEC/TD implemented the project “**Promotion of Sustainable Fisheries Resources Enhancement Measures in Critical Habitats/ Fishing Grounds in Southeast Asia**” starting from 2015. The Project activities involve identification of resource enhancement tools that are appropriate for the region and useful for the development of fishery resource enhancement and habitat conservation measures; analysis and diagnosis of effectiveness of the measures; and formulation of strategies and guidelines through regional consultative meetings and workshops. Regional training programs on the theories and methodologies of fishery resource enhancement and habitat conservation measures would also be conducted to build the capacity of the ASEAN Member States (AMSs) in promoting sustainable fishery resource enhancement.

After TD organized the “Symposium on Strategy for Fisheries Resources Enhancement in the Southeast Asian Region” in 2015 which adopted the “Strategic Plan for Fishery Resources Enhancement,” the Strategic Plan was supported by the SEAFDEC Program Committee at its Thirty-eighth Meeting in November 2015, and subsequently endorsed at the Forty-eighth Meeting of the SEAFDEC Council in April 2016. TD published the “Proceedings of the Symposium on Strategy for Fisheries Resources Enhancement in the Southeast Asian Region” in 2016, which contains a compilation of experiences and lessons learnt from resource enhancement initiatives undertaken by SEAFDEC and the Member Countries. Meanwhile, as part of the Strategic Plan, follow-up activities on dog conch resources management measures were carried out including monitoring of the adoption of conservation measures in Krabi Province, Thailand in December 2016.



Proceedings of the Symposium on Strategy for Fisheries Resources Enhancement in the Southeast Asian Region

1.2 Coastal Area Capability Enhancement

SEAFDEC/TD in collaboration with the Research Institute for Humanity and Nature (RIHN), Japan and other collaborating agencies and institutes, implemented the research project “**Coastal Capability Enhancement in Southeast Asia**” from 2012 to 2016. The Project was aimed at adopting a “holistic approach” that could provide full understanding on how people utilize the coastal resources, and establishing rational and practical measures for social and ecological sustainability.

Specifically in 2016, activities on the standardization of methods for data collection, monthly field surveys and tests, equipment and systems development as well as data collection on the environment were undertaken. It should be noted that the first four years of the project implementation emphasized on the conduct of preliminary surveys to examine the current status of the resources, biology, livelihoods, social activities, and the environment that contribute to the future evaluation of area capability in coastal areas that use set-net as the core fishing gear of the Project activity.



Socio-economics and data collection of fishing activities of the RIHN Project

Considering that physical conditions such as wind, current and oceanographic parameters are the key factors that contribute to the catchability and performance of set-net and fishing activities, a series of preliminary surveys for data collection were conducted, monitored, and followed up regularly. Moreover, social and livelihood surveys and fish samplings were also undertaken. However, since the fishing season for set net is limited only for seven months (from October to April), the periodic monitoring and follow-up surveys on the fishing activities and oceanography were incomplete to conclude the whole year status. After the transfer of the Japanese-type set-net technology in Rayong Province, Thailand in 2003, catch and marketing records had been accumulated for 10 years under the set-net research but discontinued in 2014 because of the termination of the permit to operate the set-net in 2014. As the request for extension of set-net operation was still undergoing negotiations until 2016, the installation and operation of set-net was suspended during the past two years leading to limited activities conducted during 2015 and 2016.

Nevertheless, survey results were disseminated to the public through oral and poster presentations during the annual RIHN Seminars organized on the first, second and third years of the project implementation. Activities and findings of each component were reported at the “Seventh World Fisheries Congress – Challenge to Sustainable Fisheries and Safe Seafoods” held in Busan, Korea on 23-27 May 2016 under the session “Area-Capability Approach for Coastal Community and Fisheries Developments.” Considering that 2016 is the final year of the Project, the summary of activities and research results that had been compiled would be reported at the “Fifth RIHN Final Project Seminar” in February 2017 in Thailand.



SEAFDEC representatives to the Seventh World Fisheries Congress - Challenge to Sustainable Fisheries and Safe Seafoods in Busan, Korea on 23-27 May 2016

1.3 Enhancing Coastal Community Resilience for Sustainable Livelihood and Coastal Resources Management

In 2016, MFRDMD implemented a new project “**Enhancing Coastal Community Resilience for Sustainable Livelihood and Coastal Resources Management**” with the objective of improving the socio-economic status of coastal dwellers through community fisheries organization and governance to ensure that the coastal resources utilized by fishers could continue to sustain its function as source of food for the region’s fishing communities. Specifically, this project aims to: 1) enhance the capacity and capability of fishers and women in the fishing community to improve their social well-being and contribute to poverty alleviation; and 2) build the capacity of fishing communities to engage in sustainable livelihoods and improve coastal resource management. The target beneficiaries of this project are the Muslim communities in the region’s coastal areas, particularly the countries with the highest Muslim populations, *i.e.* Brunei Darussalam, Indonesia, and Malaysia.

To start off the Project, MFRDMD organized the “Regional Technical Consultation on Enhancing Coastal Community Resilience for Sustainable Livelihood and Coastal Resources Management” on 16-19 May 2016 in Kuala Lumpur, Malaysia, with representatives from Brunei Darussalam, Indonesia and Malaysia in attendance. During the Regional Technical Consultation (RTC), the community survey questionnaire for each participating country was harmonized. Subsequently, the questionnaire was used for the baseline survey and assessment of needs in selected communities in the three countries, the feedback of which was analyzed for identification of the training courses needed by the communities towards improving coastal resource management.



Participants in the RTC on Enhancing Coastal Community Resilience for Sustainable Livelihood and Coastal Resources Management in Kuala Lumpur, Malaysia on 16-19 May 2016

1.4 Management for Sustainability of Inland Capture Fisheries

Inland fisheries is one of the most important socio-economic components of many countries in the Southeast Asian region, and its contribution to the economies of rural communities is particularly important in terms of poverty alleviation, food security, and nutritional well-being. The sustainability of inland capture fisheries greatly depends on the quality of aquatic habitats and ecosystems. Nonetheless, it is not fully recognized that inland water ecosystems are utilized not only by the fishery sector but also by other sectors, depicting the less attention given to inland fisheries. In fact, in many instances, inland fisheries are generally overlooked in the planning and policy making.

In order to improve the management of inland capture fisheries in the region, the five-year project “**Promotion of Responsible Utilization of Inland Fisheries in Southeast Asia**” was initiated by IFRDMD in 2015 to establish and strengthen the regional networking for the improvement of fisheries management, conservation of fishery resources, and assessment of the environmental and habitat issues on the inland waters of the region.

IFRDMD conducted a study on fisheries management in Lao PDR on 13-17 March 2016 and the results showed that management of fisheries activities in Nam Ngum Reservoir and Nam Houm Reservoir are being carried out by the local fishers who live along the reservoirs. Fisheries Committees had been organized among local fishers in the respective sites and developed their own fishery regulations. Conservation zones with patrolling activities had also been established by the Committees to ensure the sustainable use of the fishery resources. To address the issues on sustaining the stocks, the local fishers annually release fingerlings, *e.g.* every 13 July. Meanwhile, for the fishery activities in Cambodia, a survey was conducted on 16-21 May 2016 in Phnom Penh and Siem Reap, where the IFRDMD team learned the roles of the Fisheries Committees in regulating fishing gears, supporting stock enhancement, controlling the issuance of fishing licenses, and establishing conservation zones. At the regional level, IFRDMD organized the “First Workshop to Review Activities and Methodologies for Promotion of Inland Fishery” on 8-10 August 2016 in Palembang, Indonesia. The Workshop facilitated the sharing of information and discussions with a view of paving the way towards the development of future activities of SEAFDEC and Member Countries especially in improving the plans, as well as the implementation and management of activities on inland fisheries in Southeast Asia.



Interviewing the leader and members of Fishery Community in Kampong Phlux, Tonle Sap Great Lake, Cambodia



Nam Houm Reservoir, Lao PDR – during the second half of the dry season



Meeting with the leaders of villages and members of Nam Souang Fisheries Committee, Lao PDR



IFRDMD In-house Training on Co-Management of Inland Fisheries

SEAFDEC/TD pursued the implementation of the **“Application of Fish Passage Design Principles to Enhance Sustainability of Inland Fishery Resources in the Southeast Asian Region”** and came up with a fishway model design that focused on critical parameters such as slope, water flow and velocity, and pass dimension among others as well as developed the most appropriate design for various conditions. Under this Project, experimental fishway model was constructed in 2015 to support on-station experiments using selected indigenous fish species, the results of which could provide the basic information on the considerations for designing fishways for different localities in the Southeast Asian region.

As part of the Project, SEAFDEC conducted the “Experts Workshop on Fishway Design Principles to Enhance Sustainability of Inland Fishery in the Southeast Asian Region” on 6-10 March 2016 in Thailand and Lao PDR, with the objective of obtaining information from experts on their works related to biology and ecology in relation to fish migration and fishway designs, as well as their recommendations on the criteria for fishway design towards enhancing the sustainability of inland fishery resources in the Southeast Asian region. After the Experts Workshop, TD constructed an improved version of a fishway model, where preliminary trials were conducted using several indigenous fish species, and the results showed that several species could swim upstream through the improved fishway model. Data collection in a more scientific manner would be undertaken to ensure that the design could serve as an effective pathway for fishes. Nonetheless, further research is needed to improve the knowledge on appropriate designs that facilitate upstream migration of indigenous fish species found in the region.



Fishway model (left) and preliminary experiments to monitor migration of indigenous fish species (right)

The experiences and progress of works undertaken by SEAFDEC were shared during the “Conference on Fish Passage in the Lower Mekong Basin” on 14-17 November 2016 organized by the Living Aquatic Resources Research Center (LARReC) in Lao PDR with the participation of SEAFDEC officers responsible for the implementation of the Project.

1.5 Energy Saving and Safety at Sea

The project “**Optimizing Energy Use/Improving Safety Onboard in Fishing Activities**” has been implemented by TD since 2013 with the objectives of transferring appropriate knowledge and enhancing awareness on optimizing energy use in fishing activities, and promoting safety at sea for small fishing vessels in the Member Countries. In 2016, TD organized the “On-site Training on Optimizing Energy and Safety at Sea for Small Fishing Vessels” from 20 to 22 September 2016 in Preah Sihanouk, Cambodia. Participated by fisheries officers and fishing vessel owners, the training enhanced the awareness and capacity of participants to use and improve energy saving technologies and practices for capture fisheries in the future. In order to raise the understanding of trainees on the subject matter, the FAO publications “Guidelines on Energy Saving Measures and Energy Consumption in Fishing Industry” and “Safety Recommendations for Decked Fishing Vessels of Less Than 12 Meters in Length and Undecked Fishing Vessels” that were translated into Khmer language earlier, were used as references during the on-site training.



On-site Training on Optimizing Energy and Safety at Sea for Small Fishing Vessels in Preah Sihanouk, Cambodia on 20-22 September 2016

1.6 Promotion of Sustainable Aquaculture Development

1.6.1 Quality Seeds for Sustainable Aquaculture

With the intensification of aquaculture systems and environmental challenges, AQD has given equal importance to maintaining genetic quality and culture management to ensure a steady yield of good quality seeds and later, marketable products from aquaculture. Thus, AQD implements a program that aims to generate, verify, and promote technologies to ensure the sustainable production of quality seed stock for aquaculture as well as for stock enhancement. In 2016, the studies implemented were aimed at determining the optimal conditions and methods for the production of quality seed stock in sufficient quantities. These include the use of 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.

Development of good quality broodstock

This Program focuses on production of fit larvae or stocks that can survive and grow well when farmed or released in specific environments. The activities emphasized on monitoring the genetic structure of base populations, establishing husbandry techniques, culture of live food, and developing suitable formulated diets necessary for good reproductive performance of various commodities.

Molecular markers were used for genetic characterization in stocks of several regionally important species such as the donkey's ear abalone (*Haliotis asinina*), the slipper oyster (*Crassostrea iredalei*), and the mud crab also known as mangrove crab (*Scylla serrata*) for aquaculture as well as the indigenous seahorse (*Hippocampus* spp.) for stock enhancement. Six microsatellite DNA markers have been developed for abalone to characterize the existing AQD hatchery stock and several Philippine stocks obtained from the wild for broodstock evaluation. Spawning batches were also set up for reproductive efficiency and production trait evaluation. Molecular marker variation data are currently being analyzed to be correlated later with breeding performance. From the reproductive efficiency comparison, hatchery-bred abalone stocks had the highest number of eggs as well as the number of eggs per gram body weight of female. Information on reproduction efficiency and those obtained from the molecular marker variation assessment shall be used in the formulation of broodstock management and selective breeding scheme for the donkey's ear abalone.

For the slipper oyster (*C. iredalei*), apart from genetic screening of potential good quality broodstock from wild populations, protocols for broodstock management and conditioning are being developed to maximize seedstock production in the hatchery. Rearing of broodstock at 30°C promoted rematuration, *i.e.* from stocks where 82% were spent or had spawned to 70% sexually mature oyster stocks. Highest broodstock survival (60%) was noted in conditioning tanks that held stocks in ambient water temperature. Selective breeding to improve growth and disease resistance of the mangrove crab (*S. serrata*) is being pursued. Six msDNA markers are being used in the on-going mass selection project in the mangrove crab, to keep track of the impact of domestication and selective breeding on the farmed stocks that are being improved for growth, survival, and disease resistance such as white spot syndrome virus (WSSV). For the tiger shrimp (*Penaeus monodon*), the type of holding system and different water depths and temperature gradients were assessed to identify the suitable environment that will have positive effect on the mating behavior and mating success of wild and captive broodstock.

Nutritional approaches have also been investigated to improve reproductive performance in farmed aquatic commodities. A study on the refinement of feeding protocols for the sustainable mass production of the marine annelid (*Marphysa mossambica*) was initiated in 2016. Interventions such as optimizing light exposure to promote growth and survival of the annelids in the nursery phase as well as utilization of feed enriched sediments in annelid grow-out rearing were tried.

Apart from the traditional aquaculture species, several indigenous species with aquaculture potential are also being studied. A study on the growth, reproductive performance, and nutritional composition of wild and hatchery-reared silver thraupis (*Leiopotherapon plumbeus*) showed highest mean monthly gonadosomatic indices (GSIs) in both sexes of

cultured fish in September and was high in February until March. In terms of reproductive performance, the combination of human chorionic gonadotropin (HCG) and ovaprim was the most effective hormone in inducing ovulation of *L. plumbeus*. For the effect of broodstock age on reproductive performance of hatchery-bred stocks, the younger *L. plumbeus* broodstock had higher spawning success, fertilization, and hatching rates compared to older groups. Finally, in another experiment, monthly GSI of *L. plumbeus* sampled from fed and unfed wildstock and hatchery-bred stocks showed that for hatchery-bred stocks, the mean GSIs in both sexes were similar in both treatment groups.



Sexually mature hatchery-bred female silver therapon, Leiopotherapon plumbeus (left); fertilized eggs of hatchery-bred silver therapon (right)



*Rearing trials of silver therapon (*L. plumbeus*) larvae in fiberglass (left) and concrete tanks (right) using tropical almond (*Terminalia cattapa*) leaves as substrate*



*Tank (left) and lake-based (right) culture of hatchery-bred *L. plumbeus**

Meanwhile, several aquatic species that are known to be threatened and are recommended for stock management and enhancement were focused in some studies. Activities implemented for the second year of the ACIAR-funded study on giant grouper focused on broodstock development and breeding. Since groupers first mature as females and

later change sex to males, as in other grouper species, a major constraint in breeding giant grouper is the availability of males. Hence, immature giant groupers were treated with methyl-testosterone (MT) to induce early male maturation. However, levels of vitellogenin, a female-specific protein, in the mucus of treated fish increased after withdrawal of MT treatment. On the other hand, attempts to induce spawning in mature giant groupers using combination of GnRH implants and HCG injection (500 IU/kg BW) resulted in ovulation but the fish did not spawn, thus a higher dose (1,000 IU/kg BW HCG) was tested. Furthermore, cryopreservation trials of sperm from other grouper species were done in preparation for stripping, artificial fertilization and hybridization of giant grouper with other grouper species.

Tissue samples of seahorses (*Hippocampus* spp.) collected from three different study sites, namely: 1) Molocaboc Island, Sagay City, Negros Occidental; 2) SEAFDEC seahorse hatchery; and 3) seahorse hatchery in Japan were analyzed. Sequencing of the same genes in all six species of seahorses [*Hippocampus comes* (tiger tail seahorse), *H. barbouri* (Barbour's seahorse), *H. kuda* (yellow seahorse), *H. spinosissimus* (hedgehog seahorse), *H. trimaculatus* (three-spot seahorse) and *H. abdominalis* (big-belly seahorse)] and a pipefish, *Syngnathoides biaculeatus* (alligator pipefish) was done and phylogenetic trees were constructed to show the relationship among different species. Microsatellite marker analysis showed very low degree of differentiation among populations of wild and hatchery-produced seahorses. Primers of *H. comes* microsatellite loci were successfully cross-amplified with other species of seahorses and the pipefish.

For sandfish (*Holothuria scabra*) broodstock, apart from environmental manipulation, nutritional approaches were applied to improve reproductive performance. Survival of the broodstock fed with shrimp feed and *Sargassum* powder was 100% when reared for the entire 8-week experimental run. The broodstock fed with powdered shrimp feed grew heavier than those fed *Navicula* and *Sargassum* but the recorded weights fluctuated throughout the 10-week feeding experiment. When temperature shock was used in artificial spawning, 7% of the broodstock exposed to warm shock spawned, whereas 2% of those exposed to the cold shock treatment spawned. Biochemical data for wild-caught sandfish were analyzed and from the information generated through the proximate analyses, potential practical diets were developed and are being tested to improve the breeding performance of sandfish broodstock.

Refinement of hatchery and nursery management methods to improve seedstock production

Studies aimed to improve seed stock quality and increase production were carried out. For abalone, several refinements in terms of establishing 1) optimum veliger density, incubation time, and incubation temperature; 2) appropriate light to be used in harvesting trochophore larvae; and 3) suitable conditions such as light provision and addition of substrate during extended incubation time were tried to improve larval production. A modified harvesting system that could minimize handling stress was designed to improve veliger survival rates. Other interventions were also made to increase abalone juvenile production through chemical cues, e.g. positive ions and algal extracts to improve settlement rate. In using illuminated and non-illuminated transparent tanks for settlement and rearing of early juveniles, results suggested that light is not needed in the transparent settlement tanks.

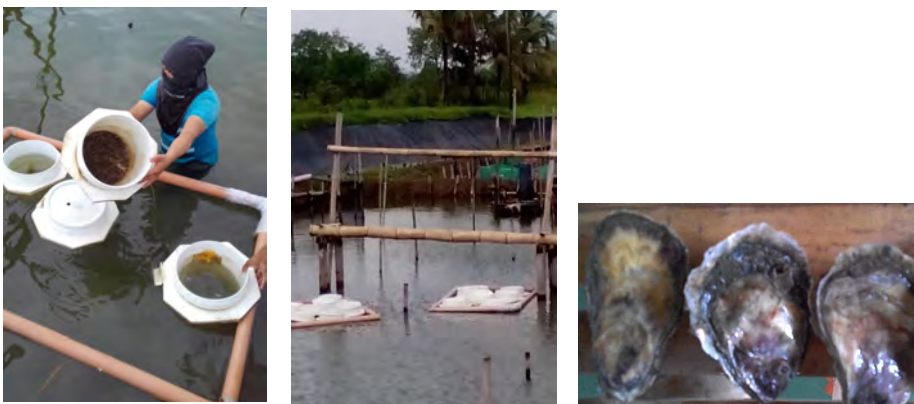
Finally, an efficient sorting and harvesting protocol was developed for abalone using anesthetic agents as muscle relaxant for juveniles. The use of 1.0 ml/L 2-phenoxyethanol for large-scale harvesting of abalone juveniles is recommended.



