



# SEAFDEC Annual Report

# 2012



Southeast Asian Fisheries Development Center



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## **Preparation and Distribution of this Document**

This SEAFDEC Annual Report 2012 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), and Marine Fishery Resources Development and Management Department (MFRDMD). The Annual Report is distributed to the SEAFDEC Member Countries and Departments, partner agencies and other fisheries-related organizations, and to the public to make them aware of the activities of SEAFDEC and promote the visibility of the Center.

## **Bibliographic Citation**

SEAFDEC. 2013. SEAFDEC Annual Report 2012. Southeast Asian Fisheries Development Center, Bangkok, Thailand. 74 pp.

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## Executive Summary

The programs and activities of SEAFDEC in 2012 have been formulated and implemented in response to the policy directives and priority actions recommended by the Member Countries through the SEAFDEC Council and Program Committee. In addition, the planning processes for the development of such programs and activities took into consideration the Resolution and Plan of Action on Sustainable Fisheries for Food Security for the ASEAN Region Towards 2020 which were adopted by the ASEAN-SEAFDEC Ministers and Senior Officials responsible for fisheries during the ASEAN-SEAFDEC Conference in June 2011.

The programs and activities of SEAFDEC that were directed towards sustainable development of fisheries were categorized into: Departmental Programs (9 programs), Programs under the Fisheries Consultative Group of the ASEAN-SEAFDEC Strategic Partnership (25 programs), and Other Programs (1 program). For a better grasp of the progress and achievements in 2012, for this Annual Report 2012, the activities undertaken under the programs have been grouped into eight major scopes, namely: i) Responsible Fishing Technologies and Practices; ii) Exploration and Monitoring of Fishery Resources and Their Utilization; iii) Management for Sustainable Fisheries; iv) Conservation and Management of Aquatic Species under International Concerns; v) Post-harvest Technology and Safety of Fish and Fishery Products; vi) Sustainable Aquaculture Development; vii) Addressing Emerging Issues/Challenges; and viii) Human Capacity Development in Fisheries. In order to sustain the implementation of such activities in the Southeast Asian countries, SEAFDEC in 2012, continued to enhance collaboration with several international/regional organizations and also explored possible technical and financial support from various partners and donor agencies.

The progress and achievements of the programs and activities implemented by SEAFDEC in 2012 are thoroughly summarized in this SEAFDEC Annual Report 2012, while the programs proposed for 2013 are also briefly reported. It is the wish of SEAFDEC that through this Annual Report 2012, a distinct picture of the role and efforts of SEAFDEC in supporting the Member Countries towards achieving sustainable development of fisheries, could be clearly visualized. SEAFDEC also wishes that the various technologies it has developed and verified through the years could be adapted by the target stakeholders for the betterment of the fisheries sector of Southeast Asia. Finally, from the results of its programs and activities implemented in the region, as discussed in this SEAFDEC Annual Report 2012, SEAFDEC also looks forward to the improvement of the socio-economic well-being of peoples in the Southeast Asian region.

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## About SEAFDEC

The Southeast Asian Fisheries Development Center (SEAFDEC) is an autonomous inter-governmental body established in 1967. The mandate of SEAFDEC as endorsed by the 41<sup>st</sup> 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”*. SEAFDEC comprises 11 Member Countries: Brunei Darussalam, Cambodia, Indonesia, Japan, Lao PDR, Malaysia, Myanmar, Philippines, Singapore, Thailand, and Vietnam. The Center operates through the Secretariat located in Thailand and has four Technical Departments, namely: the Training Department; the Marine Fisheries Research Department; the Aquaculture Department; and the Marine Fishery Resources Development and Management Department.

### The Secretariat

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

### 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 in 2006, the structure and activities of TD have been adjusted to emphasize on the promotion of



SEAFDEC Secretariat



SEAFDEC/TD



SEAFDEC/MFRD



SEAFDEC/AQD



SEAFDEC/MFRDMD



coastal fisheries management to ensure responsible resource utilization and sustainable livelihoods in coastal communities, and the promotion of off-shore fisheries through the development of best fishing practices and energy optimization technology to ensure stable supply of food fish and reduce fishing pressure in coastal areas.

### **The Marine Fisheries Research Department (MFRD)**

MFRD was established in Singapore in 1969 and is responsible for promoting, undertaking, and coordinating research in fisheries post-harvest technology and furthering the development of the fish processing industry in the region. Its task includes research and development on fisheries post-harvest technology and practices, such as fish processing technology to optimize the utilization of harvested fish and enhancing 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.

### **The Aquaculture Department (AQD)**

Established in the Philippines in 1973, AQD has been carrying out research, technology verification, training and information dissemination on a wide range of aquaculture disciplines, including broodstock management and seed quality improvement, promotion of responsible and environment-friendly aquaculture, diagnosis and control of aquatic diseases, aquaculture for stock enhancement, and culture of aquatic species under international concerns. 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.

### **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 concerns, *e.g.* sharks and marine turtles. MFRDMD also implements activities that support the Member Countries in gathering information on inland capture fisheries, and developing of indicators to be used for the sustainable development and management of fisheries.



## SEAFDEC Council in 2012

### Chairperson of the SEAFDEC Council for the Year 2012-2013:

Mr. Khin Ko Lay

### SEAFDEC Council and Alternate Council Directors:

#### Brunei Darussalam

Council Director: Abdul Halidi Mohd. Salleh  
Acting Director, Department of Fisheries

Alternate Council Director: Haji Sabri Mohd. Taha (*until September 2012*)  
Deputy Director, Department of Fisheries  
Ranimah Haji A. Wahab (*from September 2012*)  
Acting Deputy Director, Department of Fisheries

#### Cambodia

Council Director: H.E. Dr. Nao Thuok  
Director-General, Fisheries Administration

Alternate Council Director: H.E. Dr. Sam Nouv  
Deputy Director-General, Fisheries Administration

#### Indonesia

Council Director: Dr. Endhay Kusnendar (*until October 2012*)  
Chairman of the Agency for Marine and Fisheries  
Research and Development  
Dr. Gellwyn Jusuf (*from November 2012*)  
Secretary-General of Ministry of Marine Affairs and  
Fisheries

Alternate Council Director: Dr. Dedi Sutisna  
Director-General of Capture Fisheries

#### Japan

Council Director: Mr. Masanori Miyahara  
Deputy Director-General, Fisheries Agency

Alternate Council Director: Mr. Tadashi Yokoyama  
Director, First Country Assistance Planning Division

#### Lao PDR

Council Director: Dr. Bounkhouang Khambounheuang  
Director-General, Department of Livestock and  
Fisheries

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



## Malaysia

- Council Director: Dato' Ahamad Sabki bin Mahmood  
Director-General, Department of Fisheries Malaysia
- Alternate Council Director: Mr. Ismail bin Abu Hassan  
Deputy Director-General, Department of Fisheries  
(Development), Malaysia

## Myanmar

- Council Director: Mr. Khin Ko Lay  
Director-General, Department of Fisheries
- Alternate Council Director: Mr. Kyaw Myo Win  
Deputy Director-General, Department of Fisheries

## Philippines

- Council Director: Atty. Asis G. Perez  
Director, Bureau of Fisheries and Aquatic Resources
- Alternate Council Director: Mr. Gil A. Adora  
Assistant Director for Technical Services, Bureau of  
Fisheries and Aquatic Resources

## Singapore

- Council Director: Mr. Lee Kwong Weng  
Deputy CEO, Agri-Food & Veterinary Authority of  
Singapore
- Alternate Council Director: Ms. Tan-Low Lai Kim  
Director, Food Supply Resilience Department, Agri-  
Food & Veterinary Authority of Singapore

## Thailand

- Council Director: Dr. Wimol Jantrarotai  
Director-General, Department of Fisheries
- Alternate Council Director: Mr. Chirdsak Vongkamolchoon  
Deputy Director-General, Department of Fisheries

## Vietnam

- Council Director: Dr. Pham Anh Tuan (*from March 2012*)  
Deputy Director-General of Vietnam Fisheries  
Administration
- Alternate Council Director: Mr. Nguyen Viet Manh (*from March 2012*)  
Director of Science, Technology and International  
Cooperation Department

## SEAFDEC Senior Officials in 2012

### Secretary-General

Dr. Chumnarn Pongsri

### Deputy Secretary-General

Mr. Kenji Matsumoto

### Training Department (TD)

#### Chief

Dr. Chumnarn Pongsri

#### Deputy Chief

Mr. Kenji Matsumoto

### Marine Fisheries Research Department (MFRD)

#### Chief

Mr. Yeap Soon Eong

### Aquaculture Department (AQD)

#### Chief

Dr. Joebert D. Toledo (*until April 2012*)

Dr. Teruo Azuma (*Acting Chief, from April - May 2012*)

Dr. Felix G. Ayson (*from May 2012*)

#### Deputy Chief

Dr. Teruo Azuma

### Marine Fishery Resources Development and Management Department (MFRDMD)

#### Chief

Ms. Mahyam Mohd. Isa

#### Deputy Chief

Dr. Masaya Katoh

## Message from the Chairperson of SEAFDEC Council For the Year 2012-2013



After the adoption of the ASEAN-SEAFDEC Resolution and Plan of Action on Sustainable Fisheries for Food Security for the ASEAN Region Towards 2020 in June 2011, regional cooperation in the fisheries sector has been gaining much momentum, and since then much progress has been attained by SEAFDEC as reflected in this SEAFDEC Annual Report 2012. As the Chairperson of the SEAFDEC Council for 2012 to 2013, I would therefore like to commend SEAFDEC for its continued efforts in implementing its programs and activities in the region, and also for relentlessly assisting the

Member Countries in their endeavors towards advancing the sustainable development of fisheries.

It is well recognized that with technical and financial assistance from its collaborating partners, especially the Fisheries Agency of Japan through its Trust Fund and the Swedish International Development Cooperation Agency (Sida), SEAFDEC through its programs and activities, has been able to continue supporting the countries in our region. As a result, the countries were able to convey our intention to safeguard regional interests and reveal the real situation of fisheries in our region, especially small-scale fisheries. The continuous assistance from SEAFDEC also enabled the countries to magnify the promotion of sustainable fisheries management and adoption of countermeasures to address illegal, unreported and unregulated or IUU fishing considering that such operation continues to jeopardize responsible fisheries operations and forestall all attempts to protect the aquatic environment. Moreover, the countries have also been able to address the issues and concerns related to the emerging requirements in fish trade, which create impacts on the economies of the countries and on the sustainability of small-scale fisheries in our region. I am therefore happy to note that the efforts of SEAFDEC as manifested in its programs and activities, are directed towards the sustainability of fisheries in the Southeast Asian region, and that such indications are clearly reflected in this SEAFDEC Annual Report 2012.

On behalf therefore of the SEAFDEC Council, I would also encourage SEAFDEC to continue strengthening its function as the technical arm of the ASEAN so that through the ASEAN-SEAFDEC Strategic Partnership, the benefits that can be reaped by the countries from such partnership could be maximized. With such strengthened collaboration in fisheries development, SEAFDEC and the Member Countries could continue to contribute significant parts to the regional economic integration, which the ASEAN hopes to achieve by 2015. Furthermore, on behalf of the Member Countries especially Myanmar, I would wish to convey our utmost gratitude to SEAFDEC for its efforts in incessantly assisting us in our endeavors towards achieving fisheries sustainability.

At this juncture, let me also take this opportunity to thank the SEAFDEC Secretary-General and staff of the SEAFDEC Secretariat and Technical Departments as well as the concerned collaborating partners for extending continued assistance to the SEAFDEC Member

Countries throughout the past year. It is also my personal wish that such assistance and cooperation would even be strengthened in the future for the benefit of the fisheries sector in the Southeast Asian region.

A handwritten signature in black ink, appearing to be 'Khin Ko Lay', written over a diagonal line.

Mr. Khin Ko Lay  
Director-General of the Department of Fisheries  
of Myanmar, and Chairperson of the SEAFDEC  
Council for 2012-2013

## Message from SEAFDEC Secretary-General



While fisheries have been recognized as one of the important sectors that contribute to food security, livelihood, well-being, and economic development for peoples in the Southeast Asian region, its sustainability is being constrained by several issues and consequences. During the past years, several emerging issues have cropped up that require particular attention to secure the sustainable contribution of fisheries to the region's food security. Such concerns include among others, the need to sustain/enhance fishery productions in response to increasing demand, guarantee the quality and safety of fish and fishery products not only for export but also for local/domestic consumption, ensure sustainable exploitation of fishery resources through improved management including combating IUU fishing, and improve socio-economic well-being of fishers and people engaged in fishery-related activities.

In order to address such concerns brought about by the changing fisheries environment, the ASEAN and SEAFDEC organized in 2011 the ASEAN-SEAFDEC Conference and came up with the Resolution and Plan of Action on Sustainable Fisheries for Food Security for the ASEAN Region Towards 2020 as policy framework for the region's fisheries development. In following-up with the said Resolution and Plan of Action, SEAFDEC in 2012 continued to respond to the requirements that had been set forth in such instruments, especially during the formulation and implementation of our programs and activities. Along the way, collaboration with the ASEAN under the ASEAN-SEAFDEC Strategic Partnership had also been strengthened in order that the ASEAN Member States could also actively work towards the realization of the ASEAN Economic Community by 2015. Bearing in mind the reality that large portion of the region's fisheries production had been contributed by small-scale fishers and farmers with limited resources, capacity and knowledge, SEAFDEC re-crafted its activities to take particular focus on the development of technologies that could be applicable for small-scale operators. Such advancements are meant to enhance their capacity in dealing with the emerging fisheries situation that usually comes with numerous issues and challenges. The results of such endeavors are incorporated in this Annual Report 2012.

The year 2012 has been considered very significant for SEAFDEC as it ushered in the process of reviewing our operations and management of the Center. It was also in 2012 that preparatory works for the establishment of a new SEAFDEC Department in Indonesia for sustainable development of inland fisheries had been initiated. As revealed in this SEAFDEC Annual Report 2012, all these initiatives are intended to improve the effectiveness of SEAFDEC, and allow the Center to continue rendering better services to the Member Countries.

On behalf therefore of the SEAFDEC Secretariat and Departments, I wish to take this opportunity to express our sincere appreciation to the Member Countries for providing directives and guidance to SEAFDEC throughout the past year. I would also wish to extend our gratitude to our collaborating partners for their collaboration and for the support extended to SEAFDEC that warranted our capacity to cater to a wider group of beneficiaries both from within and outside the region. Specifically, I wish to express our appreciation to the Government of Japan through

its Fisheries Agency and to the Government of Sweden through the Swedish International Development Cooperation Agency (Sida), as well as to the many other agencies for providing continued technical and financial supports to SEAFDEC in the course of the implementation of our activities. Finally, I would like to assure our collaborating partners that with their sustained support, SEAFDEC would continue to provide the necessary technical services to the Member Countries for them to succeed in their endeavors, in order that fisheries sustainability and food security in the Southeast Asian region could be guaranteed.



Dr. Chumnarn Pongsri  
SEAFDEC Secretary-General





## Overview of SEAFDEC Activities in 2012

The activities of SEAFDEC in 2012 were implemented in line with the policy directives given by the SEAFDEC Member Countries during SEAFDEC annual meetings, *i.e.* the 34<sup>th</sup> Meeting of the SEAFDEC Program Committee (14-16 November 2011, the Philippines), 14<sup>th</sup> Meeting of the Fisheries Consultative Group of the ASEAN-SEAFDEC Strategic Partnership (FCG/ASSP) (17-18 November 2011, the Philippines), and the 44<sup>th</sup> Meeting of SEAFDEC Council (2-6 April 2012, the Republic of the Union of Myanmar).