(from left to right) Rearing of oyster hatchery-bred spat in downweller system; oyster hatchery-bred spat (2 mm size); and hatchery-bred oyster spat (5 cm shell length) ready for grow-out culture

For the slipper oysters (*C. iredalei*), improved larval survival was noted when water change was done once every 4 days. Larval survival of eyed stage larvae was slightly higher in seawater that has been pre-filtered using a filter cartridge compared to those kept in UV-irradiated seawater.

With regards to the nursery pond rearing of hatchery produced spat, faster growth was noted when the spat were transferred to the pond after 88 days of culture in the hatchery. A protocol was also established for transporting competent larvae (eyed-larvae). When spat from remote settlement were nursed using fine mesh cylindrical containers in brackishwater pond, specific growth rate was higher using smaller sized spat than bigger sized spat.



Nursery culture of hatchery-produced oyster (*Crassostrea iredalei*) single spat by bucket floatation method (buckets with mesh net bottom to keep the spat suspended in water (left and middle); hatchery-produced oyster juveniles (right)

For blue swimming crab (*Portunus pelagicus*), larval quality determination was done through formalin stress test, where cumulative mortality increased with increasing formalin concentration in both poor and good quality larvae after 30 min of formalin exposure. However, cumulative mortality in poor quality larvae was higher than in good quality larvae. During larval rearing, the larvae survived without antibacterial agents but the survival rate was lower than those reared using antibacterial agents, *i.e.* oxytetracycline and nitrofurantoin. Different feed types were also tested to improve the production of *P. pelagicus*. Crab instars were fed formulated test diets in combination with mussel meat. Those fed natural food alone had highest average body weight but had the lowest survival rate of 22%. Another experiment was conducted to determine the most economically viable nursery enclosure system and method.

Nursery rearing techniques of *Kappaphycus* culture have been refined. Tissue cultured cultivars produced in the laboratory were reared in land-based nursery tanks and in sea cages. Thus far, production output from land-based nursery is about 8,000 *Kappaphycus* plantlets per month. In sea-based nurseries, survival rate was 35% with production output of approximately 2,500 individuals per month. Meanwhile, tissue cultured explants outplanted for grow-out exhibited high growth rates. Growth of the cultivars from the laboratory and that from farmed stocks shall be compared once data on the farmed seaweeds become available.



Outplanted nursery reared seaweed (*Kappaphycus alvarezii*) plantlets

A study that aims to develop a protocol in transporting milkfish (*Chanos chanos*) juveniles from the nursery to sea cage facilities showed no significant difference in the survival of juveniles after 7 days when transported for 6 hours under different salinity and temperature conditions. Trials on the suitable conditioning period of confinement in cages in ponds, before the juveniles are transported to milkfish sea cage farming sites, were also carried out.

Meanwhile, improvements in the hatchery and nursery production of sandfish (*H. scabra*) have been undertaken. Refinements in hatchery protocol include the use of appropriate food and stocking densities. *Chaetoceros*-fed sandfish larvae exhibited higher survival rate, faster development and lesser deformities. In another experiment, four settlement cues were compared among *Navicula* sp., *Amphora* sp., *Spirulina* paste, and *C. calcitrans* paste. Corrugated plastic sheets were used as settlement substrates. Per cent settlement was significantly high in plates with *Spirulina* paste (20.61%) as settlement cue, however, the density of spats on substrates with *Navicula* sp. and *Spirulina* paste was higher.

In larval rearing, zooplankton species and strains that can be used as live feed for initial feeding to small-mouthed fishes were identified and propagated. A study on the growth and reproductive performance of a minute rotifer (*Proales similis* de Beauchamp) showed

that feeding with 0% and 15% *Chlorella sorokiniana* pastes improved the rotifers' population growth. Centrifugation as a method of concentrating *C. sorokiniana* showed better results compared to the electrolytic flocculation method.

Development of schemes for production, management, maintenance, and dissemination of genetically selected and improved stocks

Selective breeding programs have been continued for selected commodities, *i.e.* mangrove crab, shrimp, and abalone, with support from SEAFDEC/AQD and the Department of Science and Technology (DOST), Philippines. For mangrove crab, mass selection scheme targeting improvements in growth and disease resistance commenced with the collection of founder stocks from Camarines Norte and Surigao Provinces of the Philippines. Crablets were produced from the founder stocks and used in growth and health status (post-WSSV challenge) assessment. Meanwhile, some batches of crabs belonging to the same spawns used in the growth experiment were subjected to disease WSSV challenge tests. The results will be used to identify disease resistant lines for the selective breeding program.

With regards to abalone, hybridization is being continuously implemented using the local commercial species, *H. asinina* which has been crossed with other Philippine abalone species, *H. planata*, *H. glabra*, and *H. varia* to enable the production of stocks and species with improved traits. Samples of the hybrid stocks have been analysed histologically and will be analyzed for molecular marker-based species differentiation. Meanwhile, a sensory evaluation test was done to determine acceptability of the hybrids that have been produced.



Hybridization of abalone (Haliotis asinina) using artificial fertilization: (A,B) naturally spawned female H. asinina; (C,D) extracting sperm from male abalone; (E) mixing sperm and egg for one hour; (F) counting of sperm in haemocytometer

For seaweed *Kappaphycus*, methods to develop resistant strains and reduce epiphytes are being studied. Seaweeds with epiphytes were collected and subjected to different pH levels to determine the epiphytes' survival under the aforementioned conditions.

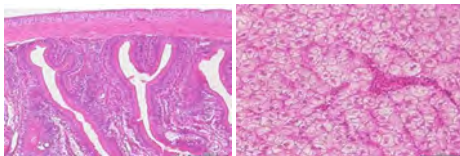
Adoption of economically viable systems to produce sufficient seedstock

Culture of several fish and shellfish species is carried out to demonstrate the viability of small-scale and large-scale seed production systems. Mass productions of various marine fishes, tilapia fry and fingerlings, giant freshwater prawn (*Macrobrachium rosenbergii*) post-larvae, crablets as well as large-scale production of abalone juveniles are continuously being done.

The quality seed program has therefore addressed several pressing issues that involve the need to provide improved or better quality seedstock that will boost, if not promote sustainable aquaculture production. Refinements in all the important aspects of fish breeding, hatchery, and nursery operations are being pursued with the hope that whatever outputs may be achieved, can directly benefit the aquaculture industry in the region.

1.6.2 Healthy and Wholesome Aquaculture

Practices that threaten food safety and concerns relating to the impact of aquaculture on the ecosystem still persist. To assist the Member Countries in addressing the problem, SEAFDEC has been promoting the concept of a "healthy and wholesome aquaculture." The concept promotes a holistic approach to fish disease management for food safety and security as well as the use of efficient feeds, *i.e.* cost effective and less polluting, to optimize production of robust and healthy farmed aquatic animals with least negative impact on the environment. This Program is aimed at improving aquaculture production through innovations in nutrition and feeding as well as fish health management, and preserving the environmental integrity of aquaculture areas.

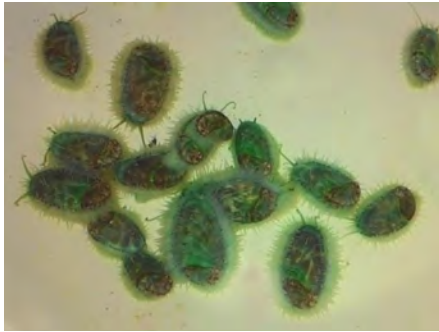


Morphological structures of milkfish fed diet with DDGS at 30% replacement level: intestine (left) and liver (right)

Fish meal, a major source of protein in aquaculture feed, is considered a finite resource. Although its inclusion in commercial aquaculture feed had decreased, the usage continue to increase due to enormous volume of feeds produced to meet the demands of fast growing aquaculture industry. In this connection, AQD's R&D efforts in 2016 have continued to give emphasis on finding

alternative protein sources for inclusion in feed formulations that would decrease the amount of fish meal in diets of important aquaculture species. The use of distillers dried grain solubles (DDGS), a by-product of the distillery industry, has improved significantly the final body weight and FCR of milkfish (*C. chanos*) at a dietary inclusion level of 30% without morphological changes in the liver and intestines.

The hydrolysate processed from milkfish by-products was also found to be another source of protein that can be used at 10% in larval diets for pompano (*Trachinotus blochii*). The seaweed *Ulva pertusa* can be enriched with ammonium chloride to increase its nitrogen



*Abalone at 90 days of culture fed with diet containing enriched *U. pertusa* at 30% replacement meal*

content, and its dried form was found to effectively replace protein coming from fish meal and soybean meal in abalone (*H. asinina*) diet at dietary level of 30%. Abalone fed this level had highest growth rate and did not affect its body nutrient composition.

In developing feeds for aquaculture species, supplementation with essential nutrients would improve the formulations especially for the early stage of growth. Essential amino acids in a protein source are important in the grow-out stage, and in sea bass, the dietary levels of three essential amino acids

for growth, namely: leucine, isoleucine, and histidine are being determined. Another high value species like pompano (*T. blochii*) has a requirement for taurine at early stage (≤ 20 g) of development. Its growth was significantly enhanced when the total amount of taurine in the diet was 1.88%, this coincided with the level of taurine in pompano flesh also at 1.88%. It was however observed that the bigger size pompano (100-352 g) did not require taurine supplement for growth when fed a diet containing 0.38% taurine.



*Pompano (*Trachinotus blochii*) weighing 350 g fed formulated diets showing golden color in their ventral part*



Size increment of crab after molting showing the soft-shell crab (top) and exuvia (bottom)

In a study funded by the DOST-Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development (DOST-PCAARRD), Philippines, farming practices for the improvement of commercial production of soft-shell crabs (*S. serrata*) were successfully demonstrated. These farming practices were adopted by three private-owned fish farms in the Philippines where one farm was capable of producing 200 pieces of soft-shell crabs a day.

For shrimp *Penaeus indicus*, the quality of seeds produced by captive, hatchery-bred broodstock was at par in terms of quality and even better in survival rate compared to seeds from wild broodstock. It is economical to stock the shrimps in pond at 20/m² for a culture period of 90 days.

With regards to the production of two species of grouper (*Epinephelus coioides* and *E. fuscoguttatus*) in ponds using SEAFDEC/AQD phased-diet, the final weights of fish ranged from 400 g to 460 g and the survival rate was about 94% after 6 or 8 months of culture period.

Investigation on the efficacy of indigenous probiotics

An indigenous poly- β -hydroxybutyrate (PHB)-accumulating mixed bacterial culture and two PHB-accumulating *Bacillus* spp. were isolated from shrimp culture pond in the Philippines, and investigated for their capacity to improve growth, survival, and robustness of *P. monodon* postlarvae. The effects of PHB-accumulating *Bacillus* spp. on the stress response of *P. monodon* exposed to extreme changes in temperature in conjunction with the expression of biomarker for thermal stress in shrimp and other immune related genes are being looked into. The efficacy of commercial probiotics (PRO W, PRO 2) and disinfectant (PUR) to control acute hepatopancreatic necrosis disease (AHPND) and luminescent vibriosis in *P. vannamei* culture is likewise being investigated.

Application of diagnostics that will ensure biosecurity within culture systems

Since site selection and effective zoning hold the keys to sustainable production of high quality aquaculture products, research was conducted to establish the sanitary quality of slipper oysters (*C. iredalei*). Results of microbiological examination of oysters done by AQD in the current and previous years revealed that oysters from the culture areas in Cabugao Bay, Capiz, Philippines need to be depurated. The potential of three-relaying stations located in the deeper portion of Cabugao Bay was also examined and results showed that the mean fecal coliform count in the water that was examined over a year was generally < 43 MPN/100 ml, which is categorized as an Approved Area based on the US National Shellfish Sanitation Program on Shellfish Harvesting Area Classification Criteria. In subsequent experiments, the effects of relaying on *Escherichia coli* count (ECC) in oyster meat during the wet and dry seasons were examined. After seven days, ECC in oysters obtained from the relaying stations significantly dropped to < 20 MPN/100 g at three weeks post-relaying, suggesting the potential of the identified sites for relaying and depurating oysters harvested from the nearby areas.

Promotion on the wider use of conventional diagnostic as well as new methods for newly reported emerging diseases

Studies are being continued to investigate the diseases that affect shrimps and the predisposing, risk, and protective factors, as well as possible prevention and control measures. Shrimp samples were collected from farms in 14 out of 17 regions in the Philippines. Eleven bacterial isolates were identified to contain the specific PirA and PirB-like toxin genes responsible for AHPND pathogenesis. Results showed that the isolated *V. parahaemolyticus* derived from outbreaks in shrimp farms in the Philippines are highly pathogenic to shrimp. Records of all the archived isolates are stored in the Online Philippine Shrimp Pathogen Information Resource (OPSPIR), which is an online database. OPSPIR geographically tags the locations with the presence of pathogens using Google Maps and currently runs on <http://opspir.seafdec.org.ph/index.php/user>. Aside from the present bio-surveillance records, data from other sources were also included to reflect the historical presence of diseases in the areas covered. To ensure continued bio-surveillance, it is necessary that cooperation among government agencies and local government units, the private sector, and other stakeholders should be enhanced for conducting remote data entry for early detection, mitigation, management, and control of disease outbreaks.

With regards to the development of shrimp pathogen diagnostic tools using nested polymerase chain reaction (PCR) and lateral flow strip biosensors (LFSB) coupled with mobile application and cloud-based information management, the current data demonstrated that the detection limit of LFSB kit is at par with the nested-step optimized WSSV PCR method. The LFSB kit provides a cost-effective DNA-based biosensor which can be readily modified and adopted to target emerging strains of WSSV when genome data for WSSV strains from the Philippine Genome Center becomes available.

Evaluating the effectiveness of natural products to manage aquaculture diseases in lieu of harmful chemicals

Infectious diseases of bacterial etiology are some of the constraints limiting hatchery production of mangrove crabs. Lack of alternatives to antibiotics, the use of which is banned or discouraged due to food safety concerns, has hampered production of adequate seeds to spur production in grow-out facilities. Investigations focused on terrestrial plants and indigenous bacteria for their antimicrobial and probiotic properties as one of the practical strategies to manage diseases of mangrove crabs in hatcheries and grow-out ponds. Extracts that showed good antimicrobial activity by agar disc diffusion technique were further tested for their toxicity to various stages of crabs including zoea, megalopa, and crab instar. Results showed that the survival of mangrove crab larvae zoea 5 and crab instar 1 treated with *Terminalia catappa* crude ethanolic extracts was comparable to the antibiotic-treated group. However, diseases of non-infectious etiologies can also have a serious impact on the final survival, hence, should receive utmost attention in developing the best management practices for *S. serrata* hatchery.

These achievements and important findings in 2016 will contribute to the development of best management strategies and good aquaculture practices, particularly in the areas of feeding and aquatic health management. In the long term, these could lead to optimization of production yield, with least impact on the environment.

1.6.3 Maintaining Environmental Integrity through Responsible Aquaculture

The aquatic environment offers enormously rich resources, therefore, it is crucial that activities are directed towards achieving a balance between aquaculture development and protection of the environment and aquatic biodiversity. Despite the significant progress made by SEAFDEC and AMSs on the promotion of the Code of Conduct for Responsible Fisheries, the aquaculture sector in the region is still confronted with issues related to environmental protection and wise use of resources. This Program was developed to address issues on the negative impacts of aquaculture on the environment by developing environment-based aquaculture technologies and promoting responsible aquaculture.

Developing and promoting efficient and suitable environment-friendly culture systems

In 2016, the Program continues to focus on developing and promoting efficient and suitable environment-friendly culture systems for sandfish (*H. scabra*), abalone (*H. asinina*), slipper oyster (*C. iredalei*), giant freshwater prawn (*M. rosenbergii*), shrimps (*Penaeus* spp.), and seaweed (*Caulerpa lentillifera*). For sandfish, AQD established three sites in the Philippines for community-based sea ranching, with each site having its own nursery set-ups producing



Abalone harvested from grow-out culture in reef flats (left) and pond set-up for abalone grow-out (right)

thousands of juveniles. These sites are located in Brgy Polopina, Concepcion, Iloilo; Brgy Pandaraonan, Nueva Valencia, Guimaras; and Molocaboc Island, Sagay City, Negros Occidental.

Culture trials conducted on abalone revealed better growth with shell length (SL) of 3.41 ± 0.04 cm and body weight (BW) of 8.42 ± 0.33 g after 119 days for stocks cultured in tanks and at lower stocking density of 200 individuals/m² compared to those reared in ponds and reef flats at 400 individuals/m² with 3.19 ± 0.01 cm SL and 7.27 ± 0.10 g BW.

Oysters were reared in different sites to evaluate the different production traits. Hatchery-bred and wild-sourced oyster spats were also compared in grow-out in pouches. The results showed significantly higher body weight (92.5 g vs. 88.1 g) and shell length (100.6 cm vs. 94.0 cm) in hatchery-bred compared to wild-sourced oysters, and the latter (wild-sourced) showed significantly higher survival rate (90.8% vs. 85.8%).



Raft for oyster culture (left) and stocking of oysters in pouches for grow-out culture (right)



*Male giant freshwater prawns (*M. rosenbergii*) with unblatated claw (left) and ablated claw that has regenerated (right)*

The experiment on the use of biofloc system of rearing giant freshwater prawn (*M. rosenbergii*) with sugar as a source of carbon is ongoing. Results of rearing in indoor circular fiberglass tanks with different stocking densities showed significantly higher final weight at 40/m² density. In another study, results revealed that ablation did not provide significant advantage since there were no significant differences in the final weight, growth rate, and survival rate in the control and the ablated stocks.

On the other hand, an ongoing experiment on seaweed *Caulerpa lentillifera* aims to optimize its culture in tanks and ponds by quantifying the nutrient, salinity, and light requirement of the species.

Biological and ecological studies on species with potentials for resource enhancement

Biological and ecological studies on species with potentials for resource enhancement are being carried out. One is a study on seahorse (*Hippocampus* spp.) funded by the Japanese Trust Fund (JTF) that is underway aims to eventually release in the wild the hatchery-bred seahorse and to improve stocks in the wild. Thus far, the transport strategy lasting from 10 to 12 hours with 100% survival rates of adults at stocking densities of 1, 2 and 3 individuals per liter has been achieved. As preparation of the community in Molocaboc Island, Sagay City, Negros Occidental for the stock enhancement of seahorse in the area, information, education, and communication (IEC) activities were conducted for school children, teachers, and members of fisherfolk organization. In 2016, the Program was able to: 1) develop appropriate culture systems and management for abalone and oysters; 2) successfully establish nursery sites for sandfish on sites where the local communities have undergone IEC activities; and 3) successfully conduct long-haul transport of live adult seahorses for stock enhancement with 100% survival rate.

1.6.4 Adapting to Climate Change Impacts on Aquaculture

Changes in the climate are projected to impact broadly across ecosystems, increasing pressures on all livelihoods and food supply chains, including the fisheries and aquaculture sectors. The future food supply will be a central issue as food resources come under greater pressure. In particular, the sustainability of aquaculture will be challenged in this scenario since the effect of climatic change on the aquaculture organisms in general, different aquaculture systems and structures, various support systems to aquaculture operations, and the fish farmers, are largely unknown. The small-scale fish farmers in the region who produce a great volume of aquaculture production are mainly vulnerable since they are dependent on aquaculture operations for food and income. Some urgent adaptation measures are therefore required in response to the threats to food and livelihood provision that may arise due to the changing climatic conditions observed around the globe. The Program therefore aims to identify the changes in the environment brought about by climate variability that may affect the aquaculture sector, prepare the sector to the possible effects of the changes, minimize and mitigate the adverse impacts of climate, and ensure continued operation of all aquaculture production systems under changing climatic conditions.

Generate scientific information on the effects of high water temperature on the reproductive performance and recruitment of economically important marine aquaculture fishes

Reproduction, spawning, and recruitment are among the physiological processes that are highly affected by environmental temperature. The Philippines experienced an extended El Niño phenomenon from around the end of 2015 until the first half of 2016. The prolonged dry and hot spell was followed by extended periods of heavy rains. During this period, disruption in the reproduction of most commodities were observed, *e.g.* decreased maturation rates and fewer spawning events in captive shrimps, abalone, and crabs, decreased production of cocoons in both wild and captive marine polychaete or annelid (*M. mossambica*), among others. Growth and survival rates of different commodities were also affected. Growth rate of the seaweed *Kappaphycus* in nursery and grow-out was lower during the El Niño months; whereas, *Caulerpa* showed slow growth especially towards the end of El Niño months. The onset of rainy season when extended periods of heavy rainfall caused fluctuations and drop in salinity, has caused negative growth rates of various commodities. Development of nectochaetes was also affected by direct exposure to sunlight and higher temperature. Better growth and survival rates were obtained in nectochaetes that were cultured indoors followed by those cultured in partially shaded area. While poor growth and survival rates were recorded for those cultured in an area directly exposed to sunlight.

The abovementioned observations point to the need for developing strategies or systems that would support normal growth and development under unfavorable or sub-optimal conditions brought about by climatic phenomena.

Promote public awareness on the possible effects of climate change to aquaculture activities

Increasing the awareness of fish farmers and the general public on the possible effects of climate change to aquaculture operations is a continuing activity. The AQD Library is continuously sending updated information about the effects of climate change on aquaculture to AQD research staff and other interested stakeholders. In addition, training courses offered by AQD since 2013 include lectures on climate change and its impacts on aquaculture.

1.6.5 Meeting Social and Economic Challenges in Aquaculture

Despite its technological improvements and overall economic performance, the aquaculture sector has been facing a number of challenges which need to be addressed to attain sustainable development. The social and economic challenges in the promotion of rural or smallholder aquaculture in the ASEAN region should be addressed and the steps that need to be taken to address them should be shaped. This Program aims to develop and implement social and economic strategies in aquaculture and



Signing of MOA between SEAFDEC/AQD and JIRCAS for a five-year project (2016-2021)

resource enhancement to secure food and income through strengthened collaboration with stakeholders.

Under this Program, the Japan International Research Center for Agricultural Sciences (JIRCAS) funded the 5-year project “Integrated Multi-trophic Aquaculture (IMTA)” with the main objective of developing smallholder IMTA strategies suitable as supplemental livelihoods for subsistence fisherfolk. Fishers in Nueva Valencia, Guimaras, Philippines were trained to perform the daily activities in IMTA milkfish production system. Having completed three consecutive cropping, the activity demonstrated improvement in economic gains from milkfish harvest. However, sandfish in the IMTA setup needs further evaluation to sustain its survival until harvest. Another study initiated under the Program is aimed at determining the economic benefits and losses of seaweed farmers due to some climate change indicators. Reconnaissance survey was conducted in Nueva Valencia to provide baseline reference data in future evaluation of benefits and losses due to changes in climate parameters. Seaweed growers reported problems relevant to decline of their seaweeds harvest including lack of new source of seaweed propagules, low buying price of dried seaweeds, lack of start-up financial assistance, and some climatic factors such as drastic changes in temperature, quantity and frequency of rainfall, as well as occurrence of calamities such as typhoons.



Women seaweed farmers hauling seaweed harvest in Nueva Valencia, Guimaras, Philippines



Up-scaled IMTA milkfish pens at Barangay Pandaraonan, Nueva Valencia, Guimaras, Philippines operated by 6 fisherfolk cooperators trained through the SEAFDEC on-site demonstration and verification

The Program also continued implementing studies on Community-Based Resource Enhancement (CBRE) since 2006 to address the declining fish catch and income in remote island communities in the Visayas in the Philippines. These include enhancement of threatened resources such as abalone (*H. asinina*) and sandfish (*H. scabra*) in Sagay Marine Reserve in Molocaboc Island, Sagay City, Negros Occidental, and tiger shrimp (*P. monodon*) in estuaries in New Washington, Aklan since 2012. The Molocaboc Sea Ranchers’ Association (MOSRA) composed of fisherfolk are actively involved in CBRE for the 10-year SEAFDEC and JTF project and they already harvested and sold abalone recruits from tagged hatchery-bred abalones that were released in 2011. Spill-overs from abalone and sandfish stocks have been reported by gleaners in intertidal areas outside the release site.

The monitoring of released stocks in Aklan showed that various sizes of tiger shrimp (*P. monodon*) were included in the catch. Consequently, prohibitions on the use of illegal fishing gears with fine mesh nets must be implemented by the local government unit.

AQD's CBRE projects were recently featured during the Philippines' biggest Agri-business Exhibition (Agri-Link) on 6-8 October 2016 in Pasay City. The purpose of joining the event was for wider dissemination of information on the concept and benefits of CBRE in terms of rebuilding coastal resources and improving people's livelihood through aquaculture.



Fisherfolk leaders of the CBRE for abalone and sandfish during monthly sampling and packaging of products for sale



AQD disseminated CBRE results at the Agri-AquaLink Fair and Exhibit at the World Trade Center in Pasay City, Metro Manila, Philippines

Results of the studies under this Program have provided motivations for local government units to formulate policies that would embed resource enhancement in local coastal fisheries management and development plans. The Program's R&D, training, and on-site technology demonstration activities have attracted multi-agency collaboration. Tri-party collaboration between organized fisherfolks, local government, and research organization ensures the successful implementation of CBRE projects. For family-based aquaculture production projects, the critical role of local governance guaranteed active participation of fisherfolk families.

1.6.6 Environment-friendly, sustainable utilization, and management of fisheries and aquaculture resources

AQD has generated science-based information and developed skills in feed development, aquasilviculture, and community-based management for aquatic species production under the regional program "Promotion of Sustainable Aquaculture and Resource Enhancement in Southeast Asia" funded by the JTF. However, these activities need to be followed up to ensure the development and transfer of technologies for effective utilization and management of aquatic resources in Southeast Asia. The focal points of the Project at present are on: 1) establishing responsible aquaculture technologies that guarantee environment-friendliness; 2) promoting community-based production and resource enhancement of high-value aquatic resources; and 3) disseminating and demonstrating resource enhancement practices.

In 2016, biologically, environmentally and socio-economically acceptable, and region-oriented approaches were promoted through the implementation of various studies and capacity building activities. One study involves the use of plant-based protein sources,

specifically agricultural wastes in tilapia feed formulations for improved production traits. Since the protein content of the potential ingredients was generally low, protein enrichment trials of agricultural wastes were done. The anti-nutritional factors of all agricultural waste samples which are likely to affect digestibility once incorporated in tilapia diets are also being analyzed. A preliminary trial to evaluate the protein quality of agricultural wastes in a 28% crude protein diet and their effects on the growth and survival of juvenile tilapia was carried out for 70 days. Fish fed the control diet had the highest final weight, percentage weight gain and specific growth rate. Percentage weight gain of tilapia fed the control diet was comparable to those fed diets containing citrus pulp, okara meal, and pineapple peel. The effects of substitution of fishmeal with mango peel silage in the diet on reproductive performance and fry production of tilapia broodstock reared in tanks and lake-based cage set-up are being monitored.

The potential of aquasilviculture to abate disease occurrence and improve shrimp survival rate in ponds via an improved water quality is being investigated. This study aims to determine the time required for a mangrove habitat to remove nutrients from shrimp farm effluents putting into consideration the ratio of mangrove forest:shrimp pond area (MPR). However, since the shrimp culture has just started, the data on nutrient removal by mangrove is not yet available. Eventually, the aquasilviculture of shrimp as an ecosystem-based management strategy for sustainable production will be promoted in the AMSs.

The community-based integrated production of abalone (*H. asinina*) and sandfish (*H. scabra*) through culture, sea ranching, and stock enhancement is another important component of the Project. Monthly monitoring of 12,640 tagged hatchery-bred (HB) abalone juveniles released in the CBRE site in Sagay Marine Reserve showed an increasing proportion (91-97%) of wild recruits vs. hatchery-bred counterparts. Nursery rearing of 64,000 early juvenile sandfish in floating net cages recorded an average of 16% survival rate, of which 8,700 were released in pens and 1,100 in the sea ranch area. Accordingly, abalone and sandfish in areas outside the release site also increased.

For the resource enhancement efforts on seahorses (*Hippocampus* spp.), trials on transport and acclimation strategies were conducted on three batches of juvenile seahorses. The optimum stocking density for seahorse juveniles is 3 individuals/L in a 12-hour transport duration. Monthly monitoring showed an increase in the number of wild seahorses, and mature male and female seahorses are available all year round. Fisherfolk organization



Sampling of sea bass breeders as part of the practicum session of the International Training Course on Marine Fish Hatchery (left) and sampling of sea bass for sex determination during the Training Course on Marine Fish Hatchery (right)

members were trained on the proper handling of live seahorses and seahorse biology. IEC activities were also conducted by giving lectures on biology, resource management, and baseline data of wild seahorse population in Molocaboc Island.

Apart from research, activities in 2016 also included the International Training Course on Marine Fish Hatchery at AQD's Tigbauan Main Station on 13 June-19 July 2016, and Community-based Freshwater Aquaculture for Remote Areas of Southeast Asia at Binangonan Freshwater Station in Binangonan, Rizal from 22 November to 1 December 2016. A total of 7 participants completed these courses through JTF Training Fellowship Grants.

1.6.7 Other R&D Activities

Agree-Build-Operate-Transfer (ABOT) Aquaculture Business (AquaNegosyo)

Promotion of technology packages developed by AQD has been continued for local and international business investors through technical assistance in every phase of on-farm operation. In 2016, the Program received a total of 34 inquiries on aquafarming of mangrove crabs (almost 50% of inquiries), shrimps, milkfish, tilapia, and high value marine fish species such as groupers, snappers, and seabass; and a few inquiries on abalone, oysters, sandfish, seaweeds, and freshwater prawn. Among those who made inquiries, two became ABOT clients and formal agreements are now being finalized.

Institutional Capacity Development on Sustainable Aquaculture (ICDSA)

This is another important initiative that provides an effective mechanism to disseminate the technologies and science-based approaches developed by AQD. In sustaining collaborative projects with BFAR, technical assistance was extended to BFAR for the construction of multi-species marine fish hatcheries in different parts of the Philippines. The multi-species marine fish hatcheries in Baler, Aurora; Sta. Lucia, Palawan; Bongabong, Oriental Mindoro; and Sta. Cruz, Davao del Sur that have long been completed are already operational, while construction of hatchery facility in Sagnay, Camarines Sur is almost completed and will be operational soon. AQD continued to provide technical assistance in the operation of such facilities.



AQD scientist showing the ways of identifying different species of mangrove crabs during the On-site Training Course on Mangrove Crab Culture in Tacloban City, Leyte



*AQD trainee and fisherfolk preparing seaweed (*Gracilaria sp.*) planting materials for culture*

In partnership with various stakeholder groups in the Philippines, AQD is also promoting on-site training courses in different parts of the country and has conducted courses in Capiz for oysters and grouper; and in Leyte for seaweeds, mangrove crabs, milkfish, and oysters.

AQD continued to work with a non-government organization (NGO), the Winrock International in the implementation of a development project for improved aquaculture production efficiency in the Caraga Region or Region XIII in the Philippines. AQD's role is on capacity building in aquaculture through introduction of technologies that will enhance production of aquaculture species that are economically important in the region. An on-farm demonstration on mangrove crab grow-out culture using AQD's feed in Bislig, Surigao del Sur was completed in December 2016.

Training and Information

A total of 261 foreign and local trainees participated in AQD's 33 training courses on various aspects of aquaculture conducted from January to December 2016. A distance learning course on principles of aquaculture nutrition known as AquaNutrition Online was also conducted. Moreover, AQD also organized internship programs availed of by 48 participants and on-the-job training program by 178 students from 33 schools. Overall, AQD's capacity building programs have helped build the critical mass of aquaculture technology experts in the Southeast Asian region.

Apart from scientific publications, AQD published two proceedings from two ASEAN-SEAFDEC Regional Technical Consultations. These are: Development and Use of Alternative Dietary Ingredients or Fish Meal Substitutes in Aquaculture Feed Formulation; and EMS/AHPND and their Transboundary Diseases for Improved Aquatic Animal Health. Furthermore, an Extension Manual on abalone, brochures on various aquaculture commodities, posters, and videos were produced. AQD is also regularly publishing the bi-monthly issues of AQD Matters, updating the website, posting AQD events in Facebook and Twitter, and participating in fairs and exhibits. In 2016, AQD participated in eight major aquaculture exhibits and fairs held in various parts of the Philippines. All these activities are expected to contribute to the Department's mandate of timely dissemination of information and at the same time help enhance its visibility to various stakeholders.



Participants during one of AQD's training courses on the practical session on spawning of oyster broodstock



AQD exhibit booth during the 2016 Agri-Link, the biggest Agri business exhibition in the Philippines

AQD's Library and Data Banking Services Section has improved its services for the users and now offers digital and online reference services, current awareness services, selective dissemination of information, and the Library Instruction and Information Literacy Program. The SEAFDEC/AQD Institutional Repository (SAIR) has continued to enhance the accessibility of AQD publications and visibility of the Department. SAIR, the official digital repository of scholarly and research information of SEAFDEC/AQD, aims to provide a reliable means for its researchers to store, preserve, share their research outputs; enable easy access to; and increase the visibility of the Department's scientific publications. From January to December 2016, SAIR obtained 2,782,648 searches and 8,366,212 files in portable document format (PDF) were downloaded. AQD's FishWorld Museum of Aquatic Biodiversity maintains a reference collection that is currently consisting of more than 5,000 species and exhibits 70 species of various live aquatic animals. Eleven local high school students availed of the internship programs on aquatic biodiversity conducted by FishWorld. The Museum also held its annual AquaWeek participated by 200 elementary and high school students from different parts of Panay Island, Philippines. A new FishWorld self-guide was also produced.

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

2.1 Biotoxins Monitoring and Harmful Algal Blooms (HABs) in the ASEAN Region

Marine biotoxins generate significant and expanding threat to human health in many parts of the world. Their impacts are evident in terms of human poisoning or even death following the consumption of contaminated shellfish or fish, as well as mass killings of fish and shellfish, and death of marine animals and birds. Thus, monitoring of seafood for toxicity is essential to manage the risks. However, there are several limitations in monitoring for toxicity such as variations in toxin contents among individual shellfish, different detection and extraction methods for various toxins that require a decision on which toxins should be tested 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. Furthermore, the growing harvest of non-traditional shellfish such as moon snails, whelks, barnacles, and so on could increase human health problems and management responsibilities.

The MFRD Programme through PHTC/AVA, implemented the project "**Chemical and Drug Residues in Fish and Fish Products in Southeast Asia - Biotoxins Monitoring and HABs in the ASEAN Region**" from 2009 to 2019 to expand and improve initiatives in monitoring, detecting, and sharing of information on marine biotoxins in order to reduce public health risks associated with consumption of contaminated fish and shellfish. The Project covered training on analytical methods for Diarrhoeic Shellfish Poisoning (DSP) toxins, lipophilic toxins, Paralytic Shellfish Poisoning (PSP), toxins and Tetrodotoxin (TTX), and a monitoring survey on PSP toxin in AMSs. After the completion of the Project's first phase, it was extended to address the needs of SEAFDEC Member Countries on capability building in biotoxins analyses and monitoring, with proposed focus on other biotoxins like Amnesic Shellfish Poisoning (ASP) toxin (Domoic Acid) and Azaspiracids (AZA). Brevetoxins (BTX) which cause Neurotoxic Shellfish Poisoning (NSP) was also recommended to be included in the extended Project as ASP, AZA and BTX along with DSP and PSP, are regulated according to the Codex for shellfish.

During the End-of-Project Seminar for the Biotoxins Monitoring Project in 2012, the AMSs pointed out the importance of identifying the species of biotoxin-producing harmful algal blooms (HABs) to complement the existing biotoxins monitoring programs and ensure that fish and shellfish are not contaminated with toxic algae or their toxins. The MFRD Programme was therefore asked to carry out a project on HABs to enhance regional capabilities for the identification of biotoxin-producing HAB species. Thus, a separate component on toxin HAB species identification was made part of the Project from 2015.

The key stakeholders and beneficiaries of this Project are the relevant agencies in fisheries departments of the AMSs that are responsible for ensuring the safety of fish and shellfish for human consumption, and monitoring and testing of fish and shellfish for biotoxins; the aquaculture farmers and harvesters of fish and shellfish; as well as the international and domestic consumers and buyers. It is expected that by the end of the Project, the AMSs would have upgraded their own laboratory capabilities and credibility testing for ASP, AZA and BTX biotoxins; established biotoxins monitoring programs for routine surveillance testing of fish and fisheries products; improved their knowledge and understanding on the levels of biotoxins occurrences and incidences in fish and fishery products as well as of toxic HAB occurrences and incidences in the ASEAN region; and enhanced their capabilities for identification of biotoxin-producing HAB species to ensure that fisheries products are safe for human consumption. Activities under this Project include a regional training course in AZA, ASP and BTX biotoxins analyses, regional training course on identification of biotoxin-producing HAB species, biotoxins monitoring surveys in the AMSs, and a technical compilation for publication.

Starting from 2015, the AMSs (except Cambodia) conducted “Biotoxins Monitoring Surveys” scheduled to be completed by the end of 2016. While Myanmar, Singapore, and Thailand conducted the survey according to their sampling plans and submitted the quarterly progress reports as required, Lao PDR, Philippines, and Viet Nam have yet to submit their quarterly reports since their surveys were supposed to have already started. Meanwhile, Brunei Darussalam, Indonesia, and Malaysia had encountered challenges in conducting the survey due to manpower and technical constraints, and had requested for an extension of the survey period. Thus, the surveys would be extended until the end of 2017 to allow the countries to gather more data for better understanding of HAB occurrences.

MFRD also organized the “Regional Training Course on Identification of HAB Species in the ASEAN Region” on 18-22 July 2016 in Singapore in collaboration with the United Nations Intergovernmental Oceanographic Commission-Sub-Commission for the Western Pacific (IOC-WESTPAC). Besides obtaining knowledge on identification of HAB species through lecture and practical sessions as well as field trip and sampling sessions, the participants also agreed to form a team headed by the Philippines and consisting of a representative from each Member Country to prepare 2 posters on red tide causing species and HAB species. Member Countries would provide photos of the species for the posters which will be distributed to the other Member Countries for knowledge sharing. The Training also highlighted the need for more training sessions on specimen preservation and culture techniques for identification and monitoring of HAB species. As such, the Member Countries requested MFRD to organize additional training courses on these topics to enhance the region’s capabilities in managing toxic HAB incidences.



*Regional Training Course on Identification of HAB Species in the ASEAN Region in Singapore
on 18-22 July 2016*

Taking into consideration the abovementioned requirements, the Project was extended for another two years until the end of 2019 to enable the countries to continue the biotoxin monitoring surveys. Moreover, additional regional training courses on HABs would be incorporated as additional activities in 2017-2018, while the Project's final year's activities, *i.e.* publication of a Technical Compilation and the End-of-Project Seminar are scheduled in 2019.

2.2 Cold Chain Management for Seafood

Seafood is an important commodity in many AMSs and serves as an important source of foreign exchange and food supply for these countries. There is an increasing demand for seafood as consumers around the world recognize its nutritional value. However, seafood is perishable and several chemical and biological changes occur immediately after capture and/or harvest. The deterioration process of seafood quality by microbiological metabolism, oxidative reaction, and enzymatic activity is accelerated by poor temperature control along the supply chain. Thus, good cold chain management is one of the most critical requirements to keep the seafood product fresh and safe, extend shelf life, and maintain the quality and economic value from catch to consumer.