Formulation and development of the programs and activities implemented by SEAFDEC in 2012 had been guided by regional and international fisheries policy frameworks, particularly the new decade “Resolution and Plan of Action on Sustainable Fisheries for Food Security for the ASEAN Region Towards 2020”, which were adopted by the ASEAN-SEAFDEC Ministers and Senior Officials during the ASEAN-SEAFDEC Conference on Sustainable Fisheries for Food Security Toward 2020 “Fish for the People 2020: Adaptation to a Changing Environment” held in June 2011 in Bangkok, Thailand.

The progress of the programs and activities implemented in 2012 has been reported and approved by the 35<sup>th</sup> SEAFDEC Program Committee Meeting held in Chiang Mai, Thailand on 26-28 November 2012, and the 15<sup>th</sup> Meeting of the Fisheries Consultative Group of the ASEAN-SEAFDEC Strategic Partnership (FCG/ASSP) on 29-30 November 2012, also organized in Chiang Mai, Thailand. The FCG/ASSP programs were categorized into five Program Thrusts in accordance with the Program Framework as endorsed by the SEAFDEC Council during its 41<sup>st</sup> Meeting in 2009.

The programs and activities implemented by SEAFDEC in 2012 included:

### A. Departmental Programs

1. Center-wide Information Network (Secretariat);
2. Tailor-made Training Programs (TD);
3. Promotion and Enhancement Fisheries Information (TD);
4. Improvement of Fisheries Technology and Reduction of the Impact from Fishing (TD);
5. Adapting to Climate Change Impacts (AQD);
6. Healthy and Wholesome Aquaculture (AQD);
7. Maintaining Environmental Integrity through Responsible Aquaculture (AQD);
8. Meeting Socio-economic Challenges in Aquaculture (AQD); and
9. Quality Seed for Sustainable Aquaculture (AQD).

### B. Programs under the Fisheries Consultative Group of the ASEAN-SEAFDEC Strategic Partnership (FCG/ASSP)

#### Thrust I: Developing and Promoting Responsible Fisheries for Poverty Alleviation and Food Security

1. Responsible Fishing Technologies and Practices: Fishing in Harmony with Nature (TD);
2. Sustainable Utilization of Potential Fisheries Resources and Reduction of Post-harvest Losses (TD);

3. Rehabilitation of Fisheries Resources and Habitat/Fishing Grounds for Resource Enhancement (TD);
4. Human Resource Development (HRD) Programs on Fisheries Management Approaches for Sustainable Fisheries (TD);
5. Strategies for Trawl Fisheries By-catch Management (TD);
6. Resource Enhancement of International Threatened and Over-exploited Species in Southeast Asia through Stock Release (AQD); and
7. Promotion of Sustainable and Region-oriented Aquaculture (AQD).

**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: Biotoxins Monitoring in the ASEAN (MFRD);
9. Traceability Systems for Aquaculture Products in the ASEAN Region (MFRD);
10. Utilization of Freshwater Fish for Value-added Products (MFRD);
11. Accelerating Awareness and Capacity-building in Fish Health Management in Southeast Asia (AQD); and
12. Food Safety of Aquaculture Products in Southeast Asia (AQD).

**Thrust III: Improving Management Concepts and Approaches for Sustainable Fisheries**

13. Activities Related to Climate Change and Adaptation in Southeast Asia with Special Focus on the Andaman Sea (Secretariat);
14. Promotion of Rights-based Fisheries and Co-management Towards Institution Building and Participatory Mechanism for Coastal Fisheries Management (TD); and
15. Promotion on Fishing License, Boats Registration, and Port State Measures (TD).

**Thrust IV: Providing Policy and Advisory Services for Planning and Executing Management of Fisheries**

16. Fisheries Resource Survey and Operational Plan for the M.V. SEAFDEC 2 (TD);
17. Deep Sea Fisheries Resources Exploration in Southeast Asia (TD);
18. Information Collection of Highly Migratory Species in Southeast Asia Waters (TD);
19. Development of Regional Database for Fishery Management (TD);
20. Improvement of Information Gathering System for IUU Fishing Related Countermeasures in Southeast Asia (TD);
21. Tagging Program for Economically-important Pelagic Species in the South China Sea and Andaman Sea (MFRDMD, in collaboration with TD);
22. Research and Management of Sea Turtles in Foraging Habitats in the Southeast Asian Waters (MFRDMD, in collaboration with TD); and
23. Improvement of Statistics and Information for Planning and Management of Fisheries in the ASEAN Region (Secretariat).

**Thrust V: Addressing International Fisheries-related Issues from a Regional Perspective**

24. Assistance for Capacity Building in the Region to Address International Trade-related Issues (Secretariat); and
25. Strengthening SEAFDEC Network for Sustainable Fisheries and IUU Fishing Related Countermeasures (Secretariat).

**C. Other Programs**

1. Cetacean Research in Southeast Asian Waters: Cetacean Sighting Program (TD).



## SEAFDEC Activities in 2012

The activities of SEAFDEC in 2012 were formulated and undertaken in response to the requirements of the Member Countries as outlined in the “Resolution and Plan of Action on Sustainable Fisheries for Food Security for the ASEAN Region Towards 2020”. Furthermore, the activities have been grouped into eight scopes as follows:

### 1. Responsible Fishing Technologies and Practices

In 2012, several programs were undertaken by the SEAFDEC Training Department (TD) in collaboration with the Member Countries. These were aimed at responding to the need for more sustainable and responsible utilization of fishery resources, while minimizing the possible impacts of fishing activities to the coastal and marine environments.

TD continued to exert efforts to obtain better understanding on the impacts of fishing to the ecosystems and the environment through a series of studies under the program on “**Responsible Fishing Technologies and Practices: Fishing in Harmony with Nature**”, which were undertaken in collaboration with the Department of Fisheries of Myanmar and Department of Fisheries of Thailand. In Myanmar on one hand, the study which was undertaken in “Kow Thaug area” in the southern part of the country, focused on the impacts of squid fishing with light on the by-catch of juveniles and trash fish. On the other hand, another study was undertaken in the coastal artificial reef areas in the Gulf of Thailand, focusing on by-catch of juveniles and trash fish from light fishing. The initial results of these studies exhibited non-significant level of juveniles and trash fish by-catch, compared with the level of target species.



*Demonstration and experiment on squid fishing with lights in Myanmar*

Under the same program, TD also pursued activities aimed to raise awareness on the need to reduce sea turtle by-catch through the conduct of “Fishing Trial and Demonstration to Promote the Use of Circle-Hook in Bottom Long-line Fishing” in Sabah State of Malaysia on 12-16 March 2012. The local long-line fishers who took part in the activity expressed their interest in applying C-hook in their fishing operations. However, the unavailability of C-hook in the market was a major constraint for its adoption. During the demonstration, information on the activities implemented by Sabah State that aimed to reduce by-catch of



*Demonstration on the application of circle hooks (C-hook) for long-line fishing operations in Malaysia*

endangered aquatic species including sea turtles was shared. Therefore, the activity conducted by TD could provide important reference for more effective implementation of the relevant activities in the future.

Throughout the past decades, TD has been supporting countries in the region in conducting a series of fishing gear surveys. In 2012, TD packaged such knowledge and experiences in the publication “Guidelines on Fishing Gear Survey”, which could be used as reference for fishing gear technologists, extension officers, researchers, etc. in the conduct of fishing gear surveys, where information on fishing gear designs and practices could also be collected and presented in a systematic and unified manner.

The initiative to promote the use of selective fishing gears and practices in order to reduce by-catch and incidental catch of unwanted species was also continued; and the long experience of TD on this subject had successfully paved the way to the formulation of the new project entitled “**Strategies for Trawl Fisheries By-catch Management**” or “REBYC-II CTI”, which was launched this year, and would be implemented starting from 2013 to 2017 with support from the Food and Agriculture Organization of the United Nations (FAO)/ Global Environmental Facilities (GEF). The project aimed to promote responsible trawl fisheries that result in sustainable fishery resources and healthy marine ecosystems in the Coral Triangle and Southeast Asian waters by reduced by-catch, discards and fishing impact on biodiversity and the environment. Project participating countries included Indonesia, Philippines, Thailand and Vietnam, together with Papua New Guinea which is non-Member Countries. Serving as Regional Facilitation Unit, TD jointly organized with FAO the “Inception Workshop on By-catch Management and Reduction of Discards in Trawl Fisheries” during 1-4 May 2012; and the “Regional Workshop” on 6-9 November 2012 to facilitate planning of activities to be undertaken in the first year of the project.



*Participants of the REBYC-II CTI Project  
Planning Workshop*

## **2. Exploration and Monitoring of Fishery Resources and Their Utilization**

### **2.1 Exploration and Fishery Resources Survey in Southeast Asian Waters**

TD continued to provide technical assistance to the Member Countries in their efforts to conduct national fishery resources surveys using the M.V. SEAFDEC 2 which was granted by the Japanese Government since 2004, under the programs on “**Fisheries Resource Survey and Operational Plan for M.V. SEAFDEC 2**” and “**Deep Sea Fisheries Resources Exploration in Southeast Asia**”. Based on the proposal of Vietnam to conduct a 5-year fishery resources survey to assess the status of fishery stocks (large pelagic, demersal and small pelagic resources) in the waters of Vietnam during 2012-2016, two resources survey cruises were conducted in 2012 in collaboration with the Research Institute for Marine Fisheries

(RIMF), one during the pre-monsoon (14 May - 23 July 2012), and another during the post-monsoon season (2 October - 13 December 2012). The studies undertaken during the two cruises include: 1) hydro-acoustic surveys using multi-frequency Simrad EK-60; 2) species composition and biological study for small pelagic resources using bottom otterboard trawl and mid-water trawl; and 3) oceanographic and plankton survey.

After conducting the 1<sup>st</sup> cruise in Vietnam, TD was requested to modify the bottom trawl net sampling gear (for deep sea areas) by increasing the mouth opening in order that the catch data could be compared and correlated with the hydro-acoustic data. In this regard, another trial using the modified trawl net was carried out in September 2012 in the Gulf of Thailand. Specifically, the modified high-mouth-opening trawl net was used for pelagic and demersal sampling during the 2<sup>nd</sup> cruise in Vietnam. This modified sampling gear could also be adapted in the resource surveys of other Member Countries.

Furthermore, considering the deterioration and decline of the fishery resources in inshore/coastal areas of countries in the Southeast Asian region, TD started to place emphasis of its activities during the past years, on the exploration of deep sea fishery resources, and build up the capacity of Member Countries in the exploration of their respective deep sea resources. In 2012, activities on development and improvement of fish sampling gears and methods were continued, *i.e.* bottom mapping sonar installed onboard the M.V. SEAFDEC 2, underwater VDO and camera for Benthic Habitat Mapping Survey, and Modification of Trawl Sampling Gears, in order to enhance their application in deep sea fishery resources surveys. Moreover, a Training Workshop on Benthic Habitat Mapping was organized to deal with the mapping techniques and procedures to chart what technically recognized as “benthic habitat” where sea-bottom dwellers thrive. In addition, TD also published and disseminated in 2012 a poster on “Marine Crabs in Southeast Asia (100-370 meters)” as one of the outputs from the “Training Workshop on Identification of Deep Sea Benthic Macro-invertebrates Vulnerable to Fishing Gears” which was jointly organized by TD and Kasetsart University of Thailand since mid-2011.



*Fish species collected during the demersal research survey onboard the M.V. SEAFDEC 2 in Vietnam waters*



*Trial on modified bottom trawl net for deep sea sampling*

## 2.2 Improving Onboard Handling and Reduction of Post-harvest Losses

Activities were implemented by TD to develop and promote post-harvest technologies, as well as preservation techniques onboard fishing vessels, which are user-friendly and appropriate for small-scale fishers. These were coordinated under the Program on **“Sustainable Utilization of Potential Fisheries Resources and Reduction of Post-harvest Losses”**. The activities focused on improving fish handling technology to enhance the utilization of harvested fishery resources and reduce post-harvest losses as well as extend the developed technologies through human capacity development program. The use of crystal/slurry ice was promoted as a hygienic fish cooling system for the catch at sea. The system uses vertical shell-and-tube heat exchanger with mechanical heat transfer augmentation to generate the liquid ice.

In order to extend the developed technologies to the Member Countries, TD conducted an “On-site Training on Environment- and User-friendly Fish Handling and Preservation Techniques: Slurry Ice System Onboard Fishing Boat” (14 February 2012, Phu Yen, Vietnam). The training aimed to promote the use of slurry ice for improving post-harvest fish handling in Vietnam, particularly in Phu Yen as a major landing site for tuna and other important pelagic fishes in Vietnam. In addition, TD also conducted the “Regional Training Course on Post-harvest Handling Techniques” (8-16 October 2012, Samut Prakan, Thailand) to extend the knowledge and experiences on fish handling, *e.g.* onboard fish preservation and handling techniques, cooling medium and its utilization, and onboard refrigeration systems, to relevant officers of the Member Countries. These officers could serve as trainers in extending the technology to other stakeholders in their respective countries and eventually help in reducing post-harvest losses from small-scale fisheries in the region.

## 2.3 Collection of Information on Highly Migratory Species

The program on **“Information Collection on Highly Migratory Species in Southeast Asian Waters”** implemented by TD since 2008 aims to address the need for better understanding of tuna captured in the EEZs of the Southeast Asian countries. The information derived from such program could serve as basis for sustainable development and management of tuna fisheries in the region. Under this program, activities to obtain data on catch and landing of tuna in Indonesia, Philippines, Thailand and Vietnam were undertaken through various means, *e.g.* development and application of logbook system (includes identification of minimum data requirements), data collection at selected landing sites, development of tuna database, and so on.

After five years, this program had successfully come up with a set of data on tuna catch landed in major landing sites of the four participating countries, as well as regional framework for tuna fisheries database that could serve as basis for future data collection even after the termination of the program. Moreover, additional data from non-participating countries, *e.g.* Myanmar and Malaysia, are considered crucial and thus, should be included in the future compilation in order to come up with a better picture of tuna catch landing in the region.



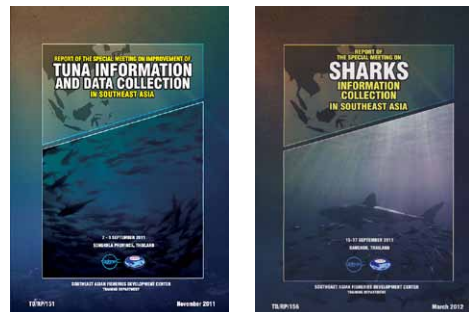
In order to enhance the capacity of relevant officers of the participating countries in collecting and compiling data on tuna production, TD continued to conduct the following activities: 1) the National Training on Improvement of Data Collection from Tuna Gillnet and Purse Seine Fisheries in Vietnam (20-22 February 2012, Binh Dinh, Vietnam), which was aimed at establishing a national mechanism for port sampling data collection, analysis and reporting of tuna catch data from gillnetters and purse seiners; and 2) Training Workshop on Monitoring Tuna Catch Data at Tuna Canneries (2-6 July 2012, Nha Trang, Vietnam), which aimed to enhance the accuracy in species identification at canneries especially for small juvenile of yellow-fin and big-eye tunas.

The On-site Training on Improvement of Tuna Information Collection at Tuna Canneries was conducted as a follow-up to the Training Workshop held in Vietnam. In addition, officers from TD also participated in the First Vietnam/WCPFC Annual Tuna Fisheries Catch Estimate Workshop (2-6 April 2012, Da Nang, Vietnam) which was aimed at improving tuna information collection and harmonizing the effort of SEAFDEC and WCPFC in this aspect.