Throughout the seafood supply chain, the seafood industry relies on proper cold chain to ensure the commercial viability of seafood products. Modern technologies for seafood production at the aquaculture farms, seafood catch on the fishing vessels, pre-harvest considerations, post-harvest handling techniques, processing, packaging, storage, distribution and transportation modes, wholesale, and retail constitute integral parts of the seafood cold chain management process. Proper management at every stage of this cold chain would enable the supply of fresh, quality, wholesome and safe seafood products to consumers. The elements in a cold chain could be in various forms that include ice, refrigerated seawater, refrigerated compartments, and cold stores. Moreover, low temperature conditions have to be supported by careful hygienic handling practices during processing, storage, and transportation to effectively reduce the spoilage of fish products.

The implementation of cold chain management for seafood in the ASEAN region involves a number of challenges. One of the major challenges is the lack of or limited integrated supply chains from farm to fork where each industry player regards itself as a separate

entity and does not impose cold chain requirements on the next stage in the supply chain. However, any breakage in the cold chain would have cumulative effects on the final quality of the seafood. The great diversity of species combined with multiple international origins and production methods (fishing or farming) further complicate the cold chain requirements. In addition, seafood and many other traditional fish products in the ASEAN region are largely handled by small and medium-sized establishments with inadequate facilities, technologies, and knowledge in adopting cold chain practices. Nevertheless, cold chain management is still seen as a non-mandatory practice in many countries. Thus, even if development of the cold chain guidelines may have been recommended, enforcement of such guidelines would remain weak.

Notwithstanding these challenges, the Project “**Cold Chain Management for Seafood**” was initiated by MFRD Programme from 2015 to 2017 to provide a platform for the ASEAN region to share knowledge, experiences, and cost-effective technologies on cold chain management for seafood products. The key stakeholders and beneficiaries of this Project are the relevant agencies in fisheries departments of the AMSs responsible for ensuring product quality and safety throughout the seafood supply chain; the seafood producers, suppliers, distributors, and other stakeholders in the seafood supply chain; as well as the international and domestic consumers and buyers. Specifically, the Project is aimed at upgrading the regional seafood industry in cold chain management and technologies, as well as developing generic guidelines on cold chain management for the ASEAN regional seafood industry. Activities under this Project include a Regional Training Workshop on Cold Chain Management for Seafood, cold chain pilot trials in Member Countries, and a general guideline that could serve as benchmark for the AMSs in developing their respective national guidelines to promote the application of cold chain management to safeguard consumers’ health and food security, and ensure the sustainability of the seafood industry.



Button-type data loggers (left) for temperature monitoring in the cold chain pilot trials (right)

Following to the Regional Workshop on Cold Chain Management for Seafood which was organized at the end of 2015, where basic knowledge and skills needed for implementing and monitoring the supply cold chain for seafood were extended to the AMSs, many countries started undertaking cold chain pilot trials in 2016. Myanmar, Philippines, and Singapore began the cold chain pilot trials and submitted their first quarterly progress reports to MFRD, while Indonesia and Viet

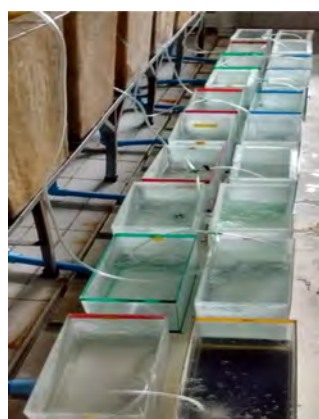
Nam were still starting their pilot trials in October 2016. The other participating countries are still in the process of implementing their respective pilot trials. The results and data of the pilot trials would be a useful resource when developing the generic guidelines on cold chain management for the seafood industry in the Southeast Asian region.

2.3 Reinforcement and Optimization of Fish Health Management and Effective Dissemination in the Southeast Asian Region: Accelerating Awareness on Fish Health Management in Southeast Asia

There is an increasing need in the Member Countries for information dissemination and technology transfer, especially in developing countries in terms of fish health management. Present and emerging aquatic animal diseases have seriously affected several aquafarmers, hindering the sustainable development of aquaculture in the region. Realizing that global market has become more stringent for exporting countries like the Southeast Asian countries, it is highly recommended that useful information such as precautions of potential diseases outbreak and recommendations on appropriate fish health management be disseminated promptly and appropriately to important stakeholders. Building the capacity of Member Countries with emphasis on resource-deprived countries and innovative research to guarantee food safety and sustainable production are therefore crucial. Hence, this project is being implemented with the objectives of 1) developing and accelerating dissemination of effective fish and shrimp health management strategies; 2) enhancing the efficacy of vaccine treatment in tropical cultured species; 3) establishing protective measures against persistent and emerging parasitic diseases of tropical fish; 4) identifying the risk factors and developing protective measures against Early Mortality Syndrome (EMS); and 5) extending and demonstrating technology to practitioners and aquatic animal health officers from Member Countries.

Determination of threshold infection levels for WSSV, AHPND, and VNN at different age/weight ranges

Viral and bacterial diseases such as the viral nervous necrosis (VNN), WSSV and AHPND have caused major constraints in marine fish and shrimp farming in many Asian countries. Early detection of these devastating pathogens is the most efficient response to be able to implement immediate and appropriate interventions to control the spread of infection. Hence, in shrimps, efforts were continued to determine the threshold infection levels of WSSV and VNN using q-PCR and expression of proteins as to the production of toxins and determination of toxicity due to the differential production of toxins A and B of AHPND.



Shrimp injected with WSSV in the 4th and 5th body segments (above); injected shrimps were placed separately in aquarium supplied with aerated and UV sterilized seawater (right)

Evaluation of the efficacy of dsRNA treatments in protecting shrimp against WSSV

Tests were also initiated to determine the efficacy of a combined recombinant protein and dsRNA as antiviral treatment against WSSV. In the first half of 2016, dsRNA was produced following protocols recommended by the Cold Spring Harbor Laboratory (CSHL), New York, USA. The time to reach 100% mortality significantly differed although all challenged shrimp eventually died. The challenge experiment will be repeated to test the specificity of gene silencing.

Evaluation for the field efficacy of previously developed formalin-inactivated NNV vaccine

For high value marine fish, experiments were continued to enhance the vaccine efficacy for the prevention of viral nervous necrosis. Part of this initiative include the investigation on field efficacy of the inactivated nervous necrosis virus (NNV) vaccine in pompano reared in floating net cages at AQD's Igang Marine Station in Guimaras Province. Determination of NNV-neutralizing antibody titer in the sera of fish is also ongoing. Concomitant to previous tank studies, it is anticipated that the inactivated NNV vaccine will be likewise immunogenic in activating the production of potent NNV-neutralizing antibodies against viral nervous necrosis in pompano reared in floating net cages in open sea.

Establishment of protective measures against persistent and emerging parasitic diseases of tropical fishes

With the objective of establishing protective measures against persistent and emerging parasitic diseases of tropical fish, studies were continued to examine and evaluate infected and uninfected fish, correlate the health status of orange-spotted grouper (*Epinephelus coioides*) and develop the index for fish health monitoring. The efficacies of garlic-based treatments against infection with gill monogenean, *Pseudorhabdosynochus lantauensis* in groupers were also tested. The median lethal concentration (LC_{50}) of crude garlic extract to grouper at 24, 48, 72 and 96 h of exposure were 6.24, 5.94, 5.15 and 3.66 ml/L, respectively. Experiments on the effect of garlic extract on in vitro parasite survival and the efficacy of bath treatment of infected fish using garlic extract are also ongoing.

Epidemiology of the Early Mortality Syndrome (EMS)/Acute Hepatopancreatic Necrotic Disease (APHND)

In response to the pressing concern of the AMSs on the outbreaks of transboundary diseases particularly on shrimps, AQD continued to investigate the epidemiology of the EMS. Preliminary studies were done to determine the efficacy of water stocked with siganid (SGW) for four weeks against AHPND using two age groups of *P. monodon*, 120 and 150 days of culture. In 120 days of culture group, survival rates in infected (97.12%) and uninfected shrimp (97.08%) maintained in SGW were significantly higher ($P < 0.05$) than the infected group (90.42%) maintained in UV sterilized seawater (UVSW). Survival rate in uninfected shrimp maintained in UVSW was 95.95%. Older *P. monodon* (> 130 days of culture), may not be susceptible to VP_{AHPND} . Also, bacterial isolation was done on the mucus and feces of siganid. All six isolated bacteria and the mucus *per se* did not have antimicrobial activity against VP_{AHPND} . However, antimicrobial activity was observed in the feces.

As part of the Project, the “Regional Technical Consultation on EMS/APHND and Other Transboundary Diseases for Improved Aquatic Animal Health in Southeast Asia” was organized with funds provided by the Government of Japan (Japan-ASEAN Integration Fund) in the Philippines on 22-24 February 2016. Over 60 delegates from AMSs, Japan, regional and international organizations, and the private sector attended the meeting which aimed to assess the status of AHPND in the AMSs, identify gaps and priority areas for R&D collaboration, and formulate regional policy recommendations to support aquatic animal health.



Participants in the RTC on EMS/APHND and other Transboundary Diseases for Improved Aquatic Animal Health in Southeast Asia in the Philippines on 22-24 February 2016

Technology extension and demonstration: Capacity building of SEAFDEC Member Countries



AQD scientist (right) and a trainee from Myanmar (left) during the practical session of the On-site Training on Bacteriological Techniques in Myanmar

In an effort to continue building the capacity of SEAFDEC Member Countries on aquatic animal health, AQD conducted a follow-up training course on bacteriological techniques, *i.e.* isolation, characterization, and, bioassay, in Myanmar with participants comprising fish health officers, as well as faculty and graduate students from Yangon University. Guided research was part of the training wherein the fish health staff of the Department of Fisheries of Myanmar, as one of the trainees, prepared research proposals which may be submitted to the Department or other funding agencies for possible funding. Meanwhile, after the on-site training course on fish parasitology organized in Cambodia, cooperation arrangements were made for publication of a manual on important parasitic fauna of freshwater fish species in Cambodia in 2017.

THRUST 3. IMPROVING MANAGEMENT CONCEPTS AND APPROACHES FOR SUSTAINABLE FISHERIES

3.1 Promotion of Fisheries Management and Combating IUU Fishing

MFRDMD has implemented since 2013 the project “**Combating IUU Fishing in the Southeast Asian Region through Application of Catch Certification for International Trade in Fish and Fishery Products**” to address concerns on IUU fishing. Under this Project, problems encountered by the AMSs in complying with the requirements of EC Regulation 1005/2008 were reviewed and based on the 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.”

The “ASEAN Guidelines for Preventing the Entry of Fish and Fishery Product from IUU Fishing Activities into the Supply Chain” developed under this Project was endorsed by the SEAFDEC Council in 2015, the Twenty-third Meeting of the ASEAN Sectoral Working Group on Fisheries (ASWGF_i) and the Thirty-seventh Senior Officials Meeting of ASEAN Ministers on Agriculture and Forestry (SOM-AMAF). The endorsed Guidelines has served as basis for the AMSs in formulating relevant policies and provided an enabling environment for a clear direction and understanding of the need to prevent the entry of IUU fish and fishery products into the supply chain. The AMSs were also encouraged to develop and/or strengthen their respective strategies and measures for immediate implementation of the Guidelines. For its part, MFRDMD would continue to support the AMSs during the promotion of the Guidelines at the national level.

Activities under this Project in 2016 focused on dissemination of the Guidelines and supporting its implementation through the development of effective and practical national implementation plans, taking into consideration the circumstances in fishing and trading of fish and fishery products in the respective countries. In this regard, MFRDMD organized the “Regional Technical Consultation on Promotion of ASEAN Guidelines for Preventing the Entry of Fish and Fishery Products from IUU Fishing Activities into the Supply Chain” on 7-9 March 2016 in Kuala Lumpur, Malaysia. During the Consultation, inputs from countries on fisheries management currently carried out and the issues encountered with respect to the “different forms of IUU fishing” indicated in the Guidelines were reviewed. Recommendations for implementation of the Guidelines were also compiled, while the



RTC on Promotion of ASEAN Guidelines for Preventing the Entry of Fish and Fishery Products from IUU Fishing Activities into the Supply Chain in Kuala Lumpur, Malaysia on 7-9 March 2016

countries' action plans to combat IUU fishing by preventing the trade of fish and fishery products from IUU fishing activities were also discussed and harmonized.

TD also implemented the project **“Promotion of Countermeasure to Reduce IUU Fishing”** as part of SEAFDEC initiatives in combating IUU fishing in the Southeast Asian region. Under this Project, the Regional Fishing Vessels Record (RFVR) was developed through collaborative initiative of AMSs in sharing information among countries on vessels engaged in “international fishing operations” which refers to fishing operations in foreign country’s Exclusive Economic Zone (EEZ) or in the high seas, so that related authorities of AMSs could check and take corrective actions against inappropriate operations of its fishing vessels, thereby supporting the elimination of IUU fishing in the region. In 2013, the development of the RFVR for fishing vessels 24 meters in length and over was endorsed by the SEAFDEC Council and the Thirty-fourth Special SOM-AMAF Meeting, and subsequently the AMSs agreed to provide information required for the RFVR, *e.g.* fishing vessels identification and other relevant data. In 2016, TD continued to update the RFVR Database using the data provided by the AMSs. To promote this initiative and enhance the utilization of the Database for combating IUU fishing, discussions were made during the year on the possibility of sharing the RFVR Database with non-AMSs; however, the guidelines or protocols for such data access still need to be developed.

Under the same Project, TD also commenced in 2016 the implementation of activities that aim to enhance regional cooperation to support the implementation of Port State Measures (PSM). The “Experts Meeting on Regional Cooperation to Support the Implementation of Port State Measures in Southeast Asian Region” was convened from 2 to 4 February 2016 in Bangkok, Thailand, where issues and the required support for the implementation of PSM in the region were discussed. As an output of the Meeting, the developed concept note on future activities was subsequently supported by the Forty-eighth Meeting of the SEAFDEC Council and the Twenty-fourth Meeting of the ASWGFi in 2016. TD also organized the “Workshop on Regional Cooperation for Implementation of Port State Measures to Improve Fisheries Management and Reduce IUU Fishing in Southeast Asia” from 7 to 10 November 2016 in Bangkok, Thailand. This Workshop facilitated better understanding on the implications of the Port State Measures Agreement (PSMA) in the region. Recently put into force as a legally-binding instrument, the PSMA was discussed during the Workshop



Experts Meeting on Regional Cooperation to Support the Implementation of Port State Measures in the Southeast Asian Region in Bangkok, Thailand on 2-4 February 2016



Workshop on Regional Cooperation for Implementation of Port State Measures to Improve Fisheries Management and Reduce IUU Fishing in Southeast Asia in Bangkok, Thailand on 7-10 November 2016

which also identified the issues in the PSMA that are relevant to the region, and the constraints and problems on PSM implementation, while the list of capacity building needs to support PSM implementation was established as well as the SEAFDEC work plan to support the implementation of PSM in the region.

Another milestone for regional cooperation in combating IUU fishing was the conduct of the “High-level Consultation on Regional Cooperation in Sustainable Fisheries Development Towards the ASEAN Economic Community,” the proposal of which was approved by the Forty-seventh Meeting of the SEAFDEC Council in 2015. While proceeding with the preparations for this High-level Consultation, the SEAFDEC Secretariat organized the Stakeholders’ Consultation on 1-2 March 2016; and subsequently the Drafting Committee Meeting on 3-4 March 2016, in Bangkok, Thailand. The draft Joint Declaration was developed and submitted for consideration by the SEAFDEC Council at its Forty-eighth Meeting and the ASWGFi at its Twenty-fourth Meeting in 2016. As the final activity, the “High-level Consultation on Regional Cooperation in Sustainable Fisheries Development Towards the ASEAN Economic Community: Combating IUU Fishing and Enhancing the Competitiveness of ASEAN Fish and Fishery Products” was convened on 3 August 2016 in Bangkok, Thailand. During the High-level Consultation, officials of the ASEAN-SEAFDEC Member Countries endorsed the “Joint ASEAN-SEAFDEC Declaration on Combating IUU Fishing and Enhancing the Competitiveness of ASEAN Fish and Fishery Products” to be implemented by the ASEAN-SEAFDEC Member Countries. It was also agreed that AMSs and SEAFDEC, with support from donors and collaborating partners, should strengthen their efforts to implement programs that aim to combat IUU fishing and enhance the competitiveness of ASEAN fish and fishery products.

3.2 Management of Fishing Capacity

Activities toward management of fishing capacity in the Southeast Asian region were undertaken by SEAFDEC in response to the request of the AMSs during the Twenty-second Meeting of the ASWGFi in 2014. In principle, management of fishing capacity focuses not only on the management of “fish” but also in regulating fishing efforts by providing schemes that give direction on where and how to fish, total number of vessels allowed to fish, and the types of gear that could be used in fishing which should be balanced with the available fishery resources.

In line with such directives, the draft Regional Plan of Action on the Management of Fishing Capacity (RPOA-Capacity) was developed by SEAFDEC and the AMSs through a series of consultations in 2015. To proceed with the finalization of the RPOA-Capacity, the final Draft RPOA-Capacity and template for the development of National Plan of Action for Management of Fishing Capacity (NPOA-Capacity) was submitted for endorsement during the Forty-eighth Meeting of the SEAFDEC Council as well as the Twenty-fourth Meeting of the ASWGFi in 2016. Subsequently, the RPOA-Capacity was adopted by the Thirty-eighth Meeting of AMAF to be used as guide for the management of fishing capacity in the region, and as reference for the development of respective countries’ NPOA-Capacity in the future.

3.3 Management of By-catch from Fisheries

Trawl fisheries is one of the most common fishing operations in the Southeast Asian region, targeting multi-species of catch and resulting in concerns on by-catch, discards, and the sustainability of the fishery resources. The project “**Strategies for Trawl Fisheries By-catch Management**” (REBYC-II CTI Project) was therefore initiated in 2012 with TD as the Regional Facilitation Unit (RFU) to work closely with the FAO Project Regional Coordinator in the implementation of the Project. The Project aims to contribute to the more sustainable use of fishery resources and healthier marine ecosystems in the Coral Triangle and Southeast Asian waters by reducing by-catch, discards, and fishing impact by trawl fisheries; which could be achieved through implementation of trawl fisheries by-catch management plan in each pilot site in five participating countries, namely: Indonesia, Papua New Guinea, Philippines, Thailand and Viet Nam. Although the Project was originally scheduled to be completed in 2015, the implementation of the activities had been extended to 2016 with a view of concluding the final results of the project implementation.

The Project convened the “REBYC-II CTI Project Steering Committee Meeting 2016” on 8 June 2016 in Bangkok, Thailand, followed by the REBYC-II CTI Project Lesson Learnt Workshop on 9-10 June 2016. Moreover, the “Southeast Asia Trawl Fisheries Round-table Meeting” and the “Regional Meeting on the Future of Trawl Fisheries Management in Southeast Asia” were convened on 21 and 23-25 September 2016, respectively, in Bangkok, Thailand. These Meetings came up with case studies and good practices of trawl fisheries management in REBYC-II CTI participating countries and policy recommendations for trawl fisheries management in Southeast Asia, as well as a summary of future projects on developing sustainable trawl fisheries in Southeast Asia.

Under this Project, emphasis was also given on the socio-economic aspects in trawl fisheries as a major part of trawl fisheries management plan under the human well-being and governance component through strengthening of ecological well-being. In addition, fishing gear experiment and zoning management were also undertaken to support the participating countries in trawl fisheries management.