As 2012 is considered the final year for this project, outputs of the project were published and disseminated, *i.e.* Report of the Special Meeting on Improvement of Tuna Information and Data Collection in Southeast Asia (7-9 September 2011, Songkhla Province, Thailand), and Report of the Special Meeting on Sharks Information Collection in Southeast Asia (15-17 September 2011, Bangkok, Thailand).



*Participants attending in the On-site Training Course for Improvement of Tuna Information Collection at Tuna Canneries*



*Report of the Special Meeting on Improvement of Tuna Information and Data Collection in Southeast Asia (left); and Report of the Special Meeting on Sharks Information Collection in Southeast Asia (right)*

## 2.4 Tagging of Important Pelagic Species

MFRDMD in coordination with TD implemented the program on **“Tagging for Economically-important Pelagic Species in the South China Sea and Andaman Sea”** which has been carried out since 2008 together with eight SEAFDEC Member Countries, namely: Brunei Darussalam, Cambodia, Indonesia, Malaysia, Myanmar, Philippines, Thailand and Vietnam. Under this program, important small pelagic fish species in the region such as the Indian mackerel (*Rastrelliger kanagurta*), short mackerel (*Rastrelliger brachysoma*), shortfin scad

(*Decapterus macrosoma*) and Japanese scad (*Decapterus maruadsi*) were tagged and released (both in the South China Sea and Andaman Sea). The recaptured tagged fishes were recorded and analyzed to provide knowledge on the movement, migration routes, and growth patterns of the target species.

In the tagging study in the South China Sea area, 32,345 fishes were tagged, comprising 14,579 (45%) *Decapterus maruadsi*, 7,665 (24%) *Rastrelliger kanagurta*, 5,220 (16%) *R. brachysoma*, and 4,881 (15%) *D. macrosoma*. In the Andaman Sea, 15,770 fishes were tagged, of which 80% were mackerels, comprising 6,636 (42%) *Rastrelliger kanagurta* and 5,975 (38%) *R. brachysoma*. For the recovery of released tagged fish, the South China Sea area recorded an overall recovery rate of 1.07% while the Andaman Sea at 1.02%.

In 2012 which is the project's final year, MFRDMD expanded the study to cover population genetic study using mitochondrial DNA (mtDNA) cytochrome b marker method for the Indian mackerel and Japanese scad. This was meant to verify the existence of sub-populations or one panmictic population which is the basic information required for better management of these pelagic fishery resources. Fish samples which were collected by the Member Countries from ten locations in the South China Sea and four locations in the Andaman Sea were sent for analysis at MFRDMD and private laboratories.



Summary of the released and recaptured tagged fish by species and tagging sites in the South China Sea and Andaman Sea, 2008-2011  
(Note: Dc = *Decapterus macrosoma*,  
Dr = *D. maruadsi*,  
Rb = *Rastrelliger brachysoma* and  
Rk = *R. Kanagurta*;  
x/y = Released/Recaptured)

As a conclusion of this project, MFRDMD organized the 5<sup>th</sup> Core Expert Meeting (17-19 July 2012, Sepang, Malaysia), where the findings from the regional synthesis of the tagging and recovery data from all participating countries were analyzed and discussed, and the preliminary findings from the genetic study were also reviewed. The Meeting also discussed the scope and methods that should be applied in future studies on small pelagic resources of the region.



Participants of the 5<sup>th</sup> Core Expert Meeting on Economically-important Pelagic Fish Species

### 3. Management for Sustainable Fisheries

To ensure the sustainable exploitation of fishery resources, several initiatives had been promoted by SEAFDEC to enhance effective fisheries management in the region, *i.e.* assessing/controlling fishing efforts which focuses on the promotion of fishing vessel registration and licensing including the development of regional record of fishing vessels; combating Illegal, Unreported and Unregulated (IUU) fishing particularly through the implementation of Port State Measures, catch certification/documentation, and prevention of the trade of products from IUU fishing; conservation and rehabilitation of fishery habitats; and resources enhancement. The implementation of an ecosystem approach to fisheries (EAF) had also been promoted by enhancing the understanding of officers of the Member Countries on the concept and application of EAF. Promotion of community-based and rights-based fisheries were also continued in order to strengthen the involvement of local communities and institutions in the management of fishery resources in their respective areas. Activities were also carried out to improve the collection of fisheries data and information, particularly from small-scale fisheries, while the use of available data and information was also enhanced to serve as basis for sustainable management of fisheries in the Southeast Asian region.

#### 3.1 Management of Fishing Capacity and Combating Illegal, Unreported and Unregulated (IUU) Fishing

For better understanding of the existing fishing capacity and as basis for management for sustainable fisheries and combating IUU fishing, a series of activities were undertaken under the program on **“Promotion of Fishing License, Boats Registration and Port State Measures”**. In 2012, TD convened an Experts Group Meeting on Fishing License and Boats Registration (25-28 June 2012, Bangkok, Thailand) to facilitate an in-depth discussion on the issue. Sharing of available information on the number of fishing vessels and the systems used for data compilation in their respective countries were facilitated by the experts attending the Meeting. In addition, while the basic requirements for regional vessel record of the region were identified, TD was requested to develop a database of fishing vessels in the region based initially on the data shared during the Experts Group Meeting. Henceforth, as a follow-up to the recommendations of the Meeting, TD started the development of a database for regional fishing vessels record, which was supported in principle by the FCG/ASSP during its 15<sup>th</sup> Meeting and which should be brought up for the consideration of higher authorities of SEAFDEC and the ASEAN.

With the objective of enhancing the initiatives in combating IUU fishing, TD conducted a training course on Monitoring, Control and Surveillance (MCS) in Combating IUU Fishing in Southeast Asia (5-16 March 2012, Samut Prakan, Thailand). As an offshoot, TD produced a technical movie on the *“Promotion of Countermeasures to Reduce IUU Fishing (Thai version)”*, and the script in English has been prepared for an English version of the movie in order to enhance wider dissemination of the information.

Furthermore, since Port State Measures has been identified as one of the important elements to combat IUU fishing, while the FAO has adopted in 2009 the Port State Measures to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing, a series of activities have been undertaken by TD to enhance the implementation of Port

State Measures in the region. In 2012, TD convened the Experts Group Meeting on Port State Measures in Southeast Asia (12-14 November 2012, Bangkok, Thailand), which came up with recommendations which include the need for the countries to consider the implementation of the PSM Agreement. While the Meeting recommended the implementation of PSM in the region, common issues and constraints were also identified as well as the required follow-up activities by Member Countries in cooperation with FAO, RPOA-IUU and SEAFDEC with regards to PSM.



*Experts Group Meeting on Fishing License and Boats Registration*

Activities were also implemented by MFRDMD to combat IUU fishing by developing guidelines to prevent the export of IUU fishing products, by collating initial information from Malaysia, Philippines, Vietnam, Myanmar, and Indonesia (through the conduct of visits), as well as from Brunei Darussalam, Cambodia, Japan, Lao PDR, Singapore, and Thailand, (through questionnaires). The information was consolidated and discussed during the Regional Workshop to Develop Regional Guidelines to Prevent IUU Fishing and Its Products from Being Exported (20-22 November 2012, Kuala Lumpur, Malaysia). The said Workshop came up with the draft outline of the Regional Guidelines to Prevent Trading, Import and Export of IUU Fishing Products, as well as identified the required follow-up activities to be undertaken by MFRDMD and the Member Countries in order to come up with recommendations to develop the draft Guidelines.



*The Expert Group Meeting on Port State Measures in Southeast Asia*

Furthermore, the initiatives undertaken by the Member Countries in compliance with the European Commission (EC) Regulation 1005/2008 “Establishing a Community System to Prevent, Deter and Eliminate IUU Fishing” which was enforced since 2010, was coordinated by SEAFDEC. It was noted that since most of the fishers in the region are small-scale, the application of the EC Regulation had created significant impacts to small-scale fishers. The experiences of the countries in this aspect were shared through the Workshop on Assessment of the Impacts of IUU Fishing and EC Regulation 1005/2008 on Small-scale Fisheries in the Southeast Asian region (17-19 October 2012, Nha Trang, Vietnam), which was jointly organized by SEAFDEC in collaboration with the Fisheries Administration of Vietnam and the Agri-Food and Veterinary Authority (AVA) of Singapore. The Workshop identified the issues and came up with recommendations for the development of the draft Strategic Plan of Action for Small-scale Fisheries to Implement the EC Regulation 1005/2008.

### 3.2 Ecosystem Approach to Fisheries

Ecosystem approach to fisheries (EAF) has been acknowledged as a concept which aims to promote sustainable management of fisheries by planning, developing and managing fisheries in a manner that addresses the multiple usage and interaction of several activities in the ecosystems. In order to enhance the knowledge and understanding of concerned officers of the Member Countries on the concept of EAF and its application, TD organized a weeklong training course on Ecosystem Approach to Fisheries Management (16-22 July 2012, Samut Prakan, Thailand). The principal themes expounded during the training course were the concepts of ecosystem approach to fisheries management, situation of fisheries in Southeast Asia, illegal fishing and its impacts on marine ecosystem, habitats and sustainable fisheries, responsible fishing practices, as well as the concept of MPAs and Fisheries *refugia*.



*Training Course on Ecosystem Approach to Fisheries Management in Thailand*

Along with the EAF concept and under the program on **“Activities Related to Climate Change and Adaptation in Southeast Asia with Special Focus on the Andaman Sea”**, activities were also conducted by SEAFDEC to improve management of fisheries and protection of important coastal habitats as important means to build up the resilience of people and communities dependent on fisheries and the aquatic resources. Thus, a series of activities were conducted to facilitate dialogues among concerned countries and agencies (both fisheries and non-fisheries) to address the issues of importance to different areas and sub-areas (*e.g.* Andaman Sea, Gulf of Thailand, Sulu-Sulawesi Sea, etc.), and enhance transboundary cooperation and information sharing for better management of fisheries.

In 2012, SEAFDEC organized the Sub-regional Consultative Workshop of the Northern Andaman Sea (13-14 March, Thailand) which discussed and identified emerging needs and required actions relevant to: critical habitat management, management responses for trans-boundary and migratory fish stock (particularly *Rastrelliger* spp.), and management of fishing capacity. As a follow-up activity, SEAFDEC supported the conduct of a Workshop on Fish Sampling Survey for Myanmar Researchers (10-14 September 2012, Ranong Province, Thailand) to provide hands-on experiences to participants from Myanmar in the conduct of fish sampling surveys at landing sites. A subsequent workshop was also conducted (1-4 October



*Technical staff of DOF Myanmar compiling data at a fishing port in Ranong*

2012, Myanmar) for the participants who attended the first workshop to extend the knowledge and experiences gained to other local officers in Myanmar.

As 2012 is the final year of the program's first phase, the 2<sup>nd</sup> Meeting of the Andaman Sea Sub-region (28-29 August 2012, Phang Nga Province, Thailand) was organized to conclude the recommendations and actions made during the series of sub-regional meetings and on-site events conducted over the past three years starting with the First Meeting of the Andaman Sub-region held in 2009.



*2<sup>nd</sup> Meeting of the Andaman Sea Sub-region  
in Phang Nga, Thailand*

In addition, activities were also undertaken to enhance the collaboration between SEAFDEC and other regional organizations, *e.g.* the RPOA-IUU, Bay of Bengal Large Marine Ecosystem (BOBLME) Project, International Union for Conservation of Nature, and Coral Triangle Initiatives – Coral Reefs, Fisheries and Food Security (CTI-CFF), towards improved conservation and management of fisheries.

### **3.3 Habitat Conservation and Resources Enhancement**

In order to support activities of Member Countries on habitat conservation and resource enhancement, TD implemented a series of activities under the program on “**Rehabilitation of Fishery Resources and Habitat/Fishing Grounds for Resource Enhancement**”. A desk study was carried out to investigate the existing information and research works on the effective designs/models and methodologies of the resource enhancement tools/practices used in various fishery habitats. In addition, research studies were also conducted on the effectiveness of such tools/practices in providing shelter and enhance the abundance of the fishery resources.

A survey was undertaken to collect data on fish species composition (using trammel net, giant trap, juvenile fish trap and underwater video recording) in the *artificial reef areas* (previously deployed by the Department of Fisheries of Thailand in Rayong Province, Thailand in 2009), and where fish enhancing devices (FEDs) in floating vertical design were installed on 5-9 June 2012. Socio-economic data was also obtained through a questionnaire survey.



(left) Installation of fish enhancing devices (FEDs); and (right) Juvenile fish trap was prepared to monitor fish composition around sea grass rehabilitation area

Meanwhile, in a pilot *sea grass rehabilitation* site in Krabi Province, Thailand (Andaman Sea), activities were undertaken to monitor the progress of sea grass rehabilitation programs. Surveys were conducted on 2-7 April and 27-31 August 2012 to collect data on fish species compositions using juvenile fish traps and trammel net. In addition, seedstocks (30,000) dog conch were released in the selected site (200 x 200 m area), which was identified by the local fishers to serve as conservation area and was demarcated using buoys.

In the *inland area*, a pilot activity was undertaken in Nam Houm Reservoir, Lao PDR with the aim of providing technical assistance on the appropriate designs for resources enhancement tools and practices suitable for freshwater ecosystems. Surveys were conducted in collaboration with the Department of Livestock and Fisheries of Lao PDR and local fishers on 23-27 April, and 28 July - 4 August 2012 to investigate the fish species compositions using gill net and trammel nets, as well as to collect information on fish larvae and fish landing through discussions with local fishers and fisheries officers. Geographic survey was also undertaken to assess and obtain information on the reservoir's profile. In addition, hands-on training was conducted for local officers and fishers on: 1) fish larvae collection using beach seine net and preservation of larvae samples; 2) fish shelter construction and installation in the fish conservation area; and 3) mobile hatchery demonstration for breeding and releasing of juvenile fish. These activities were aimed at enhancing the capacity of local officers and fishers in undertaking the project activities as well as future activities relevant to resources monitoring and enhancement.



Case study on the identification and evaluation of fisheries ecosystem in Lao PDR

In order to enhance the capacity and awareness of the other Member Countries on the rehabilitation of fishery resources and habitats/fishing grounds, and extend the knowledge and methodologies (both technical and management aspects) developed through this project, TD conducted the Regional Training Course on the Identification of Critical Fishing Grounds and Habitat Rehabilitation and Management Approach on 19-28 March 2012 in Samut Prakan, Thailand.

### 3.4 Promotion of Co-management and Rights-based Fisheries

Fisheries in Southeast Asia is being characterized by the involvement of a large number of fishers, most of whom are small-scale, and where the activities involved integrated sectors, both fisheries and non-fisheries. In order to enhance the effective management of fisheries, co-management and rights-based fisheries have been promoted in the region, particularly by strengthening the roles and functions of local communities and institutions in the management of the fishery resources in close coordination with the relevant local government units.

In supporting this concept, TD implemented a project on the **“Promotion of Rights-based Fisheries and Co-management Towards Institutional Building and Participatory Mechanism for Coastal Fisheries Management”**. Under such project, TD organized in 2012 a series of on-site training courses on Practical Approach to Co-management and Right-based Fisheries in collaboration with the Member Countries, *i.e.* Vietnam (10-12 July 2012), Cambodia (4-7 September 2012), Lao PDR (10-14 December 2012), and Myanmar (17-21 December 2012). During the training, the concept and theoretical framework of co-management and rights-based fisheries for fishery resources management was imparted to fisheries officers who are potential trainers in their respective provinces/states, in order that the knowledge could be extended to enhance the application of fisheries co-management and right-based concepts in the target communities.

Activities were also undertaken to promote the important roles of women in fishing communities by introducing alternative livelihoods that would bring in additional incomes to the households and communities. A Training Course on Practical Approach to Co-management for Community Level was organized on 29 August - 1 September 2012 in Phu Yen Province, Vietnam. Since the local government in Phu Yen has been undertaking activities to promote the sustainable production of fish sauce from anchovies including labeling and branding of their product, TD offered to support such initiative by encouraging the establishment of women’s group, conducting study tour for group members to observe relevant and successful activities, transferring of technologies to improve product quality and packaging, and supporting the development of marketing and basic accounting for the group.



*Participants of the On-site Training on Practical Approach to Co-management and Right-based Fisheries in Cambodia*





*On-site Training on Practical Approach to Co-management and Right-based Fisheries in Lao PDR*

### 3.5 Enhancing the Collection and Usage of Fishery Information and Statistics

Considering the need for reliable data and information as basis for sustainable development and management of fisheries, SEAFDEC conducted a number of programs to support and improve data collection, particularly for commercially-exploited species such as tuna, small pelagic fishes and highly migratory species. However, the need to compile reliable information from small-scale fisheries is another area that should be addressed.

Specifically, in order to enhance the compilation of information from small-scale coastal and inland fisheries in the Member Countries, activities were conducted by TD under the program on **“Improvement of Information Gathering System for IUU Fishing Related Countermeasures in the Southeast Asia”**. In 2012, a series of activities were implemented with the objective of improving and extending the tools and methodologies for data and information collection. These included: 1) Local Workshop on Compilation of Fisheries Information and Statistics on Inland Fisheries (12-15 February 2012, Pursat, Cambodia); 2) Local Workshop on Compilation of Fisheries Information and Statistics on Inland Fisheries (19-22 March 2012, Vientiane, Lao PDR); and 3) Local Workshop on Compilation of Fisheries Information and Statistics on Inland Fisheries (27-30 March 2012, Yangon, Myanmar). It was well recognized that fishery statistics of the region could be improved through the development of such practical data collection methodologies.

The SEAFDEC Secretariat also continued the implementation of activities under the program on **“Improvement of Statistics and Information for Planning and Management of Fisheries in the ASEAN Region”**. While the harmonization of norms/ standards, definitions and classifications of fishery statistics was on-going, activities in 2012 emphasized on enhancing the use of data and information available in the region, particularly those available at SEAFDEC Departments through the implementation of programs and projects. The fishery statistics data compiled by SEAFDEC throughout the past years have been utilized, in



*The Southeast Asian State of Fisheries and Aquaculture 2012 (SEASOFIA 2012)*

order to provide better understanding of the status of the region’s fishery resources. The information was then synthesized and published “The Southeast Asian State of Fisheries and Aquaculture 2012 (SEASOFIA 2012)”, which also outlined the important fishery-related issues/challenges, and the outlook for fisheries development towards the coming decade.

SEAFDEC also participated in statistics-related events at the regional and international levels, *i.e.* the CWP Second Inter-sessional Aquaculture Group Meeting (14 July 2012 in Rome, Italy), Workshop on Fisheries Statistical Working Group to support the Development of Regional and Sub-regional Fisheries Management Plans (18-19 March 2012, Medan, Indonesia), and the 24<sup>th</sup> Session of the Asia and Pacific Commission on Agricultural Statistics (8-12 October 2012, Vietnam) to support the streamlining of regional statistics with international standards, classification and definitions of fishery statistics at the international level.



Workshop on Fisheries Statistical Working Group in Medan, Indonesia

Activities were also undertaken by TD to enhance the dissemination of data and information obtained from various programs through the development of databases. The regional database for the tagging program of pelagic fishery resources was developed (accessible at [http://map.seafdec.org/tagging/tagging\\_adm.php](http://map.seafdec.org/tagging/tagging_adm.php)), with the inputs updated by respective national coordinators of the project. The database for Fisheries Statistics of Southeast Asia (<http://fishstat.seafdec.org>) was also maintained with the data set of 2010 fishery statistics of the Southeast Asian countries added. In addition, web-based application was developed to store and share information from cruise surveys carried out by the M.V. SEAFDEC (at [http://map.seafdec.org/cftd/mv\\_seafdec/index.php](http://map.seafdec.org/cftd/mv_seafdec/index.php)) and the M.V. SEAFDEC 2 (at [http://map.seafdec.org/cftd/survey\\_mv2/mvseafdec\\_2.php](http://map.seafdec.org/cftd/survey_mv2/mvseafdec_2.php)).



Regional database for the tagging program of pelagic resources (left); and Regional database for fishery statistics of Southeast Asia (right)

## 4. Conservation and Management of Aquatic Species under International Concerns

Through TD and MFRDMD, SEAFDEC continued its efforts in promoting the conservation and management of aquatic species under international concern, *i.e.* sea turtles, sharks and cetaceans, particularly by enhancing data collection to obtain better understanding on the status of the species. Moreover, AQD also conducted activities on stock enhancement by implementing R&D on the aquaculture and release of internationally-threatened species as well as regionally over-exploited species.

### 4.1 Sea Turtles

The conservation and management of sea turtles has been undertaken by MFRDMD since 1999 which included activities on sea turtle hatchery management, stock enhancement, and tagging of sea turtles in collaboration with the Member Countries. Starting in 2010, MFRDMD implemented the program on **“Research and Management of Sea Turtles in Foraging Habitats in the Southeast Asian Waters”**, by studying the ecological parameters in sea turtle foraging habitats and collecting tissue samples of sea turtles for genetic analysis using mitochondrial DNA markers in order to obtain information on sea turtle sub-population structures in the region.

Thus, tissue samples of sea turtles (81 green turtles and 3 hawksbill turtles) were collected through scientific survey to collect ecological parameters in pilot foraging habitats in Mabul and Sipadan Islands (Malaysia) since 2011 and analyzed the mitochondrial DNA as genetic markers. Results of the sequencing DNA were blasted to GenBank for similarity, after which it was concluded that the green turtle samples consisted of 13 haplotypes, of which 3 haplotypes have not been published in the GenBank. Meanwhile, for hawksbill turtles, all three samples have different haplotypes.

In 2012, MFRDMD also prepared the Draft Action Plan for Managing Foraging Habitats of Sea Turtles in the Region. The Action Plan outlined the need for management of fishing activities that could threaten adult sea turtles, as well as reduction of poaching of sea turtle eggs in nesting areas.



*Analyses of samples by using mitochondrial DNA as genetic marker*

### 4.2 Sharks and Rays

MFRDMD organized the Regional Workshop on Taxonomy and Identification of Sharks and Rays (22-26 April 2012, Kuala Terengganu, Malaysia) with the objective of enhancing the capacity of participating countries, namely: Brunei Darussalam, Cambodia, Indonesia, Malaysia, Myanmar, Philippines, Thailand and Vietnam, in data collection and species

identification of sharks and rays. This was also intended to improve the collection of information on catch species, utilization and trade of sharks and rays in the future. Biological data of sharks and rays, such as length, sex, maturity size, number and size of embryos/eggs were also recorded; and the information is meant to supplement data on the reproductive information on major species of sharks and rays compiled from studies undertaken by MFRDMD in 2003-2004.

MFRDMD also published the “Field Guide to Sharks of the Southeast Asian Region”, which was launched during the workshop. This Field Guide includes 69 species of sharks which are mostly found in abundance in the region, with colorful pictures and identification description.

Materials for another two books “Field Guide to Rays of the Southeast Asian Region” and “Field Guide to Sharks and Rays Look-alike Species of the Southeast Asian Region” have been prepared for publication in early 2013. In addition, the Standard Operating Procedures for sampling of tissues of sharks and rays for DNA analysis was also prepared by MFRDMD to support the collection of tissue samples by the Member Countries.

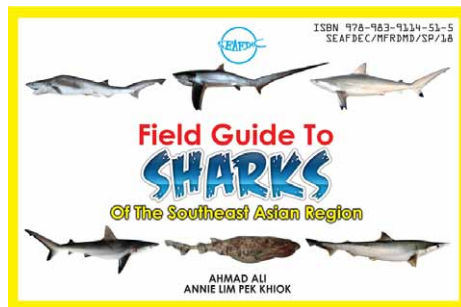
### 4.3 Cetaceans

The program on “**Cetacean Research in Southeast Asian Waters: Cetacean Sighting Program**” was implemented by TD since 2008 by incorporating cetacean sightings in research cruises conducted by SEAFDEC and the Member Countries, and gathering of relevant information from other various sources. Completed in 2012, the program’s major achievements were presented during the End-of-Project Meeting on Cetacean Research in Southeast Asian Waters: Cetacean Sighting Program (27-29 March 2012, Bangkok, Thailand).

Discussed during the Meeting were the outputs from the project, *i.e.*: 1) training materials on cetacean sighting techniques for officials of the responsible agencies in the region; 2) methodologies for coastal



*Participants observing sharks and rays landing at LKIM Kuantan Fishing Port*



*The “Field Guide to Sharks of the Southeast Asian Region”*



*Cetacean research project meeting*

cetacean stock assessment in Southeast Asia; 3) training handbook on cetacean information collection in Southeast Asia; 4) summary results of the cetacean sighting survey in Southeast Asian region carried out onboard research/training vessels; and 5) information on cetacean hotspots in Southeast Asia.

#### 4.4 Resource Enhancement of Internationally Threatened and Over-exploited Species in Southeast Asia through Stock Release

SEAFDEC/AQD has been implementing a project on stock enhancement of internationally threatened species to address issues related to the listing or proposed listing of several commercially-exploited species in the CITES Appendices. The AQD project focused on seahorse (*Hippocampus* spp.), Napoleon wrasse (*Cheilinus undulatus*), sandfish or sea cucumber (*Holothuria scabra*), donkey's ear abalone (*Haliotis asinina*), and mud crab (*Scylla* spp.). Studies on adaptive measures for coral replenishment have also been initiated.

In the genetic characterization of wild and hatchery-bred seahorses using mitochondrial DNA (mtDNA), the mtDNA of the seahorse samples was amplified using the universal primer, while about 480 base pairs of the cytochrome b gene fragment were sequenced.



Seahorse (*Hippocampus comes* (top-left) and *H. barbouri* (bottom-left)) propagated for stock enhancement at the Seahorse Hatchery in AQD's Tigbauan Main Station (above)



The stock and site assessment for Napoleon wrasse confirmed that juveniles can be found in reefs (8-12 meters deep) with hard branching coral adjacent to seagrass areas.

The mean density of the natural population of *Holothuria scabra* within 50 meters from edge of nursery area has improved (6 per 100 m<sup>2</sup>) compared with that of 2011 (3 per 100 m<sup>2</sup>), although the size structure of natural population remained skewed to small size cohorts (<100 g) comprising 70%.

A baseline assessment of the wild population of three species of mud crab, *Scylla* spp. showed that *S. olivacea* (86.6%), *S. serrata* (12.3%) and *S. tranquebarica* (1.1%). In addition, the yield and CPUE in terms of both quantity and biomass did not significantly differ between the two types of traps used, bamboo traps and crab pots.



AQD hatchery-bred *H. asinina* inside PVC pipes (left) after experimental release (right)

Results of the monitoring of abalone, *Haliotis asinina* after experimental releases, showed that none of the hatchery-reared abalone was recaptured although some were observed outside the permanent transects. During the monthly abalone samples, 42.6% were obtained from the transect embracing dead branching corals with encrusting algae, supporting previous findings that abalone may be utilizing coral branches as shelters and encrusting algae as food. In the analysis of molecular variance to determine the impacts of released hatchery-bred abalone on the wild population, the results showed that 95.8% of the observed haplotype variation was due to differences within stocks rather than between stocks.

Training on abalone culture and continuous dialogue with community folk were conducted through the IEC (information, education and communication). Promotion of abalone cage culture as alternative livelihoods and complement stock enhancement have been implemented to develop strategies for managing released stocks and come up with socio-economic analysis of the stock enhancement activities.

## 5. Post-harvest Technology and Safety of Fish and Fishery Products

### 5.1 Monitoring of Biotoxins in Fish and Fishery Products in Southeast Asia

As a follow-up activity to the project on “**Chemical and Drug Residues in Fish and Fish Products in Southeast Asia**” conducted from 2004 to 2008, the project on “**Biotoxins Monitoring in Fish and Fish Products in ASEAN**” was initiated and implemented by MFRD from 2009 to 2012. This follow-up project aimed to enhance awareness and improve monitoring, detection and sharing of information on marine biotoxins in order to reduce public health risks associated with the consumption of contaminated shellfish and fish. Specifically, the project focused on the development of methodologies on biotoxins analysis through human resource training and increased understanding of levels of biotoxins occurrences and incidences in fish and fish products in the ASEAN Member States.

Under the project, all Member States except Brunei Darussalam, participated in the biotoxins surveys for Paralytic Shellfish Poisoning (PSP) toxins in either green mussels or baby clams in their respective countries, the results of which were submitted to MFRD for incorporation into the Technical Compilation published in February 2013. This Technical Compilation would serve as useful reference and resource tool for the Member Countries

in their efforts to implement biotoxins monitoring. The publication would also help in improving the knowledge and understanding of the levels of biotoxins occurrences and incidences in fish and fish products in the ASEAN region and facilitating the exchange of information among the ASEAN Member States.

The project was concluded during the End-of-Project Seminar in Singapore on 20-21 November 2012. The Seminar, which served as a platform for the Member States to share their experiences and challenges encountered during the implementation of biotoxins monitoring in their respective countries, was also an avenue for presenting and disseminating the results of the biotoxins monitoring survey. A network of biotoxins expertise and responsible persons/national authorities in each Member State was established to facilitate cooperation and coordination in the future.



*Participants of the End-of-Project Seminar on Chemical and Drug Residues in Fish and Fish Products*

## **5.2 Traceability Systems for Aquaculture Products in the ASEAN Region**

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

In view of these developments, MFRD has been implementing a project on **“Traceability Systems for Aquaculture Products in the ASEAN Region”** from 2010 to 2014 to support the regional aquaculture industries in the implementation of appropriate traceability systems for aquaculture products and to meet international traceability requirements in the network of aquaculture production, marketing, and trade. The objectives of the project are to provide a platform for the sharing of information and experiences among ASEAN Member States on the implementation of traceability systems for aquaculture products in the region, and to promote the implementation of traceability systems for aquaculture products in the ASEAN region.

A Mid-Term Project Review Meeting was organized on 7-8 November 2012 in Singapore to review the progress of the project and the activities conducted thus far. During the Meeting, the participants provided updates on the implementation status of traceability systems for aquaculture products in their respective countries, including the issues and challenges encountered during implementation and conduct of the national activities. The Review Meeting also discussed and planned for the 2<sup>nd</sup> On-site Regional Training Workshop



*The Mid-term Review Meeting for the Project on Traceability Systems for Aquaculture Products in the ASEAN*

in 2013 in Thailand, taking into consideration the recommendations of the 1<sup>st</sup> Regional On-site Training Workshop in 2011 to ensure that the 2<sup>nd</sup> training will be more effective and beneficial to the participants.

### 5.3 Utilization of Freshwater Fish for Value-added Products

MFRD has initiated and implemented from 2011 to 2013, the 3-year project on **“Utilization of Freshwater Fish for Value-added Products”** with the cooperation of Lao PDR, Myanmar, Vietnam, and Indonesia. Implemented through the Post-Harvest Technology Centre (PHTC) of the Agri-Food and Veterinary Authority (AVA), which is the Collaborating Center for MFRD programs, the project is aimed at utilizing freshwater fish species for the development of value-added products and providing assistance in upgrading the processing and packaging technology for freshwater fish products in the participating countries.

In 2012, the four participating Member Countries successfully developed value-added products using indigenous freshwater fish species, making use of the knowledge gained through the regional training course in 2011. Indonesia has developed two products from catfish; Myanmar, two products from rohu fish; Lao PDR, one product from clown featherback fish; and Vietnam, two products, one each from catfish and another from snakehead fish. Shelf-life studies on the products were also conducted by the respective countries.