3.4 Promotion of Ecosystem Approach for Fisheries Management (EAFM)

Also under the **REBYC-II CTI Project**, SEAFDEC continued to promote the application of the concept of Ecosystem Approach for Fisheries Management (EAFM), as well as strengthen the interaction between trawling and other fishing activity with various stakeholders.

Specifically, the Project supported the development of Essential Ecosystem Approach to Fisheries Management (E-EAFM) Leaders, Executives and Decision Makers (LEAD) Materials to enhance the understanding of leaders and policy makers on the EAFM concept. The “Regional Workshop on Piloting E-EAFM LEAD Materials” was organized on 27-29 June 2016 in Rayong Province, Thailand; followed by the “EAFM Leader Writeshop on Material Finalization for Leaders, Executives and Decision Makers (LEAD)” on 10-14 October 2016 in Bangkok, Thailand. Through the Writeshop, the Project came up with complete materials on EAFM such as brochure, conversation and animation, video clip, poster, PowerPoint presentations, etc., which could be used to make leaders and policy makers better understand the importance of EAFM.



EAFM Leader Writeshop on Material Finalization for Leaders, Executives and Decision Makers (LEAD) in Bangkok, Thailand on 10-14 October 2016



EAFM High-Level Consultation for Leaders, Executives and Decision Makers (LEAD) in Viet Nam on 17-18 November 2016

The “EAFM High-Level Consultation for Leaders, Executives and Decision Makers (LEAD)” was subsequently organized in Viet Nam and Philippines on 17-18 and 25-26 October 2016, respectively. The EAFM concept and LEAD EAFM toolkit were introduced and presented to impart knowledge and enhance the understanding of participants who are leaders, executives and decision-makers in the fisheries and other sectors. Their understanding and support to EAFM through improved planning and implementation to achieve sustainable fisheries management are the ultimate expected outputs of these two activities.

In addition, promotion and awareness building on trawl fisheries management issues and how these relate to sustainability, and identification of measures to make fishing more responsible, were promoted as important components of the EAFM project. Training and workshop sessions were also organized for various stakeholders, *e.g.* fishers, private sector, policy makers, fisheries managers, government officials, extension officers, and NGOs, to enhance their knowledge on best management practices and responsible trawl fisheries. The “Training on Fisheries Management for Thailand Fishery Officers” was organized in Rayong Province and Songkhla Province on 1-4 and 15-18 November 2016, respectively, to build the capacity and enhance knowledge of various stakeholders on the principles of fisheries management and fishing gear technology. The Training focused on the status of fisheries and management at the national and regional levels, fishing gear materials, classification of fishing gears, and basic fishing gear construction and design through fishing operations. The Training also supported the undertakings of Port In-Port Out Control (PIPO), which is one of the important measures adopted in Thailand to combat IUU fishing, focusing on vessels over 30 gross tons.



Training on Fisheries Management for Thailand Fishery Officers in Rayong Province on 1-4 November 2016 and in Songkhla Province, Thailand on 15-18 November 2016



Training of Trainers on E-EAFM in Champasak, Lao PDR on 25-29 April 2016



Training on E-EAFM in Siem Reap, Cambodia on 5-10 September 2016

For the promotion of the EAFM concept at the national level, SEAFDEC conducted the “Training of Trainers on Essential Ecosystem Approach to Fisheries Management (E-EAFM)” on 25-29 April 2016 in Lao PDR; on 23-27 May 2016 in Thailand; and on 27 June-1 July 2016 in Myanmar. For Cambodia, Training on E-EAFM was also organized for Cambodian officers on 5-10 September 2016, which was followed by the Training of Trainers on 27-30 September 2016.

3.5 Promotion of the Fisheries *Refugia* Concept

The South China Sea is a global center of shallow water marine biological diversity that supports significant fisheries that are important to food security and export incomes of the Southeast Asian countries. Consequently, all inshore waters of the South China Sea basin are subject to intense fishing pressure. With fish production being intrinsically linked to the quality and area of habitats and the heightened dependence of coastal communities on fish, a need exists to improve the integration of fish habitat considerations and fisheries management in the region.

Taking into consideration the aforementioned circumstances, TD embarked in 2016 a 5-year project “Establishment and Operation of a Regional System of Fisheries *Refugia* in the South China Sea and Gulf of Thailand” with the specific objective of “*operating and expanding the network of fisheries refugia in the South China Sea and Gulf of Thailand for improved management of fisheries and critical marine habitats linkages in order to achieve the medium and longer-term goals of the fisheries component of the Strategic Action Programme for the South China Sea.*”



To start-off, the “Project Inception Meeting” was organized on 1-3 November 2016 in Bangkok, Thailand to introduce and discuss the Project goals, objectives, management framework, strategy, and plan, in order to enhance the understanding of concerned countries on the Project implementation.

Fisheries Refugia Project Inception Meeting in Bangkok, Thailand on 1-3 November 2016

Initially, information and data collection would be undertaken on fisheries and coastal habitats of 14 priority fisheries *refugia* sites to serve as basis for conducting future activities, *e.g.* facilitating agreement among stakeholders on the boundaries of fisheries *refugia*; developing Community-Based Management Plans for the sites; establishing operational management for the sites; and strengthening the participation of civil society and community organizations in the management of these 14 fisheries *refugia* sites. Subsequently, activities would continue on improving the management of critical habitats for fish stocks of transboundary significance via national and regional actions to strengthen the enabling environment and knowledge-base for fisheries *refugia* management in the South China Sea.

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 the marine fishery resources in their respective waters. TD carried out the surveys through its projects “**Fisheries Resource Survey and Operational Plan for M.V. SEAFDEC 2**” and “**Offshore Fisheries Resources Exploration in Southeast Asia.**”

In 2016, TD collaborated with the Government of Malaysia in undertaking the “National Demersal Research Survey in the East Coast of Peninsular Malaysia” using the M.V. SEAFDEC 2 from 5 May to 9 July 2016. The survey was aimed at obtaining the current biomass of fish stocks as well as their potentials (Maximum Sustainable Yield or MSY) for formulation of proper management plans of the resources and its demersal trawl fisheries. In line with these objectives, the activities included sampling of demersal species using bottom otter board trawl with 160 operations, oceanographic data collection at 51 stations using conductivity, temperature, and depth (CTD) Rosette, Vandorn bottle sampler, and collection of benthic macro-invertebrate community using Smith-Mcintyre Grab.



Activities during the national demersal research survey in Malaysia



Activities were also undertaken by TD to improve fish handling at sea through the “Regional Training Course on Fish Handling Techniques Applicable to Various Fishing Operations in Southeast Asia” on 22-26 August 2016 at TD in Samut Prakan, Thailand. Appropriate environment-friendly fish handling tools and simple techniques applicable to maintaining the quality of the catch were extended to the participants of the training. Awareness building on the reduction of post-harvest losses for fisheries, promoting food safety, and minimizing post-harvest losses in catching, storing, and transportation processes of fish were also a major part of the training course.



RTC on Fish Handling Techniques Applicable to Various Fishing Operations in Southeast Asia at SEAFDEC/TD, Samut Prakan, Thailand on 22-26 August 2016

4.2 Regional Cooperation for Tunas Fisheries Management

Recognizing that the management of oceanic tunas is already covered by relevant RFMOs, the regional cooperation for management of tunas in the region focused on neritic tunas, which are abundant in the Southeast Asian waters. The “**Regional Plan of Action on Sustainable Utilization of Neritic Tunas in the ASEAN Region (RPOA-Neritic Tunas)**” developed by SEAFDEC in collaboration with the Member Countries was endorsed by the SEAFDEC Council at its Forty-seventh Meeting and the ASEAN through its Twenty-third ASWGF Meeting in 2015. The RPOA-Neritic Tunas serves as regional framework and platform for cooperation among countries in the region in coming up with better information on the status of neritic tuna resources to be used as basis for sustainable utilization of the resources in the future. The Scientific Working Group (SWG) for Stock Assessment on Neritic Tunas in the Southeast Asian Region was also endorsed by the Forty-seventh Meeting of the SEAFDEC Council to provide technical and scientific advice particularly on the current status of neritic tuna resources and policy consideration needs to the SEAFDEC Council for the improvement of fisheries management in Southeast Asia.

The “Special Training/Workshop on Stock Assessments of Longtail Tuna and Kawakawa in the Southeast Asian Region” organized by SEAFDEC Secretariat and MFRDMD on 17-25 April 2016 in Kuala Terengganu, Malaysia focused on Catch Per Unit Effort (CPUE) standardization and stock assessment analysis using specific software for stock assessment analysis, *e.g.* CPUE standardization by GLM, ASPIC and Kobe Plot using sample data provided by the participating Southeast Asian countries. Subsequently, SEAFDEC Secretariat convened the “Third Meeting of the Scientific Working Group on Stock Assessment of Neritic Tunas” on 27-29 June 2016 in Chonburi Province, Thailand, where discussions were made on the results of the stock assessment of longtail tuna and kawakawa in some AMSS based on the

respective countries' data compilation of neritic tunas production as well as catch and effort. The Meeting also reviewed the biological and ecological aspects, and developed plans for genetic studies of neritic tunas in the region. The SWG agreed on the results from the stock assessment of longtail tuna and kawakawa in two sub-regions, the Pacific Ocean and the Indian Ocean. In addition, the SWG also agreed with the draft policy recommendations on improvement of fisheries management and data collection to better understand the status of neritic tuna resources in Southeast Asia.



Special Training/Workshop on Stock Assessment of Longtail Tuna and Kawakawa in the Southeast Asian Region in Kuala Terengganu, Malaysia on 17-25 April 2016



Third Meeting of the Scientific Working Group on Stock Assessment of Neritic Tunas in Chonburi Province, Thailand on 27-29 June 2016

Following up the results of the stock assessment of longtail tuna and kawakawa, MFRDMD in collaboration with SEAFDEC Secretariat organized the “Workshop on Management of Longtail Tuna and Kawakawa Resources in the Southeast Asian Region and Development of Ecosystem Approach to Fisheries Management (EAFM) as Alternate Approach” on 19-21 December 2016 in Kuala Lumpur, Malaysia with the overall objective of developing the appropriate model of Ecosystem Approach for Neritic Tunas Fisheries Management (EAFM-Neritic Tunas). The Workshop introduced the lessons learned from EAFM in Malaysia and how to apply EAFM for neritic tunas. A highlighted output of this Workshop was the management recommendations based on the risk assessments of longtail tuna and kawakawa in the Southeast Asian sub-region of the Pacific Ocean and Indian Ocean. The detailed work plan for the genetic study of the species and data preparation for seer fish stock assessment in 2017-2018 was also discussed and agreed upon.



Workshop on Management of Longtail Tuna and Kawakawa Resources in the Southeast Asian Region and Development of EAFM as Alternate Approach in Kuala Lumpur, Malaysia on 19-21 December 2016

4.3 Small Pelagic Fisheries Management

Small pelagic fishes such as the Indian mackerel, scads, and sardinella are very important in the Southeast Asian region in contributing to food security, as well as providing employment and livelihood opportunities to a large number of fishers. Purse seine is one of the major fishing gears used in catching these small pelagic fishes. However, sustainable management of the region's purse seine fisheries has not yet been established because information on stocks and biological characteristics are lacking. MFRDMD therefore implemented the project “**Comparative Studies for Management of Purse Seine Fisheries in the Southeast Asian Region**” since 2013 to compile and compare data on CPUE available in the Southeast Asian region during the past three decades to examine the trends and status of stocks generally exploited by purse seine fisheries. Under this Project, MFRDMD also reviewed the purse seine fisheries management systems including Total Allowable Catch (TAC) and Total Allowable Effort (TAE) to examine the applicability of such systems for management of small pelagic fisheries in the region. Genetic study of spotted sardinella (*Amblygaster sirm*) as small pelagic fish targeted by purse seine, was also conducted as part of this Project.



Core Experts Meeting on Comparative Studies for Management of Purse Seine Fisheries in the Southeast Asian Region in Kuala Lumpur, Malaysia on 9-11 August 2016

MFRDMD organized the “Core Experts Meeting on Comparative Studies for Management of Purse Seine Fisheries in the Southeast Asian Region” on 9-11 August 2016 in Kuala Lumpur, Malaysia, where the latest information about landings and CPUEs of purse seine fisheries in the region were shared, while comparison in the application of TAC, TAE, and other management options as well as the data required

were also made. A preliminary result of the genetics study on *A. sirm* was also presented at the Meeting. The genetic samples of *A. sirm* collected by participating countries were analyzed, and the preliminary result based on four sampling locations, namely: Muara (Brunei Darussalam); Kuantan (West Malaysia); Kudat (Sabah, East Malaysia); and Songkhla (Thailand), showed that *A. sirm* in South China Sea is a single evolutionary unit and therefore can be regarded as a single conservation unit for the management of sustainable fisheries.

4.4 Research and Management of Sharks and Rays

During the past decades, several species of marine animals had been considered under international concern for conservation, which include sharks and rays, leading to 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 in the CITES Appendices. It has therefore become necessary for the Southeast Asian region to come up with justifications to avert the proposals to list shark and ray species in the CITES Appendices. In this connection, MFRDMD implemented the project

“Research for Enhancement of Sustainable Utilization and Management of Sharks and Rays in the Southeast Asian Region” from 2015 to 2019 in seven participating countries, namely Cambodia, Indonesia, Malaysia, Myanmar, Philippines, Thailand, and Viet Nam. In addition to the aforementioned Project, TD and MFRDMD jointly implemented the project **“Improvement of Data Collection of the Commercially Exploited Aquatic and Threatened Species,”** aimed at assisting the countries to collect relevant landing data from their respective waters and coming up with regional picture that could serve as basis for reporting catch and landing in their national fisheries statistics at species level thus, facilitating international trade of sharks and rays in the future.

As part of the workplan for a one-year data collection from 2015 to 2016 in the participating countries, the Standard Operating Procedures (SOPs) on sharks and rays data collection previously agreed among the participating countries was introduced during the “National Workshop on Validation of Sharks and Rays Landing Data” in Yangon, Myanmar from 9 to 11 February 2016, which was attended by local enumerators in selected sharks and rays landing sites in Mawlamyine and Yangon. The specific objective of this Workshop was to follow up the one-year data collection of Myanmar by validating the data collected from selected landing sites by the local enumerators based on the regionalized format for sharks and rays data record and analysis. Subsequently, the “Training on Elasmobranch Taxonomy” was also organized in Vung Tau, Viet Nam on 23-27 May 2016 with the objective of providing knowledge and experience to those who are responsible for collecting sharks and rays landing data, as well as training the ‘trainers.’ The lectures given were on the taxonomy and biology of elasmobranches, and the participants were guided to identify fresh specimens of sharks, rays and skates as well as understand the SOPs for collecting tissue samples for DNA analysis. Moreover, results of the one-year data collection carried out in two provinces of Viet Nam, Binh Thuan and Vung Tau, were also validated during the training course. To support future data collection, the field guides on sharks and rays species identification would be translated into the Vietnamese and Cambodian languages. To review the data collection undertaken by the participating countries, the “Mid-term Shark Data Collection Project Meeting” was organized on 21-23 June 2016 in Chonburi Province, Thailand.



National Workshop on Validation of Sharks and Rays Landing Data in Yangon, Myanmar on 9-11 February 2016



Training on Elasmobranch Taxonomy in Vung Tau, Viet Nam on 23-27 May 2016

During the second half of the year, the Project focused on supporting the participating countries in the development of Non-Detriment Findings (NDFs) for sharks and rays. With support provided by SEAFDEC, Malaysia and Indonesia organized the “Workshop on CITES Species Non-Detriment Findings (NDFs)” in Sandakan, Malaysia on 21-22 July, and subsequently in Jakarta, Indonesia on 26- 27 July 2016. In both cases, the 2015-2016 data as well as previous data on mobula rays (*Mobula* spp.) and scalloped hammerhead sharks (*Sphyrna lewini*) of Malaysia and Indonesia were used. From the exercise, Indonesia was able to fulfill the steps required for the development of national NDFs ‘with condition’ for mobula rays and scalloped hammerhead sharks. Nevertheless, Indonesia still needs to implement several management measures as presented during the Workshop before NDFs recommendation could be made. For Malaysia, however, the country still needs to collect more landing data to fulfill the requirements specified in Germany’s NDFs. The plan of SEAFDEC is to develop the SOPs for NDFs which should be made available by the end of 2016. However due to some problems, the guidelines will be prepared in 2017 and be ready by the end of 2017. The Workshop also recommended that SEAFDEC should initiate a regional workshop to discuss and develop regional guidelines on the development of NDFs for the Member Countries.



Workshop on CITES Species Non-Detriment Findings (NDFs) in Jakarta, Indonesia on 26- 27 July 2016

Before the end of 2016, the “Project-End-Meeting on Sharks Data Collection in Southeast Asia” was organized in Quezon City, Philippines on 18-20 August 2016. The Meeting reviewed the results of the one-year collected data on catch and landing at the selected sites, and discussed the preparation of the final technical report . Analysis on CPUE and relevant biological data analysis at regional level would be incorporated in the full report of the one-year data collection. Meanwhile, total fishing efforts data would

be included in the Standard Operating Procedures (SOPs) on Sharks Data Collection in Southeast Asia. As reported, the final report of the one-year data collection would be available by the second quarter of 2017.



Project-End-Meeting on Sharks Data Collection in Southeast Asia in Quezon City, Philippines on 18-20 August 2016

Through the implementation of projects in relation to sharks and rays, information could be obtained on the status and trends of the species which are useful for future discussion and negotiation at relevant international fora. This way, it could be assured that the regional situation is properly reflected, while capacity in the development of NDF document would be enhanced as this would facilitate international trade of species being listed under the CITES Appendices in the future.

4.5 Conservation and Management of Eel Resources

Catadromous eels (*Anguilla* spp.) are popular as an important commercial food, due to their nutritional value and preference especially in East Asian countries. The species are also well known for their unique catadromous life history. As population of temperate eels has dramatically decreased due to habitat destruction, overexploitation, and other environmental conditions; tropical eels become more important in the market during the recent years, resulting in drastic increase in capture of glass eels (juvenile stage of eels) in tropical areas. While several eel species, e.g. *A. anguilla* and *A. japonica*, had already been listed in the CITES Appendices with a view of assuring that the species would not decrease through international trade, concern was expressed on the possibility of listing commonly found eel species in the Southeast Asian region, i.e. *A. bicolor* as “near threatened” and *A. marmorata* as “least concern” that are already included in the IUCN Red list, in the CITES Appendices in the future. Some countries have however enforced various measures to avoid the over exploitation of eel resources, i.e. prohibiting the export of eel seeds less than 150 g in Indonesia, or smaller than 15 cm in the Philippines. Similar policies to prohibit export of eel seeds are also enforced in other countries.

The project “**Enhancement of Sustainability of Catadromous Eel Resources in Southeast Asia**” was implemented by IFRDMD in 2015 with a view of enhancing the sustainability of anguillid eel resources in Southeast Asia. Considering that lack of data and statistics on tropical eel species may bring negative impact to the fisheries sector, the Project therefore aimed to collect information on tropical eels from various sources, including the fishing activities, catch statistics, biological surveys, and from the stakeholders (traders, consumers and so on). Since conservation and management policy issues on the sustainability of tropical eel resources become more important for the region, a balance between utilization and sustainability of tropical eel resources is therefore necessary. Several surveys were conducted in Indonesia and Myanmar in 2016 to obtain information on the present status and recent trends of eel fisheries, resource status, commercial fishing activities, aquaculture, and markets in the AMSs. Specifically, in Indonesia, surveys were conducted on 18-21 January 2016 in Bogor and Palabuhan Ratu, and on 19-21 June 2016 in Solo. In Myanmar, the survey was conducted on 6-10 February 2016 in Yangon and Mandalay.