*Product sensory evaluation session during Mid-term Evaluation Meeting*



The Mid-term Evaluation and Progress Meeting on 27-28 June 2012 discussed and evaluated the progress of the project and planned for the subsequent activities, *i.e.* the preparation and publication of the processing handbook and the End-of-Project Seminar. The Meeting also provided a useful platform for the participating countries to share information and results of their product development and processing trials as well as shelf-life studies for product improvement in the future.



*Mid-term Evaluation and Progress Meeting for the Project on Utilization of Freshwater Fish for Value-added Products*

## 6. Sustainable Aquaculture Development

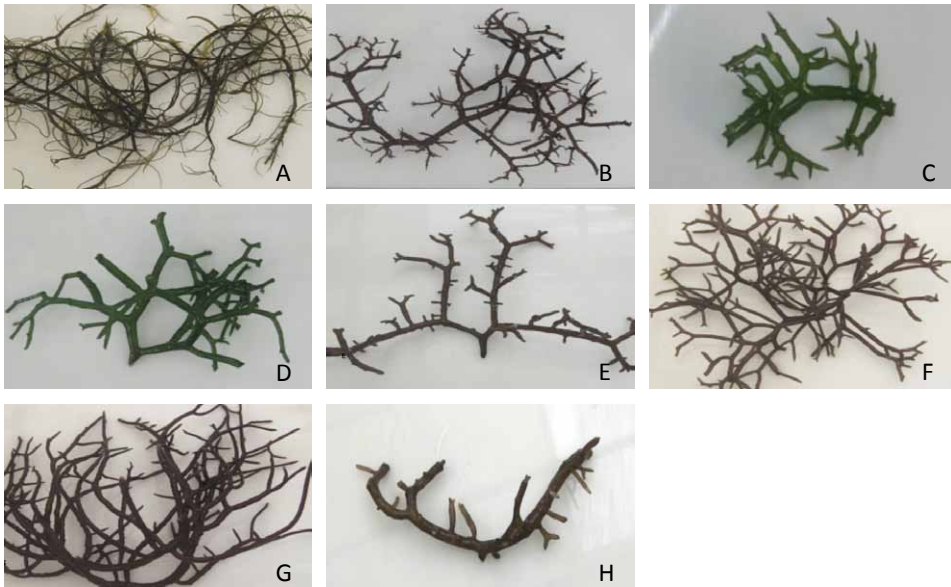
### 6.1 Quality Seed through Sustainable Aquaculture

Activities were conducted to determine the optimal conditions and methods for production of quality seedstock in sufficient quantities, using conventional methods of stock improvement such as domestication, broodstock management, strain evaluation and selective breeding or genetic improvement of traditional and emerging freshwater and marine species. The highlights of accomplishments include the following:

#### ***Development of good quality broodstock and implementation of proper broodstock management protocols***

Improvements in the diet formulation for the giant freshwater prawn, *Macrobrachium rosenbergii* (mean initial weight = 0.04 g) through higher inclusion or replacement levels of fish meal protein with cowpea meal protein in the grow-out diet revealed that prawns fed diets with 30-45% replacement levels showed the highest mean body weight (~0.58-0.60 g) after 65 days of culture from the post-larval stage in tanks. Meanwhile, broodstock given diets with 30% cowpea replacement level had the most number of berried females and gave the highest number of eggs (1,934 g<sup>-1</sup> female).

For the donkey's ear abalone, *Haliotis asinina*, breeders fed on seaweed diet were significantly smaller than those fed the formulated maturation diet. The reproductive performance of wild-sourced abalone breeders generally improved when the dietary protein/energy levels were increased. Pioneering work on genetic documentation of milkfish stocks using microsatellite markers was started with the screening of primers for 72 potential markers to identify stocks and aid in determining genetic quality. The same approach is being done for mud crabs, shrimps, abalone, and the seaweeds *Kappaphycus* and *Eucheuma*. DNA extraction from seaweeds and PCR amplification for selected genetic markers had also been optimized.



Red seaweed samples used in the optimization of DNA extraction protocol: (A) *Gracilaria* sp.; (B) *Euchema denticulatum* var. *spinosum*; (C) *Kappaphycus striatum* var. *sacol green*; (D) *K. alvarezii* var. *giant green*, (E) *giant brown*, (F) *vanguard*; and (G and H) two unknown variants of *K. alvarezii*. Seaweeds were obtained from Guimaras (A-C), Zamboanga (D and F), Sorsogon (E), Antique (G), and Surigao (H), and cultured at the Seaweeds Farming Lab of SEAFDEC/AQD and then sampled for total cellular DNA extraction.

Broodstock conditioning methods for the sandfish or sea cucumber by returning them to natural sea pens resulted in recovery in terms of body size. Sandfish nursery production is being improved through refinements of rearing systems and protocols.

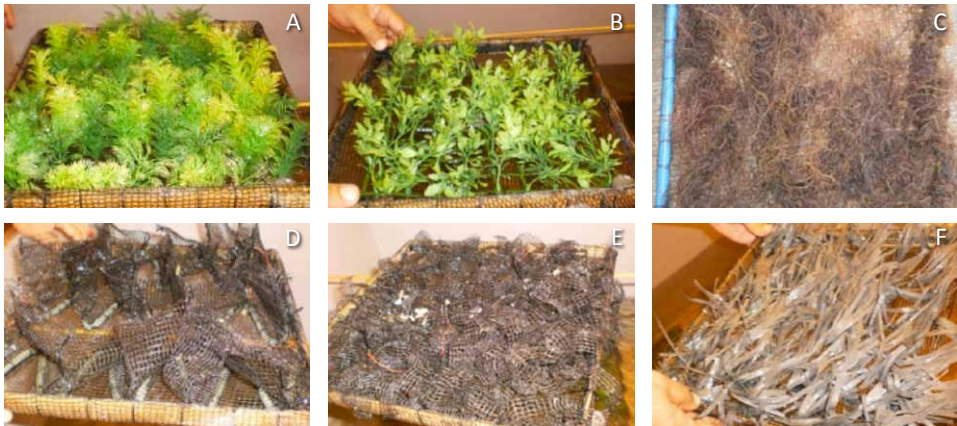
Initial domestication efforts of the indigenous freshwater prawns, *Macrobrachium lar* and *M. mamilodactylus* resulted in unsuccessful metamorphosis to the post larval stage, suggesting the need to continuously refine the larval rearing protocols.



Sandfish nursery at AQD's Igang Marine Station (left) and preparation of sandfish for spawning (right)

### ***Refinement of the hatchery and nursery management methods to improve seedstock quality and production of various commodities***

Under the collaborative project which is part of the Philippine Department of Science and Technology (DOST) National Mud Crab Science and Technology Program to develop the optimal hatchery and nursery protocols, results of trials on the frequency of oxytetracycline application (daily, every other day or every 5 days until the megalopa stage) in seed production showed that molt death syndrome occurred in larvae treated more frequently with the chemical. Survival from zoea 4 to megalopa was better in groups fed with Selco-enriched *Artemia* compared with the control. An assessment of the influence of stocking density and tryptophan-supplemented diets on the survival and growth of mud crab in the nursery phase, suggested that mud crabs fed mussel and 0.5% tryptophan-supplemented diet had better survival for crabs stocked at 30/m<sup>2</sup> during the first month and 5/m<sup>2</sup> for the second month of nursery rearing. When fed mussel and 0.75% tryptophan-supplemented diet only, an improvement in the survival of juvenile crabs was observed for both stocking densities (5 and 10/m<sup>2</sup>). Tryptophan supplementation in the diets was carried out to minimize cannibalism during the larval and nursery stages of marine fish.



*Different shelters used for the mud crab preference experiment, a component of the study on the strategies for reduction of cannibalism in the mud crab nursery: A-B, plastic plant decors; C, seaweeds; D-E, nets; F, straw*

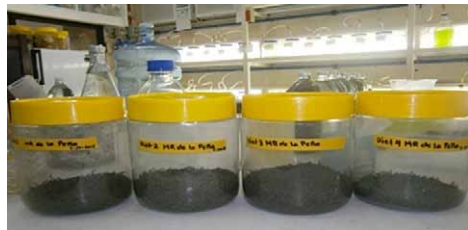


*Net cage with plastic straw used as shelters for mud crab (left), mud crab nursery set-up in Dumangas Brackishwater Station (right)*

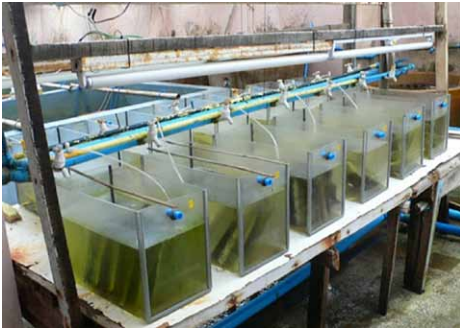
In analyzing the effect of feeding sodium iodide enriched rotifer and *Artemia* on the metamorphosis and survival of larvae of three high value marine species, namely: mangrove red snapper *Lates argentimaculatus*, pompano *Trachinotus blochii* and grouper *Epinephelus fuscoguttatus*, results showed that the red snapper had significantly higher survival while pompano had better growth when fed sodium iodide enriched rotifer and *Artemia*, with the survival rate of grouper initially showing positive effect from the diet.

Initial feeding trials comparing the reproductive performance of milkfish broodstock fed fortified (with arachidonic acid, beta-carotene, vitamin C and soy-lecithin) vs non-fortified (control) diets suggested that those fed fortified diets spawned more frequently, generally producing more viable eggs and resulting in higher egg fertilization and hatching rates. A strain of thraustochytrid *Schizochytrium* sp. (LEY7) that contains high lipid and omega 3 fatty acid levels, such as DHA used for feed enrichment in abalone gave better growth and survival.

Feeding trials using natural food organisms (*Nitzschia* sp., *Diploneis* sp. and *Cocconeis* sp.) for post-larval abalone revealed that *Nitzschia* sp. is good candidate species for early settlement and *Cocconeis* sp. after 15-day post-settlement of abalone post-larvae. In the feeding trials that used microparticulate diets in large scale tank systems, abalone reared on agar-based microparticulate diet had longer shell lengths and higher survival rates.



Feeds for abalone juveniles with lipids sourced from thraustochytrid (2-6% lipid)



Stocking of abalone veliger larvae in settlement tanks



Experimental set-up for larval settlement of abalone fed with different types of benthic diatoms

Hatchery rearing and feeding protocols for the climbing perch, *Anabas testudineus* and the silver therapon, *Leiopotherapon plumbeus* which are indigenous to Laguna de Bay, are currently being improved to increase survival rate.



Outdoor concrete tank used for rearing of silver therapon larvae



(from top to bottom) Newly-hatched silver therapon larvae; Silver-therapon larvae at 16 days after hatching; and Harvested 40-day old silver therapon juveniles

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

Selective breeding programs have been conducted for selected commercial species like mud crab, tiger shrimp, giant freshwater prawn, tilapia, abalone, and seaweeds. Hybridization of the abalone, *H. asinina* was conducted by crossing this with other Philippine abalone species, *H. varia*, *H. planata* and *H. glabra*, to produce stocks with improved traits. About 140 hybrids were produced and stocked in sea-based cages with the growth and survival of the hybrid abalone juveniles being compared with that of pure *H. asinina* juveniles. In the evaluation of methods to develop strains of *Kappaphycus* that are resistant to epiphytes, using tissue-cultured *Kappaphycus* with different commercial fertilizers, the results showed no significant difference in the growth of the fertilized and unfertilized stocks.

From January to December 2012, the AQD abalone demonstration hatchery produced 95,210 pieces of 5-8 mm shell length abalone juveniles, where the survival rate from veliger to juveniles (90 days of culture) ranged from 0.28 to 1.00%. From the study on large-scale abalone juvenile production, 198,501 pieces of 5-8 mm shell length abalone juveniles were generated with survival rate from veliger to 90 days old ranging from 0.11 to 1.07%, indicating that the hatchery protocol for the production of early juvenile abalones still needs to be refined.

***Enhancement of adoption of economically viable systems to produce sufficient seedstock***

Mass production of sex-reversed and mixed-sex Nile/red tilapia fingerlings as well as large-scale production of abalone juveniles, are continuously being done to demonstrate the viability of small-scale and/or large-scale seed production systems. Capacity-building of fish farmers and other industry stakeholders on appropriate breeding and a larval rearing technology was promoted through several specialized training courses offered to local government representatives, private sector investors, feed company staff, and the fisherfolk. The species in focus were sandfish, abalone, mud crab, marine fishes, tilapia, and the giant freshwater prawn.

**6.2 Healthy and Wholesome Aquaculture**

Activities were conducted with the objective of improving aquaculture production through innovations in nutrition and feeding and fish health management, and in preserving the environmental integrity of aquaculture areas.

***Finding different sources of fish meal substitutes and development of effective feed management schemes that incorporate sound management***

Culture of milkfish in marine floating net cages using improved milkfish practical feed with optimum inclusion of soybean meal (SBM) and soy protein concentrate (SPC) resulted in good growth and significantly reduced Feed Conversion Ratio. In the improvement of the nutritional value of locally available feed resources by fermentation, protocols for small-scale fermentation were standardized prior to increasing the volume of fermentation. The use of varying levels of copra meal (0, 10, 20, 30, 40 and 50% level) as replacement

to soybean meal in diets for mud crab indicated no significant difference in body weight, survival, increase in carapace, body weight and molting interval. In the experiment to determine the stocking densities (5, 10, and 15 prawns/m<sup>2</sup>) of the giant freshwater prawn, *M. rosenbergii* supported solely by periphyton productivity in cage culture in Laguna Lake, significantly better growth was observed at lowest stocking density although there were no significant effects on survival among the treatments.

***Development of aquafeeds for selected species at specific growth stages especially for species or stages for which no artificial feed has been formulated***

Nine test diets containing different protein (38, 46 and 54% Crude Protein (CP)) and lipid levels (8, 11 and 14%) were formulated for feeding experiment on pompano fry in tanks using practical feed ingredients. After 14 weeks, survival rates in all dietary treatments were almost 100%. The Feed Conversion Ratio (FCR), Specific Growth Rate (SGR) and % weight gain of fish on diets containing 46 and 54% were significantly better than those fed 38% CP regardless of lipid level.

***Promotion of better understanding of the concept of feed conversion ratio and adequate nutrition and efficient feeding practices among fish farmers to promote fish health***

Demonstration and verification experiments in brackishwater ponds include intensive grow-out culture of milkfish using alternative day feeding, intensive culture of red snapper using SEAFDEC-formulated phased diets and semi-intensive culture of pompano using commercial feeds. The polyculture of tilapia and freshwater prawn to compare the performance of stocks fed SEAFDEC-formulated feed and commercial feed during rearing in net cage in freshwater dam/reservoir revealed that growth, survival and feed conversion ratios were better in both species fed the SEAFDEC-formulated diet compared with those fed the commercial feeds, suggesting a large-scale demonstration of this technology.

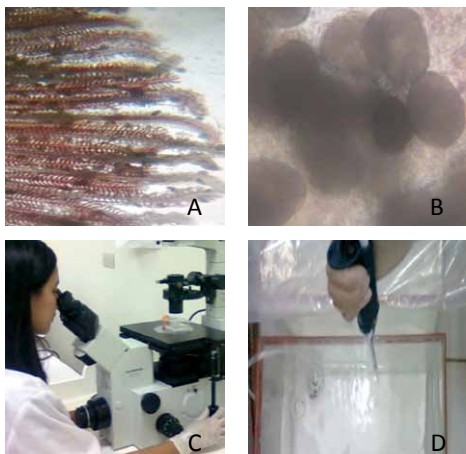
***Investigation on the efficacy of probiotics and rationalization of the need and application of diagnostics that will ensure biosecurity within the culture systems***

The beneficial effects of polyhydroxybutyrate (PHB) supplementation on the different developmental stages of *Penaeus* sp. include protection from pathogenic infections, growth enhancement, and improved larval survival. Bacterial isolates P4-47 and P4-1 were chosen as experimental probiotic *Bacillus* spp. in the *in vitro* susceptibility assay and feeding experiment. Cell free extracts of both *Bacillus* isolates inhibited the growth of pathogenic *Vibrio campbellii* LMG2136. The average body weight and body length of shrimps fed artificial diet supplemented with *Bacillus* P4-1 and P4-47 isolates were at par with shrimps solely fed with artificial diet.

AQD initiated a new study that will elucidate the geographic distribution and transmission route of shrimp viral diseases in Southeast Asian countries to address the occurrence of Early Mortality Syndrome (EMS) in the region. Gills and pleopods of *Penaeus monodon* samples taken from several farms and provinces in the Philippines have been examined for the detection of shrimp viruses.

### Finding effective alternative safe drugs/chemicals to manage aquaculture diseases in lieu of the harmful chemicals and drugs

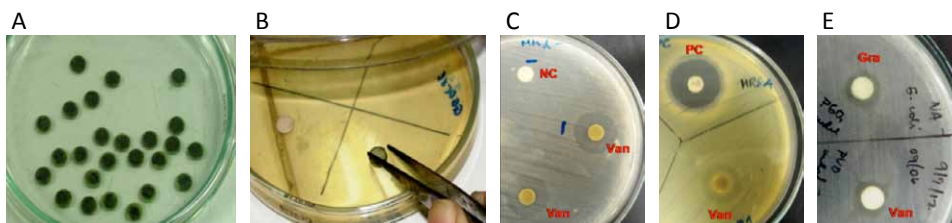
In examining the host response to pathogens and developing control methods such as the use of natural immunostimulants for marine fishes to counter the several epizootics that occurred in the AQD marine fish hatchery, an experiment on host defense of *Lates calcarifer* against *Amyloodinium oocelatum* was conducted.



Assessment of immune parameters and expression of antimicrobial peptides upon exposure to infective dinospores and trophonts revealed various factors such as poor hatching of tomont due to bacterial and fungal contamination in low dinospore counts, or development of resistance as fish increase in age and size resulting in successful infection of the healthy fish by the parasite. Similar results were seen in cohabitation experiments using bigger fish (mean body weight: > 50g) where infection rates gradually declined with each passage until no further mortalities were observed.

(A) *Amyloodinium*-infected gill of *Lates calcarifer*;  
 (B) Tomonts isolated from gills of the fish;  
 (C) Monitoring the hatching of tomont to collect dinospores; and (D) Inoculation of dinospores in tanks for LD<sub>50</sub> determination

Promising results were observed for some organic extract preparations of *K. alvarezii* (Vanguard variant) and *Gracilaria* sp. (unknown variant) against *S. aureus*, MRSA, or *E. coli*.



Antibacterial screening of red seaweed organic extracts by disc assay method:  
 (A) Ethanol extract of *Kappaphycus alvarezii* loaded onto sterile paper discs (5 mg/disc);  
 (B) Mueller-Hinton Agar (MHA) plates swabbed with test bacteria and inoculated with test extracts;  
 (C-E) Zones of inhibition of *K. alvarezii* Vanguard variety and/or *Gracilaria* sp. against *Staphylococcus aureus* (C), Methicillin-resistant *S. aureus* (MRSA) (D), and *E. coli* (E). PC indicates the zone of inhibition against an antibiotic positive control (chloramphenicol-30 or penicillin-10). No inhibition was observed in all negative controls (NC)

### 6.3 Maintaining Environmental Integrity through Responsible Aquaculture

Activities were carried out to develop environment friendly-based aquaculture technologies by integrating environmental factors in the AQD research activities and promoting responsible aquaculture.



***Assessment of impacts of aquaculture on biodiversity, and water and sediment qualities in the culture areas and adjacent ecosystems both in marine and freshwater systems***

Bathymetric survey and mapping of seagrass beds and coral areas of Igang Bay in Guimaras Island and assessment of species in and around the marine cages and adjoining habitats at Igang Marine Station (IMS) were conducted with 805 species from 292 families from samplings conducted in 2011-2012 documented.

***Identification of appropriate extractive species that may be used in integrated multitrophic aquaculture (IMTA)***

Various experiments to identify appropriate extractive species for IMTA suggested that the sandfish *Holothuria scabra*, bivalve mollusk *Anodontia philippiana* and seaweed *Gracillaria bailinae* could be co-cultured with other commercially-important commodities. Results of experiments have shown that milkfish (*Chanos chanos*), sea bass (*Lates calcarifer*), pompano (*Trachinotus blochii*) and mangrove snapper (*Lutjanus argentimaculatus*) are compatible with sandfish (*H. scabra*) in small-scale tank setting, while rabbitfish (*Siganus guttatus*) and groupers (*Epinephelus fuscoguttatus*) were unsuitable.

The bivalve mollusk *Anodontia philippiana* is known to assimilate sulfide and together with *Gracillaria bailinae*, could reduce sulfide and nutrient levels, respectively, in milkfish ponds. Results indicated that the growth rates of milkfish ranged from 15 to 90 g/month and survival rate of 50-92%. In subsequent trials sandfish *Holothuria scabra* will be used as the extractive species to replace *Gracillaria bailinae*.



*Polyculture of sandfish or sea cucumber with selected marine fish species (left), and rabbitfish, shrimps, and other species recovered from the pens during sampling*

***Development and promotion of an efficient and suitable environment-friendly culture systems***

Small-scale pond and pen culture experiments were conducted to evaluate the culture parameters for optimal growth and survival of sandfish by assessing sea grass cover, substrate quality, sea cucumber population density and other biota composition as well as risk factors and environmental stresses.

The carrying capacity of inland water bodies in the Philippines is being modelled using the Cage Aquaculture Decision Support Tool (CADS Tool), which was initially developed for marine cage systems and is being refined for application in freshwater production systems. An initial trial of the CADS tool has been done for Lake Bato and for some lakes in the Philippines.

### **Conduct of biological and ecological studies on species with potentials for resource enhancement**

Biological and ecological studies were conducted on species with potentials for resource enhancement such as the giant clam *Tridacna gigas*, abalone *Haliotis asinina*, and three species of mud crabs *Scylla serrata*, *S. olivacea* and *S. tranquebarica*. From the total of 214 clams stocked in nursery cages in a Marine Protected Area (MPA), mortalities were observed due to harsh weather conditions during the early part of 2012 and only 50 clams remain. Sites were already identified for re-stocking.



(A) Giant clams stocked in Marine Protected Area in Cataan, San Joaquin, Iloilo; (B) Clam restocking sites at Barangay Cataan MPA; and (C) Barangay Lawigan-Igcadlum MPA



## **6.4 Adapting to Climate Change Impacts**

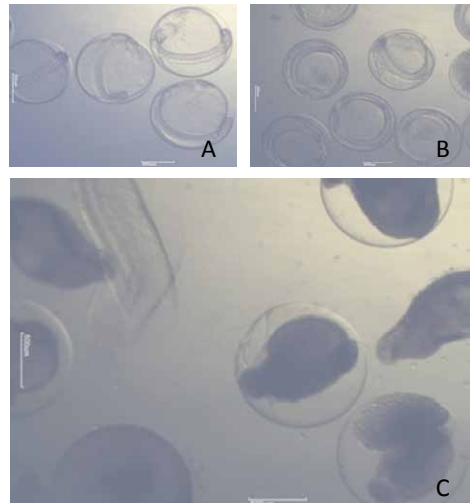
Studies have examined how climate change affects the biology of various species presently farmed and the various support systems. Although very little information is known on how gonadal maturation and spawning of tropical aquaculture fishes is affected by elevated temperature, the gonadal development and spawning performance of rabbitfish breeders were observed to be high at ambient temperature (27-29°C), while spawning was affected when breeders were exposed to temperature of 33°C.



(Left) Tanks used to demonstrate the effects of higher water temperature on the reproductive performance of rabbitfish. Note the water heater (in orange on the right side) and the thermostat control for the heater (big orange structure at the end of the tank). Water is heated (29 - 33°C) and the temperature is automatically maintained by the thermostat (Right). The recirculating system set-up for the larval rearing experiments (milkfish, sea bass and rabbitfish) where the water temperature is again maintained by small heaters with thermostat

In evaluating the effects of elevated water temperature on embryonic development of the other important marine fishes such as the milkfish, rabbitfish and the Asian sea bass as well as on important crustaceans and mollusks such as the mud crab and abalone, results suggested that for marine fishes, although embryonic development proceeded normally in embryos incubated at 31°C, hatching rate was lower compared with those incubated at ambient temperature (28-29°C).

Mud crab larvae (zoea 1) survived very well at 31°C but least at 33°C. Elevated temperature (33°C) had no significant effect on settlement rate and survival of abalone larvae, where highest settlement rate and survival was observed in larvae at 31°C. In determining the interactive effects of temperature, pH and salinity in rotifers, an important zooplankton that is commonly used in fish hatcheries, results indicated that there was no interactive effects suggesting that rotifers could tolerate the unfavorable conditions that are predicted to happen in the future due to climate change.



Embryonic development proceeded normally at ambient temperature (A) and at 31°C (B). Embryonic development was aborted when embryos were incubated at 33°C and no hatching took place (C). Hatching rate of milkfish embryos was best (>80%) when incubation was done at ambient temperature

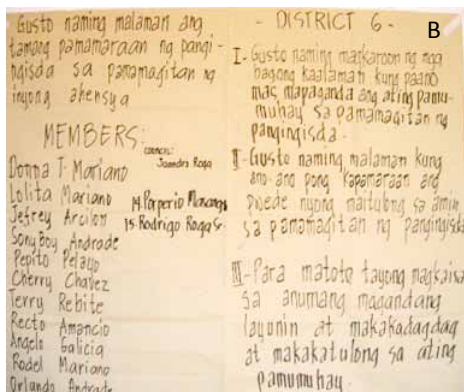
## 6.5 Meeting Social and Economic Challenges in Aquaculture

The accomplishments are described below:

### ***Prioritizing collaborative R&D in aquaculture in the region***

Studies on the promotion, adoption and implementation of aquaculture of new, indigenous and economically-important species in inland and coastal communities were conducted on-farm in collaboration with fishers and cooperatives in Laguna Lake in Luzon and in upland rice-farming communities in Capiz Province as well as in coastal communities in Guimaras. Results revealed that hatchery-bred seeds did not only contribute directly to food production but also in the restocking of overfished water bodies. The action-oriented research through community-based stock enhancement of threatened high-value species such as abalone and sea cucumber in Sagay Marine Reserve in Negros Occidental demonstrated the synergy between the biological and social dimensions of fisheries management. Lessons from these stakeholder participation models will be replicated in other shrimp stock enhancement initiatives. Preliminary findings revealed that sustainability of technology adoption to form small and medium enterprises is constrained by various factors, *i.e.* (i) lack of reliable supply of tilapia breeders in remote rural areas; (ii) organizational and solidarity commitment; and (iii) inadequate financial management. Therefore, the modalities for introducing and

implementing aquaculture technologies and stock enhancement using hatchery-bred seeds are being evaluated.



(A) community-based stock enhancement project orientation meeting with fishers, local government and SEAFDEC/AQD staff; (B) community goals and project expectations; and (C) identification of project collaborators and roles

### ***Allocating R&D resources to address emerging issues***

Recommendations for policy and up-scaled ordinances to support and maintain fisheries management mechanisms were established and resulted in assistance to local government units in formulating ordinance on abalone catch size regulation (6 cm) as one of the strategies for managing enhanced stocks in Sagay Marine Reserve. In order to increase adoption of full-cycle aquaculture (FCA) technologies by fish farmers, especially for high value species, training and IEC on use of seeds for aquaculture and provision of seeds from aquaculture to motivate adoption of FCA during start-up in project sites were conducted in the project sites.



*(A) Project collaborators participated in stock release; (B) 2.75 cm shell length (SL) tagged hatchery-bred juveniles released in Sagay Marine Reserve; (C) abalones bigger than 6 cm SL are harvested periodically providing funds for fisherfolk organization; and (D) the first 4,000 m<sup>2</sup> stock enhancement demo-site in Molocaboc Dacu established in June 2011 became the model for two more release sites in December 2012*

### ***Enhancing multi-agencies collaborations***

Information dissemination of the objectives, activities and milestones was carried out through the SEAFDEC special publication 'Fish for the People' informing the Member Countries on technology adoption methods, modalities and pathways experienced in various project sites in the Philippines. At the local level, R&D activities have been implemented on-farm site through participatory schemes with stakeholders such as fishers, farmers, cooperatives, fisherfolk associations, traders, government agencies and policy-makers.



*Briefing and selection of fishers and cooperators for on-farm lake-based cage culture of freshwater prawn in Laguna Lake*

## 6.6 Other R&D Activities

### ***Institutional Capacity Development on Sustainable Aquaculture (ICDSA) and other Collaborative Projects***

The ICDSA which is being implemented in partnerships with the local government unit, donor communities, fisherfolks/farmers and other stakeholder groups provides a mechanism for the assessment of socio-economic and environmental impacts of AQD aquaculture technologies and, for building the capacity of beneficiary communities. Thus, the community-based milkfish cage culture project involving fisherfolk organizations in Guimaras is on its third phase which would entail the establishment of mini-mariculture parks for family-based milkfish cage culture enterprise. Other projects include abalone culture project in Palawan, grouper and abalone culture in Romblon, abalone and tilapia culture as well as community-based fisheries resources management in Albay, and aquaculture livelihood project in Masbate.

Through collaborative projects with the Philippine Bureau of Fisheries and Aquatic Resources (BFAR), AQD rendered technical assistance in the construction of multi-species marine fish hatcheries in different parts of the country (e.g. in Baler, Aurora; Santa Lucia, Palawan; Bongabong, Oriental Mindoro; Santa Cruz, Davao; Sagnay, Camarines Sur and Laoang, Samar), while technical assistance was also provided by AQD for the operation of the hatcheries that are already operational (Baler, Aurora; Sta. Lucia, Palawan). Consultation with BFAR was made on how AQD can assist BFAR in the implementation of their national programs on aquasilviculture and community-based multi-species hatchery.

### ***ABOT AquaNegosyo***

Under the ABOT (agree-build-operate-transfer) AquaNegosyo (aquaculture business), technology packages are promoted to potential local and international business investors through the provision of technical assistance in every phase of on-farm operations, from site selection to fish stocking, feeding, water and health management, monitoring, harvesting and post production. In 2012, the ABOT AquaNegosyo Program received 25 local clients and responded to 17 international inquiries. Top commodities inquired are freshwater fish and prawn, high value fish, mud crab, and abalone. Three international clients have already signed formal agreements with AQD for the assessment of sandfish hatchery facility of the Century Marine Products in Sabah, Malaysia; evaluation of the multi-species hatcheries and pond facilities in India; and evaluation of Acantilado Aqua Resource Corporation's mud crab hatchery and operation in Samal Island, Davao. Technical support was provided to ABOT's continuing projects such as ACDI/VOCA (Crab Culture and Fattening Project) for the hatchery construction in Timor Leste and pond grow-out construction and preparation in Sorsogon.