On 27-29 April 2016, IFRDMD organized the “First Workshop on Enhancement of Sustainability of Catadromous Eel Resources in Southeast Asia,” in Palembang, Indonesia. Attended by scientists and specialists on anguillid eels from the Member Countries, the



Fishing gear used in catching anguillid eels in Myanmar



Discussion on rearing anguillid eels in the farm in Bogor, Indonesia



Discussion on rearing anguillid eels in the laboratory of a university in Solo, Indonesia



First Workshop on Enhancement of Sustainability of Catadromous Eel Resources in Southeast Asia in Palembang, Indonesia on 27-29 April 2016

Workshop identified the important and controversial issues on the present status of eel industry in Southeast Asia. Important recommendations from the Workshop focused on the need for improving data collection, increasing the survival rate of glass eels in culture condition, and compiling existing information on researches conducted, unregulated trade, and restocking and resource enhancement measures.

IFRDMD also participated in regional events to share information with regards to eels, *i.e.* the “Experts Meeting on Assessment of the Proposed Listing of Commercially Exploited Aquatic Species to the CITES Appendix” held in Bangkok, Thailand on 16-17 May 2016. During the Experts Meeting, it was agreed that the AMSs should consider developing the aquaculture of eels; and continue collecting more data on eel species to prepare for the scientific consultation to be organized between the CITES-CoP 17 and CoP 18; and to consider developing traceability of eel species to be qualified for trade. Specifically, while agreeing to collect statistics on catch of juvenile eels, the Meeting participants suggested that a harmonized template of collecting data should be developed in order to obtain good statistics. The Experts Meeting was followed up by the small discussion on anguillid eel resources and their catch statistics on 14-15 December 2016 at IFRDMD in Palembang, Indonesia with resource persons from the Directorate General of Fisheries Resources Management-Ministry of Marine Affairs and Fisheries (DGFRM-MMAF) of Indonesia and Japan International Cooperation Agency (JICA). The Meeting came up with the way forward for developing the template for data collection and the questionnaire for data collection was prepared by IFRDMD and DGFRM-MMAF.

4.6 Improving Information and Statistics Collection for Management of Fisheries

The project “**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 in collaboration with MFRDMD and SEAFDEC Secretariat since 2013 to compile quality fisheries data and information in support of policy planning and management of fisheries. The Project comprises three sub-projects, namely: 1) facilitating fisheries activity information gathering through the introduction of community-based management; 2) improvement of data collection of commercially exploited aquatic and threatened species; and 3) harmonization of fishery statistics in the Southeast Asian region. The first sub-project focuses on the collection of information on small-scale inland and coastal fisheries through community-based management. The second sub-project specifically intends to improve data collection of commercially exploited aquatic and threatened species. The third emphasizes on coordination and support for statistics reporting systems of Member Countries to be able to generate timely regional fishery statistics.

For the first sub-project “*facilitating fisheries activity information gathering through the introduction of community-based management,*” the problems and constraints faced by countries in collecting fisheries data from coastal small-scale and inland fisheries at the national level were reviewed, followed by the conduct of training to facilitate fisheries information gathering through the introduction of community-based resources management or co-management. Under this sub-project, TD continued the promotion of innovative fisheries management approaches including co-management applicable and effective for small-scale, tropical, and multi-species fisheries. In 2016, activities were conducted to support the fisheries officers of the Member Countries including the training on co-management for community fishers’ organizations, and designing of coastal and inland fishery management plans applying the co-management approach. The activities conducted include: 1) On-site Training of Trainers on Data Analysis and Extension to Promote Co-management in Da Nang City, Viet Nam on 15-17 June 2016; 2) Monitoring and Evaluation on Co-management Approach in Chong Khneas Commune, Siem Reap, Cambodia on 21-22 July 2016; 3) Training of Trainers on Facilitating Fisheries Information



Onsite Training of Trainers on Data Analysis and Extension to Promote Co-management in Da Nang City, Viet Nam on 15-17 June 2016



Monitoring and Evaluation on Co-management Approach in Chong Khneas Commune, Siem Reap, Cambodia on 21-22 July 2016



Training of Trainers on Facilitating Fisheries Information Gathering Through Introduction of Co-management and Community-based Fisheries Management: Effective Implementation of Co-management and CBFM in Vientiane, Lao PDR on 19-22 September 2016



Monitoring and Evaluation Co-management in Nam Oon Dam, Sakon Nakhon Province, Thailand on 14-18 November 2016

Gathering Through Introduction of Co-management and Community-based Fisheries Management: Effective Implementation of Co-management and CBFM in Vientiane, Lao PDR on 19-22 September 2016; and 4) Monitoring and Evaluation of Co-management in Nam Oon Dam, Sakon Nakhon Province, Thailand on 14-18 November 2016.

For the second sub-project “*improvement of data collection of the commercially exploited aquatic and threatened species,*” activities were implemented by TD in collaboration with MFRDMD to support the data collection on sharks and rays. For the third sub-project “*harmonization of fishery statistics in the Southeast Asian region,*” SEAFDEC Secretariat continued to coordinate with the Member Countries and relevant organizations to facilitate submission of national statistics for regional and international compilation. Moreover, the structure and contents of the publication “*Southeast Asian State of Fisheries and Aquaculture*” or SEASOFIA was adopted during the Thirty-eighth Program Committee Meeting in 2015. This was then used as a basis for the preparation of inputs from the respective SEAFDEC Departments. During the Seventeenth SEAFDEC Information Staff Program (ISP) Meeting on 25-27 October 2016, the draft inputs were discussed among the SEAFDEC Departments, and the draft outline was subsequently considered by the SEAFDEC Program Committee during its Thirty-ninth Meeting in 2016 with additional inputs provided to improve the publication.

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 the regional and international levels over the past decades, with a number of international instruments including market-driven measures agreed upon and applied by relevant organizations and 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 U.S. Presidential Taskforce on Combating

IUU Fishing and Seafood Fraud; and the more stringent need and emerging instruments for ensuring sustainable utilization of fishery resources of the region. Supported by the SEAFDEC Departments, the SEAFDEC Secretariat implemented the project **“Assistance for Capacity Building in the Region to Address International Fish Trade-related Issues,”** to enhance the understanding and capacity of the Member Countries in addressing the aforementioned issues and requirements. Furthermore, the participation of countries in relevant international fora related to the development of fisheries-related instruments needs to be improved so that the regional specificity of fisheries would be appropriately considered in the development of such instruments and related measures in the future.

SEAFDEC continued to facilitate the development of several guidelines and policy recommendations for the region. The documents that had been developed and endorsed in 2016 include 1) Regional Plan of Action for the Management of Fishing Capacity; 2) Regional Guidelines on Traceability System for Aquaculture Products in the ASEAN Region; and 3) Joint ASEAN-SEAFDEC Declaration on Combating IUU Fishing and Enhancing the Competitiveness of ASEAN Fish and Fishery Products. These documents were endorsed by the SEAFDEC Council at its Forty-eighth Meeting, and subsequently submitted under the ASEAN mechanism and were endorsed by the Twenty-fourth Meeting of the ASWGFi and the subsequent Thirty-eighth Meeting of AMAF in 2016.

As for the ASEAN Catch Documentation Scheme (ACDS), the third draft of ACDS and the Info-graphic on Usages of ACDS in Various Scenarios of Trading of Fish and Fishery Products in ASEAN Region were developed. After discussing the ACDS and accompanying documents, the SEAFDEC Council at its Forty-eighth Meeting in 2016 endorsed the plan to pilot test the ACDS in Brunei Darussalam.

On the proposed listing of commercially-exploited aquatic species (CEAS) into the CITES Appendices at the “Seventeenth Conference of the Parties of the Convention on International Trade in Endangered Species of Wild Fauna and Flora” or CITES-CoP17 in 2016, SEAFDEC conducted and/or participated in the following regional fora:

- Meeting of the ASEAN Experts Group (AEG) on CITES (organized by ASEAN on 24-25 March 2016 in Cambodia)
- Experts Consultation on the Impact of CITES Listing of Sharks and Ray Species in the South and Southeast Asian Region (organized by FAO on 19-20 April 2016 in Penang, Malaysia)
- Experts Meeting on Assessment of the Proposed Listing of Commercially Exploited Aquatic Species to the CITES Appendices (organized by SEAFDEC on 16-17 May 2016 in Thailand)
- Regional Consultation for the Development of Common Position on the Proposed Listing of Commercially Exploited Aquatic Species to the CITES Appendices (organized by SEAFDEC on 19-20 May 2016 in Thailand)
- Regional Joint Preparatory Meetings for CITES-CoP17 and CBD-CoP13 (Asia) (organized by CITES Secretariat on 1-4 August 2016 in Bangkok, Thailand)



Experts Meeting on Assessment of the Proposed Listing of Commercially Exploited Aquatic Species to the CITES Appendices in Thailand on 16-17 May 2016



Regional Consultation for the Development of Common Position on the Proposed Listing of Commercially Exploited Aquatic Species to the CITES Appendices in Thailand on 19-20 May 2016

Through the inputs compiled at the aforementioned events, SEAFDEC developed the “ASEAN-SEAFDEC Common Positions on Inclusion of Commercially-exploited Aquatic Species (CEAS) to the CITES Appendices at CoP17” and submitted the document for policy support during the Twenty-fourth Meeting of the ASWGF, and the SOM-AMAF Meeting in 2016. The document was subsequently used as a basis for the AMSs in expressing their views and positions during the CITES-CoP17 convened on 24 September-5 October 2016 in South Africa.

SEAFDEC also developed in 2016 the two concept proposals: 1) Regional Cooperation for Supporting the Implementation of Port State Measures in the ASEAN Region and 2) Development of the ASEAN Guidelines on Implementation of Labor Standards for the Fisheries Sector. The two proposals were supported by the Forty-eighth SEAFDEC Council and the Twenty-fourth Meeting of ASWGF for implementation by SEAFDEC.

SPECIAL PROJECTS

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

The project “**Fisheries and Habitat Management, Climate Change and Social Well-being in Southeast Asia**” is being implemented by SEAFDEC with support from the Government of Sweden. The original period of the Project was five years, from January 2013 to December 2017, but in 2016, it was extended for two more years as agreed upon by SEAFDEC and the Embassy of Sweden. The Project aims to achieve sustainable use of aquatic resources and reduce the vulnerability of coastal and rural fishing communities in the ASEAN region.

Thus, activities are being implemented to build up the capacity of AMSs to achieve the objectives of 1) integrating habitat and fisheries management and adapting to climate change; 2) improving and strengthening systems for the management of fishing capacity (monitoring, record, and control); and 3) drafting and implementing regional and sub-regional agreements and improvement of policy development processes. The focus areas covered four sub-regions, namely the Gulf of Thailand, Andaman Sea, Sulu-Sulawesi Sea, and the Mekong River Basin. In 2016, the Project continued to support the AMSs in strengthening regional cooperation that emphasized on issues that are critical for improving the management of fishery resources and fishing capacity; combating illegal and destructive fishing; maintaining and conserving the critical habitats; building up the well-being of coastal and rural people; and building the capacity of fisherfolk to mitigate the effects of climate variability in the ASEAN region. Specifically in 2016, the Project put emphasis on the implementation of wide range of activities that lead towards achieving the following three defined output objectives:

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

After facilitating the establishment of bi-lateral agreements and work plans, the project moved ahead with the implementation of activities in four sub-regions. The Gulf of Thailand and Andaman Sea sub-regions have been engaged with direct implementation of activities under this Project, while activities in the other two sub-regions have been undertaken mostly in collaboration with partners, *e.g.* Bay of Bengal Large Marine Ecosystem (BOBLME), Mekong River Commission (MRC), Coral Triangle Initiative on Coral Reefs, Fisheries, and Food Security (CTI-CFF), U.S. Agency for International Development’s Oceans and Fisheries Partnership (USAID Oceans).

Gulf of Thailand Sub-region: In collaboration with TD and MFRDMD, the Project conducted several training courses as requested by the participating countries which comprised part of the agreed action plans. The Project also reviewed the progress on the development and implementation of bilateral and sub-regional agreements.

Andaman Sea Sub-region: Similar to the Gulf of Thailand sub-region, the focus of activities in this sub-area is on monitoring the progress on the bilateral and sub-regional cooperation including implementation of the action plans, and reviewing the progress on the development and implementation of the bilateral and sub-regional agreements. In addition, the Third Meeting of the Andaman Sea sub-region was organized on 18-20 October 2016 in Bangkok, Thailand.



Third Meeting of the Andaman Sea Sub-region in Bangkok, Thailand on 18-20 October 2016

As part of the implementation of activities in these two sub-regions, a number of training courses were conducted in collaboration with TD and MFRDMD. The Training, which aimed to enhance the knowledge and capacity of fishery officers of AMSs on related subjects, included:

Training course on stock assessment:

- Regional Training Course on Stock Assessment – Part I: Basic Knowledge of Fisheries Biology (29 January - 5 February 2016, Rayong Province, Thailand)
- Regional Training Course on Stock Assessment – Part II: Fish Stock Assessment (12-26 March 2016, Samut Prakan Province, Thailand)



Regional Training Courses on Stock Assessment

Training on larval fish identification:

- Regional Training Workshop on Larval Fish Identification and Fish Early-life History Science (Basic course: key to family) (1-13 February 2016, Samut Prakan Province, Thailand)
- Regional Training Workshop on Larval Fish Identification and Fish Early Life History Science (Advanced course: key to species) (4-14 July 2016, Samut Prakan Province, Thailand)



Regional Training Workshop on Larval Fish Identification and Fish Early-life History Science (Basic course: Key to Family)



Regional Training Workshop on Larval Fish Identification and Fish Early Life History Science (Advanced course: Key to Species)

Training on Essential Ecosystem Approach to Fisheries Management (E-EAFM):

- Training of Trainers on E-EAFM for Lao PDR (25-29 April 2016, Champasak, Lao PDR)
- Training of Trainers on E-EAFM for Myanmar (27 June - 1 July 2016, Myanmar)

- Training Course on E-EAFM for Cambodia (5-10 September 2016, Siem Reap, Cambodia)
- Training of Trainers on E-EAFM for Cambodia (27- 30 September 2016, Siem Reap, Cambodia)

Mekong River Basin Sub-region: As the MRC had already drafted the Mekong Basin Wide Fisheries Strategy, the Project in collaboration with MRC therefore organized the “Regional Consultation Stakeholder Workshop on Proposal for a Basin-wide Fisheries Management and Development Strategy” on 11 October 2016 in Siem Reap, Cambodia to finalize the draft Strategy. Advice from the Mekong countries on how the inter-governmental cooperation on fisheries in the Mekong River Basin could be best pursued was also sought during the Twenty-second Meeting of Technical Advisory Body (TAB) to the MRC Fisheries Program, which was organized back-to-back on 12-13 October 2016 also in Siem Reap, Cambodia.

Sulu Sulawesi Sea Sub-region: The Project continued to monitor the progress and program development of the CTI-CFF and USAID Oceans with regards to traceability and monitoring and control of fishing efforts in the Sulu-Sulawesi Sea.

- **Review of laws and regulations**

Starting in 2015, the need to review national laws and regulations was given emphasis, especially those related to fisheries and habitats of countries with transboundary areas, particularly in the Gulf of Thailand and Mekong River sub-regions. This is meant to raise the awareness among concerned stakeholders on the rules and regulations relevant to fisheries and habitat management in each country as basis for joint action.

In 2016, the Project continued to compile the information on fisheries laws and regulations of “Cambodia and Viet Nam” and “Cambodia and Lao PDR,” and planned to compile also those of “Cambodia and Thailand.” This was followed by the dissemination of such information to stakeholders through the conduct of on-site training workshops that aimed to raise their awareness. In addition, an International Legal Expert was contracted in October 2016 to facilitate the conduct of a comparative analysis of the laws and regulations of “Cambodia and Lao PDR,” and “Cambodia and Viet Nam.” When the comparative study was completed in December 2016, the results were discussed during the “Bilateral Workshop on Results of Comparative Study of Laws and Legislations of Cambodia and Lao PDR” on 6-8 December 2016 in Champasak, Lao PDR, as well as during the “Bilateral Workshop on Results of Comparative Study of Laws and Legislations of Cambodia and Viet Nam” on 13-15 December 2016 in Phu Quoc, Viet Nam.



Bilateral Workshop on Comparative Study of Laws and Regulations between Cambodia and Viet Nam in Phu Quoc on 13-15 December 2016

- **Management of transboundary species**

Activities on transboundary species were identified as common priority among the countries bordering the Gulf of Thailand. Such priority was confirmed during the dialogue events organized for Cambodia-Viet Nam (2014), Malaysia-Thailand (2014), and Cambodia-Thailand (2015). The common elements in the work plans for 2015 and 2016 on transboundary species management include 1) raising the understanding on stock assessment, biological parameters, life cycle, schooling behavior, and migration of priority species for the establishment of fisheries resources conservation areas for transboundary species; 2) improving the skills and expertise of involved researchers and officers regarding the application of modern and traditional technologies; and 3) compiling existing data and information to be used in identifying critical habitats and in reversing the degradation of essential habitats through the demarcation of the protected habitats. Moreover, the Working Group on Transboundary Species Management was established.

A set of SOPs on biological parameter surveys which focused on selected transboundary species, including anchovy, Indo-Pacific mackerel and blue swimming crab (AIB Species), was developed in 2015 followed by the conduct of training for researchers and enumerators on data collection based on the SOPs. The Working Group's recommendations included the need for countries to strengthen their fisheries policy and management frameworks with regards to improvements in data collection and stock assessment at the national level. In addition, the countries were requested to consider including data collection and stock assessment in its national fisheries statistical frameworks for the improvement of national fisheries statistics.



Experts Group Meeting on Stock Status and Geographical Distribution of AIB Species in the Gulf of Thailand in Bangkok, Thailand on 22-23 September 2016

Subsequently, during the “Experts Group Meeting on Stock Status and Geographical Distribution of AIB Species in the Gulf of Thailand” on 22-23 September 2016 in Bangkok, Thailand, a number of technical information and papers was presented. The information generated provided the necessary inputs for the formulation and development of joint management plans for the AIB Species in the Gulf of Thailand.

- **Regional cooperation to promote sustainable utilization of neritic tuna resources in Southeast Asian waters**

From the region-wide perspective, the SEAFDEC-Sweden Project has advanced regional dialogues involving government agencies, NGOs, and the private sector on management of neritic tunas in the Southeast Asian waters. The RPOA-Neritic Tunas and the Terms of Reference (TOR) of the SWG for neritic tunas were endorsed during the Forty-seventh Meeting of SEAFDEC Council in April 2015 and at the ASWGF. As the Project progressed

in 2016 and based on the Work Plan proposed earlier, preparations for conducting stock assessment were carried out with the assumption that there are two stocks of neritic tunas in the Southeast Asian waters.

To date, three meetings of the SWG on stock assessment have been conducted in Malaysia in 2014, Viet Nam in 2015 and Thailand in 2016 to review the existing status of neritic tunas and adopt the SOPs for data collection and genetic study. Prior to the conduct of the “Special Training/Workshop on Stock Assessment of Kawakawa (*Euthynnus affinis*) and Longtail Tuna (*Thunnus tonggol*)” on 17-25 April 2016 at SEAFDEC/MFRDMD in Kuala Terengganu, Malaysia, national discussions were held with the Department of Fisheries, Thailand on 1-2 February 2016 and the National Fisheries Research and Development Institute (NFRDI) in the Philippines on 3-4 February 2016 to determine and assess the CPUE for neritic tunas and catch data for kawakawa and longtail tuna.