### ***Training and Information***

AQD continued to demonstrate its significant contributions to aquaculture development in the region through building institutional capacities and developing a critical mass of experts on aquaculture technologies. A number of international and local training courses have been conducted for thousands of participants from various stakeholder groups of the SEAFDEC Member Countries and other interested countries. Philippines, being the host country to AQD, had the most number of participants followed by Myanmar.

Overall, AQD's capacity building programs have produced a large number of technical personnel who are now in the aquaculture business themselves or conduct or direct further R&D in their home countries. With more emphasis being given by AQD on building the critical mass of experts on aquaculture technologies, a ripple effect has been created when these technologies are promoted and practiced.



*Participants during practical session on cage construction during the International Training Course on Seaweeds at Igang Marine Station*



*Participants during practical session on (left) selection and preparation of seaweeds for sea-based nursery culture (right) during the International Training Course on Seaweeds held at Igang Marine Station*

AQD has published over 200 scientific papers (from 2005 to 2012), of which more than half are from internationally peer reviewed scientific journals (ISI-CC covered journals), thus, enhancing its visibility locally and internationally and disseminate viable technologies. Apart from 10 scientific papers published in ISI-CC covered journals, AQD in 2012 (January to September) also produced/disseminated two new manuals, seven institutional flyers and other relevant information materials. Significant efforts were also made in upgrading and updating the AQD's website, posted stories about events at AQD in Facebook, facilitated press releases about AQD events and initiatives, and participated in fairs and exhibits. All these activities address AQD's mandate of timely dissemination of information and enhance its visibility to various stakeholders.



*FishWorld, AQD's Museum of Aquatic Biodiversity, maintains a reference collection and a live animal exhibit of various aquatic organisms, and also conducts annual summer internship programs on aquatic biodiversity for high school students*



*AQD scientist and client during AgriLink held in October 2012, AgriLink is the Philippine's biggest agriculture-aquaculture business exhibition/fair*

## 6.7 Promotion of Sustainable and Region Oriented Aquaculture

For the promotion of sustainable aquaculture practices in Southeast Asia through biologically, environmentally and socio-economically acceptable, region-oriented approaches, and contributing to securing a stable supply of aquaculture products not only in the region but also globally, AQD continued to conduct activities, the accomplishments of which are discussed below:

Newly hatched zoeae and juveniles of mud crab were subjected to stress test using formalin solutions (30 and 40 ppm) and challenge tested using luminescent bacteria *Vibrio harveyi*. All batches that did not reach megalopa stage showed cumulative mortalities greater than 40% while those that produced megalopa had less than 10% cumulative mortalities at 3 hours during the stress test.

*Penaeus monodon* broodstock collected from areas with natural stocks previously identified as having suitable genetic profile for breeding were screened for viruses and used as base population, while a challenge test against White Spot Syndrome Virus (WSSV) was conducted for the additional batches of  $F_1$  that were produced.



Studies to develop new broodstock management methods for the giant freshwater prawn *Macrobrachium rosenbergii* through frequent male broodstock replacement and sex ratio experiment were sustained. From the experiments which aimed to develop the hatchery techniques of Pompano *Trachinotus blochii* by examining the effects of administration of thyroid hormone and illumination on larval rearing, it was revealed that application of thyroid hormone improved growth and survival of pompano larvae, with the highest growth and survival observed in 500 lux.

The second feeding experiment for *M. rosenbergii* verified the acceptability of 45% replacement of fish meal protein with cowpea meal protein in prawn diets without adverse effect on growth performance, consistent with the results of previous trials. Meanwhile, higher production of shrimp (*Penaeus monodon*) is achieved when these are fed with phytoplankton instead of commercial pellets.

The socio-economic impact of aquaculture technologies extended to rural communities indicated that aquaculture venture is a profitable business either done individually or by a cooperative or association, if managed properly. Also, environmental, technological and institutional issues deterring technology adoption such as climate change, institutional issues, and quality of fry are the more prevalent concerns.



*Socio-economic Assessment and Impact Analysis of Transfer and Adoption of Sustainable Aquaculture Technologies (left): Tilapia cage culture in Dumarao, Capiz, Philippines; (right): Milkfish cage culture Nueva Valencia, Guimaras, Philippines.*

To facilitate the transfer of aquaculture technologies and knowledge and human capacity building in SEAFDEC Member Countries, five international training programs were implemented in 2012 on abalone hatchery and grow-out, giant freshwater prawn production, marine fish hatchery, community-based freshwater aquaculture for remote areas of Southeast Asia, and the on-site Training on Farm-based Feed Preparation and Feeding Management in Cambodia.



*Participants of the On-site Training on Farm-based Feed Preparation and Feeding Management held in Cambodia*

## 6.8 Accelerating Awareness and Capacity-building in Fish Health Management in Southeast Asia

Accelerating the delivery of information and building awareness among the aquafarmers on technological development in aquatic animal health management ensure a holistic contribution to a stable supply of safe aquaculture products in the Southeast Asia. The major outcomes are as follows:

### ***Accelerating awareness about fish health management in resource-deprived countries through industry-wide capacity building***

A survey of farmer-respondents conducted in Cambodia in 2012 in conjunction with the training course which focused on freshwater fish health management and detection of zoonotic pathogens, displayed a low level of awareness on fish health management and other production issues among farmers in Cambodia except when these farms are owned by farmers working with the Fisheries Administration. In the screening of cultured freshwater fish species in Philippines and Cambodia for the presence of fish pathogenic parasites, a total of 455 freshwater fish were examined for the infection status with fish-borne zoonotic trematode (FZT) metacercaria. The species examined were: tilapia (*Oreochromis* sp.), catfish (*Clarias* sp.), carp (*Cyprinus* sp.), and snakehead (*Channa striata*) in the Philippines; and silver barb (*Barbonymus gonionotus*), rohu (*Labeo rohita*), silver carp (*Hypophthalmichthys molitrix*), tilapia (*Oreochromis niloticus*), snakehead (*Channa striata*), midnight gouramy (*Trichogaster trichopterus*), bighead carp (*Aristichthys nobilis*), common carp (*Cyprinus carpio*), catfish (*Pangasianodon hypothalamus*), and red-tail tinfoil barb (*Barbonymus altus*) in Cambodia. FZT metacercariae were detected in snakehead *Channa striata* from Philippines alone, while negative in all fish samples from Cambodia. A separate study for abalone revealed that the foremost parasites are the shell-boring polychaetes belonging to the family *Dorveillidae* (prevalence, 27%), which were found in hatchery-bred stocks.

### ***Innovative research to guarantee food safety and sustainable production***

The optimization of q-PCR methods for WSSV, RSIV, KHV, VNN and IMNV using infected tissues implied that the WSSV infected tissue material is ready for the preliminary infection experiment to determine the threshold level of the virus and the susceptibility of different shrimp species. Oral delivery using liposome, chitosan, and alginate microspheres as practical vaccine carriers to determine efficacy was conducted on shrimps. For sea bass, *Lates calcarifer*, juveniles were intraperitoneally injected with the formalin-inactivated Nervous Necrosis Virus (NNV) vaccine and the NNV-neutralizing antibodies titers in the sera of these fish, and the eggs from vaccinated and unvaccinated broodstocks showed neutralizing antibody titers of 1:192 and <1:40, respectively, suggesting that the current vaccination regimen is a practical approach to prevent the horizontal transmission of NNV to broodfish and vertically to their offspring. The anti-nervous necrosis activity of the seaweed extract of *Ulva pertusa* collected from floating fish net cages in Igang Marine Station (IMS) was investigated *in vivo* using pompano (*Trachinotus blochii*) juveniles, giving an initial result which suggests the potential use of *U. pertusa* extract as prophylactic/therapeutic agent against viral nervous necrosis in pompano juveniles.

### ***Technology extension and demonstration***

The following were conducted in 2012: (i) International Workshop on Fish Health Management: Accelerating Awareness and Capacity-Building in Southeast Asia; (ii) Distance Learning Course on Principles of Health Management in Aquaculture: Aqua-Health Online (AHOL); and (iii) On-site Basic Training on Freshwater Fish Health Management with Emphasis on Fish-borne Zoonotic Parasites in Cambodia.



*Participants of the International Workshop on Fish Health Management: Accelerating Awareness and Capacity-Building in Southeast Asia, held on 1-2 March 2012, Iloilo, Philippines*

### **6.9 Food Safety of Aquaculture Products in Southeast Asia**

The use of antibiotics and other chemicals in aquaculture is widely practiced to avoid disease outbreak and help meet the increasing demand for aquaculture products. However, the need to respond to environmental mitigation and consumer protection concerns for food safety is accordingly stringent and immense. AQD therefore implemented a project focusing on the following activities: (i) determination of withdrawal period of antibiotics in some fish species cultured in the tropics; (ii) surveillance of chemical contaminants in aquaculture products and feeds; (iii) investigation on antibiotics/chemical usage and regulations in aquaculture; and (iv) development of guidelines on appropriate administration and regulation of antibiotics/other chemicals. The accomplishments are as follows:

Study on the withdrawal periods of oxytetracycline (OTC) and oxolinic acid (OXA) in mangrove red snapper, *Lutjanus argentimaculatus* using the time decay curve indicated that 21 and 18 days would be sufficient to wash out OTC and OXA residues from the muscle of mangrove red snapper. From a total of 69 aquaculture products from the Philippines which were processed to determine residues of two antibiotics, OTC and OXA, and 18-20 Organochlorine Pesticides (OCPs), it was revealed that OXA was commonly used compared with OTC. The most common OCP detected in aquaculture products is Methoxychlor which was detected in samples from the three regions in the Philippines (Luzon, Visayas, and Mindanao).

AQD has also been contributed to initiatives in the Southeast Asian region on food safety of aquaculture products through its involvement during the finalization of the ASEAN Guidelines on Chemical Use in Aquaculture and Measures to Eliminate the Use of Harmful Chemicals in July 2012, convened in Kuala Lumpur, where results from on-going AQD studies on withdrawal periods for antibiotics in tropical fish and shrimp species were shared with

the participants. In order to disseminate the technology developed by AQD, the 'Food Safety of Aquaculture Products Training Program' was conducted on 12-16 November 2012, with 14 participants.



*Participants during the Food Safety of Aquaculture Products Training Program held on 12-16 November 2012 in AQD, Tigbauan, Iloilo, Philippines. (left): lecture; (right): practical*

## 7. Addressing Emerging Issues/Challenges

In 2012, SEAFDEC organized the ASEAN-SEAFDEC Regional Technical Consultation (RTC) on International Fisheries-related Issues in Bangkok, Thailand from 31 October to 2 November with the aim of providing a forum for discussion among the ASEAN-SEAFDEC Member Countries on issues relevant to fisheries trade. Two regional issues of common interest were raised including the development of common position on the proposed listing of some commercially-exploited aquatic species (CEAS) to be addressed at the forthcoming CITES-CoP16 and the proposed development of a Regional Record of Fishing Vessels 24 Meters in Length and Over as a tool for combating IUU fishing in the Southeast Asian region. The Executive Report on Fisheries-related Issues (2012-2013) reflecting the ASEAN-SEAFDEC coordinated positions for CEAS and regional support for the development of a regional fishing vessel record was submitted to the 15<sup>th</sup> Meeting of the FCG/ASSP for policy consideration and recommendation for further consideration by the SEAFDEC Council during its Meeting in 2013.



*Participants in the RTC on International Fisheries-related Issues on 31 October - 2 November 2012*

With regards to issues on commercially-exploited aquatic species and the proposed listing of the CEAS, particularly 10 shark species in the CITES Appendices during the CITES-CoP16 in Bangkok on 3-14 March 2013, SEAFDEC conducted a series of meetings and consultations to address the issues in a more detailed manner. These included: 1) Regional Workshop on Taxonomy and Identification of Sharks and Rays in Southeast Asia (22-26 April 2012, Kuala Terengganu, Malaysia); 2) SEAFDEC Regional Experts Meeting in Preparation for CITES-CoP16 (29-30 October 2012, Bangkok, Thailand); and 3) Regional Technical Consultation on International Fisheries-related Issues (31 October - 2 November 2012, Bangkok, Thailand). The outputs from the series of meetings have been compiled into the ASEAN-SEAFDEC Position, *i.e.* confirming the decision of the countries not to support the proposed listing of *Sphyrna lewini* (scalloped hammerhead shark), *Sphyrna mokarran* (great hammerhead shark), *Sphyrna zygaena* (smooth hammerhead shark), *Carcharhinus longimanus* (oceanic whitetip shark), *Lamna nasus* (Porbeagle shark) and three species of freshwater sting rays in the CITES Appendices. In addition, the ASEAN-SEAFDEC countries during the Consultation also opposed the proposal to amend of the rule of procedure on secret balloting during the CITES-CoP16. However, since this particular issue is not under the purview of fisheries, the countries agreed to conduct consultations with agencies responsible for CITES in their respective countries in order to come up with the countries' respective positions.



*During the RTC on International Fisheries-related Issues*

With regards the issues on IUU fishing, SEAFDEC conducted several meetings to assist and support the Member Countries in their efforts of combating and/or reducing the incidence of IUU fishing in the Southeast Asian region. These include: 1) Regional Training Course on Monitoring, Control and Surveillance (MCS) in Combating IUU Fishing in Southeast Asia (5-16 March 2012, Samut Prakan Province, Thailand); 2) Workshop on Assessment of the Impacts of Illegal, Unreported and Unregulated (IUU) Fishing and EC Regulation 1005/2008 on Small-scale Fisheries in the Southeast Asian Region (17-19 October 2012, Nha Trang, Vietnam); 3) Regional Core Experts Meeting on Preventing the Export of IUU Fish and Fishery Products (20-22 November 2012, Selangor, Malaysia); and 4) Experts Group Meeting on Port State Measures in Southeast Asia (12-14 November 2012, Bangkok, Thailand). Furthermore, a very important output from the series of meetings is the development of



*The Joint Workshop on Assessment of the Impacts of Illegal, Unreported and Unregulated (IUU) Fishing and EC regulation 1005/2008 on Small-scale Fisheries in the Southeast Asian Region*

a Regional Record of Fishing Vessels 24 Meters in Length and Over, as a management tool to combat and/or reduce IUU fishing in region which will be submitted for endorsement by the SEAFDEC Council during its 45<sup>th</sup> Meeting in April 2013.

## 8. Human Capacity Development in Fisheries

In order to enhance the human capacity development and support to the region's fisheries sector, the SEAFDEC Secretariat and technical Departments organized a number of activities for the Member Countries, *e.g.* consultative meetings, workshops, training courses, both at the national and regional levels. These activities were aimed to enhance human capacity under the wide scope of fisheries to ensure sustainable development of fisheries, and boost the contribution of fisheries to food security and national economy as well as to the well-being of the people especially for the generations to come. The number of participants from the SEAFDEC Member Countries in such SEAFDEC activities organized in 2012 is summarized in Table 1.

**Table 1.** Number of participants from Member Countries in SEAFDEC activities in 2012

Category	Participants from Member Countries (persons)										
	Brunei	Cambodia	Indonesia	Japan	Lao PDR	Malaysia	Myanmar	Philippines	Singapore	Thailand	Vietnam
SEAFDEC regional/international meetings, seminars, workshops	9	16	42	17	17	25	40	30	11	100	25
SEAFDEC national/local meetings, seminars, workshops, consultations	-	-	-	-	-	18	15	1088	-	5	-
International/regional training courses	14	41	19	1	51	70	53	43	6	16	249
National, on-site training courses	-	-	-	-	-	19	-	188	-	313	-
Study tours	1	2	7	24	1	13	3	346	3	2	1
Internships	-	-	-	2	-	-	-	27	-	2	3
On-the-job training	-	-	-	-	-	-	-	245	-	4	-
<b>TOTAL</b>	<b>24</b>	<b>59</b>	<b>68</b>	<b>44</b>	<b>69</b>	<b>145</b>	<b>111</b>	<b>1967</b>	<b>20</b>	<b>442</b>	<b>278</b>

In 2012, TD organized several training courses under a wide range of its technical programs to enhance the capacity of the Member Countries, particularly in the areas of responsible fishing technologies and practices, improved fisheries management, as well as in undertaking fishery resources survey and exploration and resources enhancement. Seven tailor-made training programs were also conducted and attended by over 160 trainees, with the corresponding curricula developed in accordance with the needs of trainees, either from the Member or non-Member Countries.