- **Enhancing traceability of fishery products through e-ASEAN Catch Documentation Scheme**

After the development of the ACDS, Stakeholders Consultation was conducted in March 2016 to introduce the concept and compile the stakeholders’ views for the development of appropriate system of ACDS, in electronic and manual system, to cover the requirements of the SEAFDEC Member Countries. In response to the request of the Southeast Asian countries, SEAFDEC developed the electronic system of ACDS that includes not only commercial fisheries but also small-scale fisheries. Moreover, the Forty-eighth Meeting of the SEAFDEC Council in April 2016 suggested that the electronic system for ACDS (e-ACDS) should be developed in harmony with other existing catch documentation schemes to ensure that this would be acceptable to the EU and US Presidential Task Force, and thus, enhance trading of fish and fishery products from the Southeast Asian region. The SEAFDEC Council also endorsed the proposal to have Brunei Darussalam as a pilot testing country for the e-ACDS.

In order to increase understanding on the application of the ACDS as basis for improved traceability systems and to promote intra-regional and international trade, SEAFDEC compiled information on the Swedish system for traceability of fisheries products and e-catch documentation scheme. This was carried out during a study visit to the Swedish Agency for Marine and Water Management (SwAM) by SEAFDEC officials on 12-16 September 2016 which was also an opportune time for SEAFDEC to strengthen its cooperation with SwAM.

SEAFDEC had conducted the first consultative visit to Brunei Darussalam in August 2016 to compile the basic information and observe the overall traceability procedures of fish and fishery products in the country. As planned, the second consultative visit would be undertaken in January 2017 to introduce the draft e-ACDS and discuss the possibility of establishing a Validation Unit and Competent Authority Unit for issuing the ASEAN/Brunei Darussalam Catch Certificate (ACC).

- **Combating illegal, unreported and unregulated (IUU) fishing**

Public-private consultations were convened in conjunction with various events to strengthen regional cooperation among the AMSs to combat IUU fishing, one of which

was held during the RTC on Labor and Working Conditions in the Fishing Industry. The SEAFDEC-Sweden Project has been cooperating with USAID Oceans in promoting public-private partnerships.

- **Addressing cross-cutting issues**

A number of cross-cutting elements were addressed through the Project in 2016. These included social well-being, gender, diversified livelihood options, climate variability and climate change, labor and working conditions in the fishing sector, and capacity-building in related areas.

Labor and Working Conditions

Issues on labor and working conditions in the fishing sector had been receiving increased attention during 2014 and 2015. In order to address concerns on labor, the SEAFDEC Council during its Forty-seventh Meeting in April 2015 requested SEAFDEC to facilitate the conduct of consultations in the region on improvement of the working conditions including the status of migrant labor. Thus, SEAFDEC in cooperation with International Labour Organization (ILO), the DOF Thailand, the International Collective in Support of Fishworkers (ICSF), and other partners convened the “First Regional Technical Consultation on Labor Aspects within the Fishing Industry in the ASEAN Region” on 25-27 February 2016 in Bangkok, Thailand, and came up with list of recommendations towards addressing labor issues. The RTC identified the challenges that lie ahead in facilitating cooperation and involvement of a range of responsible agencies such as Labor Departments, NGOs, trade unions, and private sector representatives – and in the process of defining suitable and acceptable role for the fisheries agencies of SEAFDEC Member Countries. One of the recommendations from the RTC was the development of ASEAN Guidelines on Implementation of Labor Standards for the Fisheries Sector which was proposed to and received support from the SEAFDEC Council at its Forty-eighth Meeting, and the ASEAN through the Twenty-fourth ASWGFI Meeting in 2016.

Addressing Regional Approach for Small-Scale Fisheries

A majority of fisherfolk in the region is engaged in small-scale fisheries, therefore it is crucial to ensure sustainability for their benefit. With the Code of Conduct for Responsible Fisheries as its backdrop, the “FAO Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication (SSF Guidelines/VGSSF),” had been developed with emphasis on securing sustainable resource use and access rights; securing post-harvest benefits; and securing social, economic, and human rights, among others. Although voluntary in nature, discussions had been carried out on the applicability of the said Guidelines to the Southeast Asian region, such as during the Bali Meeting in August 2015. On the part of SEAFDEC, this issue was discussed in several fora, and in order to follow up the recommendations of the Bali Meeting, SEAFDEC convened a regional dialogue to develop appropriate actions for the implementation of the SSF Guidelines, the “Regional Technical Consultation on Regional Approach to the Implementation of the FAO Voluntary Guidelines for Securing Sustainable Small-Scales Fisheries for Food Security and Poverty Eradication” from 7 to 9 June 2016 in Bangkok, Thailand.



RTC on Labor Aspects within the Fishing Industry in the ASEAN Region in Bangkok, Thailand on 25-27 February 2016



RTC on a Regional Approach to the Implementation of the FAO Voluntary Guidelines for SSF for Food Security and Poverty Eradication in Bangkok, Thailand on 7-9 June 2016

Gender Integration

SEAFDEC has been making advances in gender-related aspects, especially by including the requirements for a balanced gender perspective in all contracts for local level capacity-building implemented since 2015, to ensure the involvement of all community members in its activities. Specifically, reports from the contracted organizations or agencies should include reference to gender balance to ensure that there is gender balance in villages and in the implementation of local level activities. Furthermore, the SEAFDEC-Sweden Project also supported the institutional capacity and raised awareness on gender aspects by conducting the “In-house Training Workshop on Gender Awareness and Gender Mainstreaming in Fisheries Sector” on 26-28 July 2016 in Nakhon Nayok, Thailand. This was aimed at enhancing the knowledge of SEAFDEC staff and ensuring better understanding and awareness on gender aspects, and mainstreaming gender aspects in the fisheries sector throughout the project cycle. Sharing information and enhancing knowledge on related gender aspects were also sustained through the participation of SEAFDEC in regional and international fora that include the “Experts Workshop on Gender-equitable Small-scale Fisheries in the Context of the Implementation of the SSF Guidelines” organized by FAO on 28-30 November 2016 in Rome, Italy.

- **Local level capacity-building through sub-contracted activities**

SEAFDEC being an inter-governmental body is not well placed to directly engage in field level activities that requires long-term engagement. However, in supporting the improvement of livelihoods at the village level, SEAFDEC continued to strengthen the capacity of local communities by engaging local partners through contract arrangements, that are well suited for capacity-building at local or district level. Following the strategy, continued work with local partners was supported in 2016 such as the following:

- **Learning Institute (LI)** for communities and local administration in areas around Tonle Sap and coastal Cambodia including assessments of result of Cambodian fisheries reforms and right-based fisheries;
- **CORIN-Asia Cambodia** for communities and local administrations in Kampot, Kep and Sihanoukville in coastal Cambodia;
- **CORIN-Asia Myanmar** for communities and local administrations in Kawthoung Province in Southeast coastal Myanmar; and

- **Sustainable Development Foundation (SDF) of Thailand** for communities and local administrations in Trat Province, Eastern part of the Gulf of Thailand border of Koh Kong Cambodia.

- **Coordination with international and regional organizations**

Cooperation has been maintained with important regional and international partners, organizations, and relevant institutions to, as suitable, avoid duplication and provide basis for continued sharing of information and secure other inputs as necessary. These organizations and initiatives include: ASEAN and ASEAN Secretariat; FAO Regional Office in Bangkok/APFIC; Mangroves for the Future (MFF)/IUCN; Regional Plan of Action to Promote Responsible Fishing Practices including Combating IUU Fishing (RPOA-IUU); CTI-CFF; USAID, MRC; United Nations Environment Programme/Global Environment Facility/Fisheries *Refugia* (UNEP/GEF/Fisheries *Refugia*); USAID Oceans; and the ILO.

6.2 Oceans and Fisheries Partnership

Asia's fish stocks and coral reefs are at risk because of unsustainable fishing practices that also endanger biodiversity, food security, and livelihoods. The fisheries of Southeast Asia are also in a state of overcapacity as overfishing combined with IUU and destructive fishing practices have seriously impacted the region's fisheries as well as some of the world's most biodiverse marine areas. These impacts result in declining fish catch that continue to threaten regional and global food security, and seriously affecting human welfare.

With this backdrop, TD in collaboration with USAID Oceans developed and promoted the ACDS in the region by aligning this with related national-level efforts. The application of ACDS is strategically important to improve the availability of information on traceability and sustainable fisheries management programs, and enhance efforts in addressing overcapacity and IUU fishing. The goal of USAID Oceans is to strengthen the regional cooperation for sustainable and legal management and trade of natural resources in the Asia-Pacific region. In line with such goal, the Project exerted efforts to: 1) demonstrate a sustainable Catch Documentation and Traceability System (CDTS) and Fisheries Information System (FIS); 2) expand the use of CDTS/FIS to priority biodiversity areas; 3) strengthen the capacity of regional and national organizations to conserve biodiversity using EAFM and CDTS; and 4) engage the private sector to ensure sustainability, while advancing regional fisheries governance.

In order to set the activity in motion, the "USAID Oceans and Fisheries Partnership Technical Working Group Training and Workshop" was organized from 12 to 14 July 2016 in Bangkok, Thailand, where the Technical Working Groups (TWGs) from each partner fisheries organization were introduced, and given the task to commence the work together as one regional and cohesive team. The Workshop came up with the project activities, roles, and responsibilities of the TWG members, alignment of work plan in the Project's Year Two in terms of training and relevant activities, taking into consideration country specific tasks. Furthermore, the Workshop also identified two learning sites, such as General Santos City in the Philippines and Bitung in Indonesia.

SEAFDEC PROGRAMS FOR 2017

As scrutinized and endorsed during the Thirty-ninth Meeting of the SEAFDEC Program Committee in 2016, the programs and projects that would be implemented in 2017 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
3. Promotion of Sustainable Fisheries Resources Enhancement Measures in Critical Habitats/Fishing Grounds in Southeast Asia	TD	JTF
4. Environment-friendly, Sustainable Utilization and Management of Fisheries and Aquaculture Resources	AQD	JTF
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. Enhancing Coastal Community Resilience for Sustainable Livelihood and Coastal Resources Management	MFRDMD	IDB
Thrust II: Enhancing Capacity and Competitiveness to Facilitate International and Intra-regional Trade		
8. Chemical and Drug Residues in Fish and Fish Products in Southeast Asia - Biotxin (ASP, AZA and BTX) and Harmful Algal Blooms (HABs) in the ASEAN region	MFRD	JTF
9. Cold Chain Management for Seafood	MFRD	Singapore
10. Reinforcement and Optimization of Fish Health Management and the Effective Dissemination in the Southeast Asian Region	AQD	JTF
Thrust III: Improving Management Concepts and Approaches for Sustainable Fisheries		
11. Promotion of Countermeasures to Reduce IUU Fishing Activities	TD	JTF
12. Combating IUU Fishing in the Southeast Asian Region through Application of Catch Certification for International Trading in Fish and Fishery Products	MFRDMD	JTF
13. Establishment and Operation of a Regional System of Fisheries <i>Refugia</i> in the South China Sea and Gulf of Thailand	TD	UNEP/GEF



Program Category/Project Title	Responsible Department	Funding Source
Thrust IV: Providing Policy and Advisory Services for Planning and Executing Management of Fisheries		
14. Fisheries Resource Survey and Operational Plan for M.V. SEAFDEC 2	TD	JTF
15. Offshore Fisheries Resources Exploration in Southeast Asia	TD	JTF
16. Enhancing the Compilation and Utilization of Fishery Statistics and Information for Sustainable Development and Management of Fisheries in Southeast Asian Region	TD/SEC	JTF
17. Comparative Studies for Management of Purse Seine Fisheries in the Southeast Asian Region	MFRDMD	JTF
18. Research for Enhancement of Sustainable Utilization and Management of Sharks and Rays in the Southeast Asian Region	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 Projects		
21. Fisheries and Habitat Management, Climate Change and Social Well-being in Southeast Asia	SEC	Sweden
22. USAID-SEAFDEC "Oceans and Fisheries Partnership"	SEC	USAID
Departmental Programs*		
1. Quality Seed for Sustainable Aquaculture	AQD	AQD
2. Healthy and Wholesome Aquaculture	AQD	AQD
3. Maintaining Environmental Integrity through Responsible Aquaculture	AQD	AQD
4. Adapting to Climate Change Impacts	AQD	AQD
5. Meeting Social and Economic Challenges in Aquaculture	AQD	AQD
6. Promotion on Strengthening of SEAFDEC Visibility and Image	TD	TD
7. Tailor-made Training Programs	TD	TD
8. Improvement of Fisheries Technology and Reduction of the Impact from Fishing	TD	TD

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

Other Programs		
1. Coastal Area Capability Enhancements in Southeast Asia	SEC/TD	RIHN
2. Application of Fish Passage Design Principles to Enhance Sustainability of Inland Fishery Resources in the Southeast Asian Region	SEC/TD	ACIAR

There was also one **pipeline project** of which the proposals are prepared in consultation with respective donor agencies and the Member Countries:

Program Category/Project Title	Responsible Department	Funding Source
ASEAN-SEAFDEC FCG/ASSP Programs		
1. Enhancing Sustainable Utilization and Management scheme of Tropical Anguillid Eel Resources in Southeast Asia**	SEC	JAIF

** This project would be implemented under the FCG/ASSP mechanism once funding could be secured.

COOPERATION WITH DONORS AND OTHER ORGANIZATIONS IN 2016

- **Agency of Global Development and Cooperation for Fisheries, Pukyong National University, Republic of Korea**

SEAFDEC/AQD entered into a Memorandum of Agreement with the Agency of Global Development and Cooperation for Fisheries (Global DCF) of Pukyong National University, Republic of Korea. The objective of the collaboration is to promote international understanding and enhance educational and professional opportunities for students from Global DCF. Specifically, AQD will seek to provide on-the-job training to selected interns from Global DCF in light of their corresponding duties and according to their specific academic curriculum and qualifications, as well as provide them with necessary resources to carry out the tasks assigned to them.

- **Association of Southeast Asian Nations (ASEAN)**

Cooperation between SEAFDEC and ASEAN has been sustained 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 ASSP, where SEAFDEC serves as technical arm to implement fisheries programs and projects for the benefit of the AMSs. In 2016, 23 projects were implemented by SEAFDEC under the FCG/ASSP Mechanism. The progress and achievements in the implementation of these projects were reported to the Nineteenth Meeting of the FCG/ASSP organized on 1-2 December 2016 in Yogyakarta, Indonesia. SEAFDEC also continued to support the AMSs 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.

Through the projects implemented by SEAFDEC, several regional policy frameworks, guidelines, and policy recommendations had been endorsed by the highest authorities of SEAFDEC and the ASEAN while some more are still under development, all of which aim to support the promotion of a harmonized approach and enhance collaboration with the AMSs. Specifically, the ASWGFi at its Twenty-fourth Meeting on 1-3 June 2016 in the Philippines supported and endorsed the documents prepared by SEAFDEC in relation to international fisheries-related issues for submission to the higher authorities of the ASEAN. These include: 1) Concept Proposal on Regional Cooperation for Supporting the Implementation of the Port State Measures in ASEAN Region; 2) Regional Plan of Action for the Management of Fishing Capacity (RPOA-Capacity); 3) Proposed Development of the ASEAN Guidelines on Implementation of Labor Standards for the Fisheries Sector; 4) Regional Guidelines on Traceability System for Aquaculture Products in the ASEAN Region; and 5) Regional Policy Recommendations on Early Mortality Syndrome (Acute Hepatopancreatic Necrosis Disease) and Other Transboundary Aquatic Animal Health Diseases.

Subsequently, the AMAF during its Thirty-eighth Meeting endorsed the RPOA-Capacity and the Regional Guidelines on Traceability System for Aquaculture Products in the ASEAN Region for implementation by the AMSs.

In 2016, SEAFDEC also participated in the events organized under the ASEAN framework, namely: the Eighth Meeting of the ASEAN Fisheries Consultative Forum (AFCF) on 30-31 May 2016, Philippines; the Twenty-fourth Meeting of the ASWGFI on 1-3 June 2016, Philippines; Meeting of the ASEAN Expert Group (AEG) on CITES on 24-25 March 2016, Cambodia; Experts Dialogue on Climate Change Mitigation and Adaptation in ASEAN on 30 November 2016, Indonesia; and the Fifth Meeting of the Ad-hoc Steering Committee on Climate Change and Food Security on 1-2 December 2016, Indonesia.

- **Australian Center for International Agricultural Research (ACIAR)**

SEAFDEC signed a Letter of Agreement with the Australian Center for International Agricultural Research (ACIAR) on 14 May 2015, for SEAFDEC to carry out an activity on the **“Application of Fish Passage Design Principles to Enhance Sustainability of Inland Fishery Resources in the Southeast Asian Region.”** Through such arrangement, SEAFDEC received a grant for a 16-month R&D activity starting from May 2015 until September 2016. This activity aims to: 1) develop a regional collaborative approach on fish passage through the conduct of an expert workshop; 2) design and construct experimental fishway facilities in Thailand; and 3) provide a pathway for further research to improve knowledge on appropriate designs that could facilitate upstream migration of indigenous fishes. In 2016, ACIAR agreed to extend this Project until March 2017.

- **Fisheries Research Agency (FRA), Japan**

The Memorandum of Understanding (MOU) for Scientific and Technical Cooperation between SEAFDEC and Fisheries Research Agency (FRA) which was renewed in 2014 and will be valid for the period of five years, has provided the framework for cooperation between SEAFDEC and FRA on the development of scientific and technical cooperation in various fields of mutual interest; exchange of information and expertise; and conduct of detailed discussions between SEAFDEC and FRA on matters practical to both organizations.

In 2016, FRA dispatched experts to SEAFDEC, namely: *Dr. Kaoru Ishii* as Deputy Chief of TD and concurrent Deputy Secretary-General from 1 May 2016; *Dr. Chihaya Nakayasu* as Deputy Chief of AQD from 1 April 2016 to 31 March 2018; and *Dr. Satoshi Honda* reappointed as Deputy Chief of IFRDMD until 19 January 2018.

- **Fish Market Organization (FMO), Thailand**

SEAFDEC signed an MOU with Fish Market Organization (FMO) of Thailand on 27 December 2016 for the development and promotion of e-ACDS. During the Forty-eighth Meeting of the SEAFDEC Council in 2016, the Council endorsed the plan to pilot test the ACDS initially in Brunei Darussalam. Considering that FMO has already put in place an e-system of Marine Catch Purchasing Document (MCPD) for catches landed at ports under the operation of the FMO, such e-MCPD could provide a practical basis for the development of e-ACDS for pilot testing in SEAFDEC Member Countries. Furthermore, considering that FMO has also gathered landing data throughout the past years, SEAFDEC could make use of such data for stock assessment of several species that are economically important for the region leading to a more sustainable utilization of the resources.

- **Food and Agriculture Organization of the United Nations (FAO)**

SEAFDEC/TD continued to serve as Regional Facilitation Unit (RFU) of FAO in the implementation of the project “**Strategies for Trawl Fisheries By-catch Management (REBYC-II CTI)**” with funding support from GEF. Originally scheduled to be completed in 2015, the Project was extended to 2016. SEAFDEC signed two Letters of Agreement (LOA) under this Project in 2016 with a view to delivering outputs, particularly reports from events organized under the Project, conducting additional events, and completing the materials for EAFM Lead. The first LOA was signed on 8 September 2016 for SEAFDEC to organize a series of regional workshops and meetings that aim to consolidate and summarize the progress made by the Project during the period from 8 September 2016 to 25 November 2016. The second LOA was signed on 10 October 2016 to facilitate the conduct of capacity building and awareness raising activities under which SEAFDEC would complete the materials for EAFM LEAD during the period from 5 October 2016 to 15 November 2016.

TD also continued the implementation of pilot project “**Fishing Vessel Energy Audit**” which aimed to determine fuel saving potentials of different energy efficiency practices for trawlers in the Gulf of Thailand.

Moreover, SEAFDEC was also involved in regional and international events organized by FAO in 2016, namely: the Sixth APFIC Regional Consultative Forum Meeting “Promoting blue growth in fisheries and aquaculture in the Asia Pacific” on 8-10 February 2016 in Colombo, Sri Lanka; the Thirty-fourth Session of the Asia-Pacific Fisheries Commission on 12-14 February 2016 in Colombo, Sri Lanka; the Thirty-third FAO Regional Conference for Asia and the Pacific on 7-11 March 2016 in Putrajaya, Malaysia; the Sixth meeting of the Regional Fishery Body Secretariats Network (RSN) on 9 and 15 July 2016, in Rome, Italy; the Thirty-second Session of FAO Committee on Fisheries on 11-15 July 2016, in Rome, Italy; FAO Workshop on Exploring the Human Rights Based Approach in the Context of Implementation and Monitoring of the SSF Guidelines on 24-26 October 2016 in Rome, Italy; and the Experts Workshop on Gender-equitable Small-scale Fisheries in the Context of the Implementation of the SSF Guidelines on 28-30 November 2016 in Rome, Italy.

- **Gifu Prefecture, Japan**

The Forty-eighth Meeting of the SEAFDEC Council in April 2016 approved the signing of MOU between SEAFDEC and Gifu Prefecture, Japan. Considering that Gifu Prefecture is establishing a training center for inland fisheries in Japan, the Prefecture expressed willingness to receive trainees from the Southeast Asian region in the near future. Thus, the collaboration and exchange of experiences with Gifu would be beneficial for SEAFDEC and the Member Countries in the future. Signed on 27 May 2016, the MOU between SEAFDEC and Gifu Prefecture is aimed at promoting educational and technical cooperation for the sustainable development of inland fisheries in the Southeast Asian region.

- **GIZ (Deutsche Gesellschaft für Internationale Zusammenarbeit) GmbH, Germany**

GIZ, through its office in the Philippines, contracted SEAFDEC/AQD for consultancy services on mangrove crab hatchery technology. Based on this joint Agreement, AQD experts would provide technical guidance and hands-on information on mangrove crab hatchery technology practiced during the GIZ-supported trials at Bangladesh Fisheries Research Institute and share experiences in the context of Bangladesh by means of participating as resource persons during the workshop “Knowledge Sharing on Mangrove crab Hatcheries in Bangladesh.” GIZ is a federally-owned organization that works worldwide in the field of international cooperation for sustainable development with the mandate of supporting the German Government in achieving its development objective.

- **Government of Sweden**

The Government of Sweden continued its cooperation with SEAFDEC by providing funding support for the five-year project “**Fisheries and Habitat Management, Climate Change and Social Well-being in Southeast Asia**” starting in 2013, with geographical scope focusing on four sub-regions of Southeast Asia, namely: the Gulf of Thailand, Andaman Sea, Sulu-Sulawesi Seas, and the Lower Mekong River Basin. During the implementation of this Project, SEAFDEC cooperates 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 the planned activities. In 2016, the Government of Sweden agreed to extend the duration of this Project to another two years until 2019.

- **Islamic Development Bank (IDB)**

SEAFDEC developed a project proposal on “**Enhancing Coastal Community Resilience for Sustainable Livelihood and Coastal Resources Management**” for funding support from the Islamic Development Bank (IDB) with the Muslim communities in the region’s coastal areas in three countries, namely: Brunei Darussalam, Malaysia, and Indonesia, as target beneficiaries. The proposal was submitted to the ASEAN Secretariat for consideration and support by the ASEAN dialogue partners and IDB in January 2009. The Technical Assistance Agreement was signed by IDB and SEAFDEC in 2016, and the Project is being implemented by SEAFDEC/MFRDMD.

- **Japan International Cooperation Agency (JICA)**

The Government of Japan has provided the M.V. SEAFDEC 2 to SEAFDEC/TD in 2004 through the Japan’s Grant Aid Scheme for Eligible Countries. During the past decade, the vessel has been utilized to support the mission of TD in promoting responsible and sustainable tropical marine capture fisheries in the Southeast Asian region, through the conduct of marine fishery resources and environmental surveys in close collaboration with the Member Countries. After such long service, some equipment in the vessel were found to be no longer efficient and not in proper working condition. Discussion was therefore initiated between SEAFDEC and JICA in 2015 on the possibility of restoring the functions of the M.V. SEAFDEC 2. In January 2016, the JICA team visited TD to check the condition of the M.V. SEAFDEC 2; and subsequently in June 2016, the scope of work was agreed upon

by JICA and SEAFDEC including the list of equipment to be restored under this cooperation, schedule of restoration works, and the major undertakings to be carried out by JICA and SEAFDEC. The actual implementation of the restoration would be during the second and third quarter of 2017.

- **Japan International Research Center for Agricultural Sciences (JIRCAS)**

A Memorandum of Agreement (MOA) was forged between SEAFDEC/AQD and JIRCAS for the implementation of the following contracted research projects: 1) Development of Low Fish Meal Feed for Aquaculture Using Alternative Resources; and 2) Demonstration and Verification of Sustainable and Efficient Aquaculture Techniques by Combination of Multiple Organisms. The MOA was signed in July 2016 and would remain effective until March 2021.

- **Mekong River Commission (MRC)**

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 that relate to the R&D of the newly established SEAFDEC/IFRDMD. In 2016, representatives from SEAFDEC attended the “Regional Consultation Stakeholders Workshop on Proposal for a Basin-wide Fisheries Management and Development Strategy” on 11 October 2016 in Siem Reap, Cambodia; and subsequently the Twenty-second Meeting of Technical Advisory Body (TAB) on Proposal for a Basin-wide Fisheries Management and Development Strategy on 12-13 October 2016, also in Siem Reap. To further strengthen the cooperation between SEAFDEC and MRC, an MOU has been prepared and is under consideration by the two organizations.

- **National Fisheries University (NFU), Japan**

The National Fisheries University (NFU) had been collaborating with SEAFDEC for the conduct of research and training cruise using the NFU training vessel, the *T/S Koyo Maru* in the waters of SEAFDEC Member Countries. In 2014, the said collaboration was extended with the Fisheries Administration of Cambodia as beneficiary, for a joint research and training cruise in Cambodian waters. In 2016, SEAFDEC continued to facilitate the conduct of the joint research and training cruise using the *T/S Koyo Maru* in Cambodia. On 20 September 2016, a “Consultation Meeting on the Conduct of a Joint Research and Training Cruise in Area under Jurisdiction of Cambodia for 2016” was organized. NFU also planned to conduct a joint research and training cruise in Thailand, and subsequently convened the “General Discussion on the Work Plan 2017 for the Joint Research and Training Cruise in the Gulf of Thailand by *T/S Koyo Maru* of the NFU” on 21 September 2016.

- **Network of Aquaculture Centres in Asia-Pacific (NACA)**

Cooperation of SEAFDEC and the Network of Aquaculture Centres in Asia-Pacific (NACA) had long been established with the SEAFDEC/AQD serving as one of NACA's regional lead centers. In May 2016, AQD signed the MOU with NACA aiming to facilitate exchange of information and conduct of collaborative activities between AQD, NACA and other NACA lead centers. In addition, AQD would also be asked to provide technical advice and conduct technical training for NACA member governments and participating network centres, provided that all costs are shouldered by requesting parties. This collaboration would also allow AQD to obtain information on relevant activities undertaken by other organizations that could be mobilized for the Southeast Asian region, while the services of experts and utilization of facilities at AQD could also be optimized in the future.

- **Post-Harvest Technology Centre of the Agri-Food & Veterinary Authority (PHTC/AVA) of Singapore**

The Post-Harvest Technology Centre of the Agri-Food & Veterinary Authority (PHTC/AVA) of Singapore serves as Collaborating Centre of SEAFDEC to undertake the activities of MFRD under the SEAFDEC Regional Programs, as approved by the SEAFDEC Council during its Thirty-ninth Meeting in 2007. In 2016, the PHTC/AVA supported MFRD in enhancing the development of fisheries post-harvest technology in the Southeast Asian region through two on-going regional projects, namely: 1) Chemical and Drug Residues in Fish and Fish Products in Southeast Asia - Biotoxin (ASP, AZA and BTX) and Harmful Algal Blooms (HABs) in the ASEAN Region; and 2) Cold Chain Management for Seafood. Specifically, the second project is supported by the Government of Singapore.

- **Research Institute for Humanity and Nature (RIHN), Japan**

SEAFDEC/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 "**Coastal Area Capability Enhancement in Southeast Asia**" from 1 April 2012 to 31 March 2017. 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. This Project aims to create new development concept on "Area Capability" that can demonstrate how the ecosystem health could be harmonized with people's welfare. Activities in project sites in Thailand had been going on until 2016 in collaboration with TD, of which the activities and all findings in each component were reported at the Seventh World Fisheries Congress "Challenge to Sustainable Fisheries and Safe Seafoods" session 25 "Area-Capability Approach for Coastal Community and Fisheries Developments" in Busan, Korea on 23-27 May 2016.

- **United Nations Environment Programme (UNEP)**

SEAFDEC developed the project proposal “**Establishment and Operation of a Regional System of Fisheries Refugia in the South China Sea and Gulf of Thailand**” for funding support from the GEF through the UNEP. The Project focuses 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. In 2016, the Project Cooperation Agreement (PCA) was endorsed by the GEF/CEO, and the final PCA was signed between UNEP and SEAFDEC for implementation from 2016 to 2020.

- **United States Agency for International Development (USAID)**

Under a MOU signed in 2014, SEAFDEC and USAID has been collaborating in the design and implementation of activities for enhancing food security and biodiversity conservation in Asia and the Pacific. In 2016, the USAID-SEAFDEC Project “**Oceans and Fisheries Partnership**” has been ongoing in project sites in Indonesia and Philippines. In addition, SEAFDEC is also exploring additional support from the U.S. Department of the Interior to supplement the Project through the development of a CDTs by SEAFDEC and building capacity for its implementation; implementation of the EAFM; integration of fair labor and gender equity considerations; and technical and capacity building support for expanding the Project sites in Thailand and Malaysia.

- **Vocational Education Commission, Thailand**

The extension of MOU between SEAFDEC and Office of Vocational Education Commission on the development of manpower for operation of fishing vessels was signed on 10 November 2014. This collaboration was established under the MOU signed in 2011. Under this MOU, TD conducted the Training Course on Operations of Fishing Vessels from 4 October 2016 to 17 February 2017 for students from Tinsulanonda Fisheries College in Songkhla Province. The Training was designed to cover six relevant subjects, namely: 1) construction and stability of fishing vessels; 2) marine communication; 3) laws and regulations of navigation; 4) navigation technology practices; 5) marine machinery technology and practices; and 6) fishing gear technology and practices.

- **Western Philippine University**

The MOA between the Western Philippine University (WPU) and SEAFDEC/AQD was signed on 27 January 2016. WPU is one of the Centers of Excellence in Fisheries in the Philippines, conducting instruction, research, and extension activities in the fields of fisheries, marine sciences, and aquatic biology in Palawan and adjacent areas. Under this MOA, AQD would provide the necessary internship program to students and trainees from WPU. This MOA shall be in force and effective for a period of five years.

ENHANCING SEAFDEC VISIBILITY

Since its establishment, SEAFDEC has been implementing fisheries-related programs and 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 2016, the progress and achievements made by SEAFDEC in the implementation of information activities were monitored and discussed during the Seventeenth Meeting of the Information Staff Program (ISP) on 25 to 27 October 2016 in Tangerang, Indonesia, 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

- Technical and scientific materials: 25 title and issues: 5,518 copies produced, 2,942 copies distributed
- Technical and scientific articles: 57 titles: 33 titles published in SEAFDEC publications and 24 titles published in non-SEAFDEC publications
- Inquiries for information through the SEAFDEC libraries recorded and replied: 2,026 queries recorded, 220 materials sold

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

- Promotional materials: 55 titles and issues: 56,065 copies produced, 47,050 copies distributed
- SEAFDEC websites established and web blocks administered: SEAFDEC Departmental websites received a total of 104,436 unique visitors, made 5,085 links from other websites, and recorded 49,936 annual downloads
- Participation in exhibitions and related events: joined 14 exhibitions with 129,053 visitors recorded at SEAFDEC exhibition booths and displays
- Official press statements released: 2 press statements released, and recorded 53 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

- Management of libraries of SEAFDEC Secretariat and Departments: SEAFDEC Secretariat and Departments libraries continued to provide library services
- Additional acquisitions of SEAFDEC libraries: total of 1,091 issues of newsletters and serial publications, 255 titles of technical publications and 13 items of audio-visual materials were acquired



- Cooperation and exchange of materials: sustained cooperation with 481 network libraries within and outside the region
- Dissemination of technical and promotional materials: 119 titles (with 6,491 copies) of technical materials, and 32 titles (with 18,411 copies) of promotional materials disseminated to target groups
- Accessibility of information materials: 2,127 downloadable materials and 18 databases made accessible in SEAFDEC websites
- Usage of e-mail systems (including e-groups) to facilitate communications both among SEAFDEC staffs and with other concerned personalities had been enhanced
- Direct visitors to SEAFDEC Secretariat and Departments: recorded a total number of 24,013 visitors
- Participation of SEAFDEC officials to events organized by other organizations: 443 SEAFDEC officials participated in 228 events: 152 officials in events at regional and international levels, and 291 at national and local levels
- SEAFDEC events organized:
 - o International and regional meetings, seminars, workshops: 33 meetings with 1,321 participants
 - o National and local meeting, seminars, workshops, consultations: 12 meetings with 341 participants
 - o International and regional training courses: 7 courses with 149 trainees
 - o National, on-site training courses: 29 courses with 492 trainees
 - o Study tours: 2 programs with 38 trainees
 - o Internships: 3 groups with 48 interns
 - o On-the-job training: 4 colleges participated with a total of 185 students
 - o Internal meetings: 10 meetings with 288 participants
- Participation of officials from Member Countries in events organized by SEAFDEC facilitated:
 - o International and regional meetings, seminars, workshops (523 participants)
 - o National and local meetings, seminars, workshops, consultations (132 participants)
 - o International and regional training courses (121 trainees)
 - o National on-site training courses (448 trainees)
 - o Study tours (35 trainees)
 - o Internships (46 persons)
 - o On-the-Job training (172 students);
- Network and cooperation mechanisms established, now with 50 fisheries-related organizations, for the implementation of collaborative activities at national, regional and international levels
- Support from other organizations and donor agencies for relevant activities solicited: total support received in 2016: US\$ 3,450,725 representing non-regular sources of funds for the activities of SEAFDEC

Strategy 4: Strengthening SEAFDEC capability in information-related activities

- Capabilities of SEAFDEC staff in information-related offices enhanced through Human Resource Development (HRD) taking into account the scope and requirements of concerned staff, and during annual ISP Meetings
- Financial sustainability of SEAFDEC institutional publications and information activities boosted through the intensified sale of technical publications and souvenir items on cost-recovery basis)

Strategy 5: Regular monitoring and evaluation of information activities

- Feedback on materials produced by SEAFDEC was obtained, and developed for the training, research, and information transfer through communication channels, *e.g.* dedicated e-mail, etc.
- Seventeenth Meeting of the SEAFDEC ISP organized to monitor the implementation of information-related activities, in accordance with the Information Strategies for Enhanced SEAFDEC Visibility and Communication convened on 25-27 October 2016 in Tangerang, Indonesia

Table 1. Participation of Member Countries in SEAFDEC Events in 2016

Category	Participants from Member Countries (persons)										
	Br	Cm	Id	Jp	La	My	Mm	Ph	Sg	Th	Vn
SEAFDEC regional/international meetings, seminars, workshops	27	61	89	27	26	87	37	46	20	103	75
SEAFDEC national/local meetings, seminars, workshops, consultations	0	23	19	0	0	14	5	25	0	25	21
International/regional training courses	6	19	5	0	2	14	15	5	4	29	22
National, on-site training courses	0	57	0	0	35	0	10	199	7	105	35
Study tours	0	0	0	0	0	0	15	20	0	0	0
Internships	0	0	0	0	0	0	0	44	1	0	1
On-the-job training	0	0	0	0	0	0	0	164	0	8	0
SEAFDEC internal events	0	0	2	0	0	0	0	2	0	4	0
TOTAL	33	160	115	27	63	115	82	505	32	274	154

SEAFDEC REVENUES AND EXPENDITURES IN 2016

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

	2016 (Un-audited)	2015 (Audited)
REVENUES		
Contributions from :-		
Member governments	9,542,812	9,504,344
Other sources	1,654,826	2,467,763
Total Revenues	11,197,638	11,972,107
EXPENDITURES		
Operating and Capital Expenditures		
Research	3,076,368	3,529,557
Training	646,760	773,116
Information	474,666	439,458
Collaborative	149,160	195,274
Others	416,484	414,259
Administrative	4,814,819	6,156,894
Total Expenditures	9,578,257	11,508,558
SURPLUS (DEFICIT), For the year	1,619,381	463,549
FUND BALANCE, Beginning of year	7,704,897	^{1/} 7,313,251
FUND ADJUSTMENT	-6,022	-34,887
FUND BALANCE, End of year	9,318,256	7,741,913 ^{1/}
REPRESENTED BY:		
Cash and cash equivalents	8,762,244	8,582,239
Other receivables and Advances	763,949	628,240
Supplies Inventory	56,368	70,668
Fuel for vessels	106,607	99,503
Prepayments	16,260	16,491
Total current assets	9,705,428	9,397,141
Reserved budget for vessel periodic maintenance	143,102	75,154
Termination indemnity fund	1,992,726	1,921,757
Other assets-Net	454,051	526,587
Total Assets	12,295,307	11,920,639
Less : Liabilities		
Accrued payable	789,421	1,203,155
Contribution received in advance	2,000	814,321
Funds held in trust	192,904	239,493
Provision for termination indemnity	1,992,726	1,921,757
Total Liabilities	2,977,051	4,178,726
NET ASSETS	9,318,256	7,741,913

Remark: ^{1/} Difference of US\$ 37,016 is a result of varying exchange rates in US\$ transactions.

Un-audited Contribution Received by SEAFDEC from Member Countries and Other Sources of Funds for the Year 2016 (In US\$)

Sources	Secretariat	TD	MFRD	AQD	MFRDMD	IFRDMD	Total	
							In US\$	%
Brunei Darussalam	7,000						7,000	0.06
Cambodia	11,000						11,000	0.10
Indonesia ^{2/}	58,000					706,315	764,315	6.83
Japan	280,000						280,000	2.50
Lao PDR ^{2/}	5,000						5,000	0.04
Malaysia	21,000				660,436		681,436	6.09
Myanmar	21,000						21,000	0.19
Philippines	25,000			4,424,779			4,449,779	39.74
Singapore	13,000						13,000	0.12
Thailand	33,000	2,578,841					2,611,841	23.32
Viet Nam	26,000						26,000	0.23
Sub-total	500,000	2,578,841	0	4,424,779	660,436	706,315	8,870,371	79.22
Other Sources ^{3/}	65,606	1,182,753		1,078,908			2,327,267	20.78
Total	565,606	3,761,594	0	5,503,687	660,439	706,315	11,197,638	100

Remark:

^{2/} The Secretariat has not yet received the Minimum Regular Contribution (MRC) from the Government of Indonesia for the year 2015-2016 (\$US 58,000 + \$US 58,000) = \$US 116,000, and from Lao PDR for the year 2016 = \$US 5,000

^{3/} Other sources of contributions include bank interests, gain and loss from varying exchange rates, contributions from donors directly given to Departments and miscellaneous receipts

Other Contributions Received by SEAFDEC in 2016 (In US\$)

Sources	Amount in US\$ ^{3/}
UNEP/GEF	400,000
Fisheries Agency-Japan (TF-VI) (excluded: Japan-MRC=US\$280,000)	1,335,126
Sweden	921,760
Total	2,656,886

Remark:

^{3/} Other sources of contributions not reported in the SEAFDEC Financial Statements