*Tailor-made training programs for university students*

During the year, AQD also continued to demonstrate its significant contributions to aquaculture development in the region by building institutional capacities and developing a critical mass of experts on aquaculture technologies. In 2012, AQD conducted 30 local and international training courses under various thematic areas and trained a total of 295 participants. AQD also organized internship programs for 25 foreign and local interns, and supervised the on-the job training of 197 students from 27 schools/universities.

In addition to the training courses, the technical activities of MFRD and MFRDMD during the year also supported the capacity building of officers from the Member Countries in terms of enhancing their awareness and sharing of views and experiences on particular issues that would contribute to sustainable development of fisheries in the region. Moreover, SEAFDEC also undertook activities to enhance the capacity of its staff through training, study visits and attachment programs. Staff of the Secretariat and TD took part in the Result-based Management Training Workshop (11-13 January 2012, Bangkok, Thailand) which aimed to introduce the use of Logical Framework Approach (Log-frame) in future planning and implementation of SEAFDEC programs. After the Workshop, potential young staff continued their initiatives in preparing a draft master plan of activities for TD. Moreover, TD also sent a technical staff to work with researchers of the Fisheries Research Agency (FRA) of Japan onboard the Shunyo-Maru to enhance capacity in stock assessment. In addition, a number of staff of the Departments received fellowship grants under the JSPS Asia-Africa Science Platform Program (AASPP) of the Faculty of Fisheries Sciences of Hokkaido University, Japan. SEAFDEC always believes that enhancing the capacity of staff would result in improved services rendered by SEAFDEC to the Member Countries in the future.





## Cooperation with Donors and Partner Organizations in 2012

In 2012, SEAFDEC continued to establish collaborative arrangements, and undertook collaborative activities with other donors and partner organizations. These collaborative efforts are summarized as follows:

### Aklan State University, Philippines

SEAFDEC/AQD and Aklan State University (ASU), a government institution of higher learning in the Philippines, agreed to cooperate in the areas of research, training and information utilizing their joint expertise. The Memorandum of Understanding which was signed in October 2011 and will remain effective for 5 years, aims to: 1) develop cooperative activities in the furtherance of the common goals and objectives of SEAFDEC/AQD and ASU; 2) participate in cooperative research and training programs; 3) promote the exchange of scientists and researchers between SEAFDEC/AQD and ASU for research, training, and other related activities; and 4) strengthen the capabilities of SEAFDEC/AQD and ASU in the field of aquaculture and fisheries through the cooperative use of materials and facilities.

### Association of the Southeast Asian Nations

- **Programs under the ASEAN-SEAFDEC FCG/ASSP Mechanism**

Cooperation between SEAFDEC and the Association of the Southeast Asian Nations had been initiated since 1998 with the establishment of the ASEAN-SEAFDEC Fisheries Consultative Group (FCG) Mechanism, which was later on formalized under the ASEAN-SEAFDEC Strategic Partnership (ASSP). In 2012, SEAFDEC implemented 25 programs under the FCG/ASSP framework, the progress of which was reported to the Fifteenth Meeting of the Fisheries Consultative Group of the ASEAN-SEAFDEC Strategic Partnership (29-30 November 2012 in Chiang Mai, Thailand). Out of 25 programs implemented in 2012, 16 programs would be continued in 2013. The implementation of these SEAFDEC regional programs had contributed to the development of the several key clusters under the ASEAN Fisheries Consultative Forum (AFCF), the relevant activities of which were reported to the Third Meeting of the AFCF.

- **Other ASEAN-SEAFDEC Collaboration**

In 2012, SEAFDEC took active role in providing inputs to several ASEAN Meetings, such as the Fourth Meeting of the ASEAN Fisheries Consultative Forum (4-5 June 2012, Indonesia); 20<sup>th</sup> Meeting of the ASEAN Sectoral Working Group on Fisheries or ASWGF<sub>i</sub> (6-9 June 2012, Indonesia); 1<sup>st</sup> Meeting of the *Ad-hoc* Steering Committee on Climate Change and Food Security (13-14 September 2012, Jakarta, Indonesia); ASEAN-ROK Network on Climate Change Adaptation in Aquaculture and Fisheries (Institutionalization Phase) Regional Consultation Workshop (10-12 September 2012, Jakarta, Indonesia); and the Meeting of the ASEAN Experts Group on CITES (6-8 November 2012 in Cambodia).

### **Australian Centre for International Agricultural Research (ACIAR)**

SEAFDEC/AQD continued its collaboration with the Commonwealth of Australia through the Australian Centre for International Agricultural Research (ACIAR) with the forging of another contract of agreement signed on 5 October 2012. The new Agreement which commenced in October 2012 and will be concluded in December 2013 involved AQD as a collaborating institution for the implementation of the project on 'Expansion and Diversification of Production and Management Systems for Sea Cucumbers in the Philippines, Vietnam and northern Australia'.

### **Century Marine Products SDN. BHD (Malaysia)**

SEAFDEC/AQD entered into a Letter of Agreement with Century Marine Products SDN. BHD in November 2012. Under such agreement, AQD provides technical expertise under its Agree-Build-Operate-Transfer (ABOT) AquaNegosyo scheme by assigning a Sandfish Expert to the company during the implementation of the ABOT AquaNegosyo project. The Expert is tasked to evaluate the proposed project site in terms of its suitability for sandfish hatchery and nursery operations, and submit the site assessment report and recommendations to Century Marine Products SDN. BHD, which is a privately owned company based in Malaysia.

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

Under the collaborative arrangement with FRA, one staff from TD joined the one month research cruise onboard the Shunyo-Maru (research vessel of FRA) which conducted tuna longline, mid-water trawl fishing and oceanographic survey in the Pacific Ocean from October to November 2012. The said research cruise had provided the TD staff with the basic concept of sampling design for tuna longline research as well as data analysis using R program for calculation process, GMT for output data plotting, as well as SAS statistical package for the standardization for CPUE analysis. The knowledge and experiences gained from this collaboration serve as basis for the development of future SEAFDEC activities in stock assessment and better understanding of the status of the fishery resources in the region.

### **Food and Agriculture Organization of the United Nations**

SEAFDEC has been collaborating with the Food and Agriculture Organization of the United Nations (FAO) on technical issues relevant to sustainable development of fisheries in line with the Code of Conduct for Responsible Fisheries, the International Plans of Action developed under the CCRF framework, as well as other relevant Technical Guidelines adopted at the global level, with a view of enhancing the sustainability of fisheries and ensuring better utilization of the fishery resources in the Southeast Asian region. In 2012, the collaboration between SEAFDEC and FAO focused on:

- **Bay of Bengal Large Marine Ecosystem Project**

The collaborative activities between SEAFDEC and the Bay of Bengal Large Marine Ecosystem (BOBLME) Project were centered on the joint study of important critical habitats to fish and ecosystems for migratory fish stocks such as the *Rastrelliger* spp. and other relevant marine aquatic species in the Andaman Sea. Specifically in 2012, SEAFDEC and the BOBLME Project co-organized the Sub-regional Consultative Workshop of the Northern Andaman Sea (13-14 March 2012, Bangkok, Thailand) and the 2<sup>nd</sup> Meeting of the Andaman Sea Sub-region (28-29 August 2012, Phang-Nga, Thailand) where the concept of integrating fisheries and habitat management, conservation measures for important migratory species such as the *Rastrelliger* spp., measures to combat IUU fishing were discussed. Moreover, the possibility of formalizing the sub-sub-regional cooperation at the local/provincial levels was explored to facilitate effective trans-boundary dialogues, information sharing and sustainable fisheries management in the sub-region.

Also in 2012, SEAFDEC/MFRDMD signed two Letters of Agreement with FAO for the involvement of MFRDMD in two activities of BOBLME Project, namely: genetic study of the Indian mackerel (samples obtained from Bangladesh, Maldives, Myanmar, and South China Sea), and study on shark resources.

- **Coordinating Working Parties on Fishery Statistics and Fisheries Resources Monitoring System**

SEAFDEC continued its collaboration with the Coordinating Working Parties on Fishery Statistics (CWP) in fishery statistics and information. In 2012, SEAFDEC participated in the 2<sup>nd</sup> Inter-sessional CWP-Aquaculture Sub-group Meeting (14 July 2012), where discussions revolved around the need to strengthen the coordination mechanism on fishery statistical programs among regional fisheries bodies and other inter-governmental organizations, as well as on the development of the future CWP workplan including the need to provide inputs for the Aquaculture Component of the CWP Handbook.

SEAFDEC also continued its collaboration with the Fisheries Resources Monitoring System (FIRMS). In an effort to enhance national level support to FIRMS, SEAFDEC Secretariat and MFRDMD coordinated with the Department of Fisheries Malaysia to publicize the fact sheets on Malaysian fisheries in the FIRMS website, and validated other data provided to FIRMS.

- **FAO/Global Environment Facility (GEF)**

In the collaboration with FAO/Global Environment Facility (GEF), TD was designated as the Regional Facilitation Unit (RFU)/executing partner for the implementation of the project on Strategies for Trawl Fisheries By-catch Management or “REBYC-II CTI”, which would be implemented from 2013 to 2017. The said project is aimed at promoting responsible trawl fisheries for the sustainable development of the fishery resources, and maintaining healthy marine ecosystems in the Coral Triangle and Southeast Asian waters by reducing by-catch and discards as well as the impact of fishing on biodiversity and the environment. The participating countries for the project are Indonesia, Philippines, Thailand, and Vietnam together with Papua New Guinea.

- **Workshop on Fish Passage in Southeast Asia**

SEAFDEC and FAO signed a “Letter of Agreement for a Provision of Services to Conduct the Workshop on Fish Passage in Southeast Asia” in December 2012. Under this Agreement, SEAFDEC would be responsible for the preparation and conduct of a Workshop on Fish Passage in Southeast Asia, including inviting participants from the Southeast Asian countries, arrangement for scientific excursion programs to fish passage facilities, and facilitate the conduct of the Workshop in order to come up with updated information on fish passages in the region, and recommendations/ considerations for the future development of fish passage facilities. Under the Agreement, FAO agreed to support the participation of participants from the Southeast Asian countries, and provided resource persons to share knowledge and experiences on biological and engineering aspects relevant to fish passages.

### **Hokkaido University, Japan**

As a part of the activities under the three-year Asia-Africa Science Platform Program (AASPP) funded by the Japan Society for the Promotion of Science (JSPS), SEAFDEC and the Hokkaido University Faculty of Fisheries Sciences (HUFFS) would co-organize the International Seminar on Marine Fisheries Policy on 21 February 2012 in Bangkok, Thailand. The AASPP comprises five components, namely: 1) marine fisheries policy; 2) sustainable production of fisheries resources; 3) environmental friendly aquaculture and stock enhancement; 4) highly efficient utilization and processing of fisheries resources; and 5) globalization of education in fisheries science. The activities under AASPP include cooperative research, technical training through fellowship exchange, and dispatch of staff to international meetings and study tours of organizations. Under this AASPP Program, a number of technical staff from SEAFDEC Secretariat and Departments had been provided the opportunity to join the program as exchange fellows at the Hokkaido University under the guidance of renowned professors from the Faculty of Fisheries Sciences of the University.

In 2012, two officers from the Training Department received fellowship grants which enabled them to conduct their respective studies on: 1) Characteristic of Community-based Fisheries Management in Thailand: Case study in Bangsaphan Bay; and 2) Socio-economic Conditions of Small-scale Fisheries and the Need for Community-based Management in Bangsaphan Bay. Another officer of MFRDMD also conducted a study on Merit and Demerit of the Multi-species Modelling in Fisheries Management. After completing their studies at HUFFS, the exchange fellows participated in a series of International Seminars organized by HUFFS to report on the accomplishments and conclusion of their respective research activities.

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### **International Service for the Acquisition of Agri-Biotech Application (ISAAA)**

A Letter of Agreement was forged between SEAFDEC/AQD and ISAAA on 22 March 2012 for the conduct of the training course on biotechnology from 29 April to 3 May 2012. Under such Agreement, AQD provided the required services during the training course intended to capacitate the technical staff of the Philippine Fertilizer and Pesticide Authority based in the Visayas and Mindanao on the basics of the biotechnology tools and applications as well as the existing biotechnology regulations in the country. ISAAA is a non-profit international organization that shares the benefits of crop biotechnology to various stakeholders, particularly resource-poor farmers in developing countries.

### **Institute National des Sciences et Techniques de la Mer (INTECHMER, France)**

SEAFDEC/AQD signed an Agreement with INTECHMER last 14 February 2012 for the conduct of an internship training program on the 'Comparison of the Performance of Penaeid Larvae Fed SEAFDEC-formulated Diets and Other Feeds used in Commercial Hatcheries in the Philippines'. Conducted from 27 February 2012 to 22 June 2012, the program enabled the intern from INTECHMER to acquire technical knowledge and skills in the operation and management of a shrimp hatchery system, learn the basic concepts of utilizing formulated feeds in hatcheries in the Philippines, and visit some commercial hatcheries in Panay Island, Philippines.

### **National Agriculture Training Council, Malaysia**

Starting in 2009, the technical and training collaboration between SEAFDEC/TD and the National Agriculture Training Council (NATC), a government agency under the Ministry of Agriculture and Agro-Based Industry of Malaysia, had been sustained. In 2012, TD organized a tailor-made training for trainers on Marine Engineering (18-27 September 2012, Malaysia), which was aimed at strengthening the understanding and maintenance skills of participants on engine room machineries, deck machinery, refrigeration system, and electronic system for various equipment onboard, as well as in trouble-shooting and repairs onboard vessels.

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

Under the academic and educational cooperation framework between SEAFDEC and NFU, a TD staff had the opportunity to join the research and training cruise onboard the training ship KOYO MARU of the NFU of Japan, in the West Philippine Sea, Ilocos Province, Philippines from 7 to 15 November 2012.

### **Philippine Nuclear Research Institute (PNRI)**

A Letter of Agreement (LOA) was executed between SEAFDEC/AQD and PNRI setting out the need to foster cooperative research and development starting on 5 October 2012 until the completion of the research study on the ‘Potential Uses of Irradiated Low Molecular Weight Carrageenans in Aquaculture’. This research comprises four projects, namely: i) Use of irradiated seaweeds as potential growth promoter in the Donkey’s ear abalone, *Haliotis asinina*; ii) Use of irradiated seaweeds in growth enhancer in formulated diets for fingerlings of popular aquaculture species; iii) Screening for anti-dengue virus activity of irradiated carrageenan from Philippine seaweeds; and iv) Screening of anti-microbial activity of irradiated carrageenan from Philippine seaweeds.

A Philippine Government agency, PNRI is mandated to undertake research and development activities on the peaceful uses of nuclear energy, institute regulations on the said uses and carry out the enforcement of said regulations to protect the health and safety of radiation workers and the general public.

### **Research Institute for Humanity and Nature (RIHN)**

Under the Memorandum of Understanding between SEAFDEC and the Research Institute for Humanity and Nature (RIHN) of Japan, TD is implementing a 5-year collaborative project on “Coastal Area Capability Enhancement in Southeast Asia” from April 2012 to March 2017. The project comprises eight (8) components, namely: i) Capture capability survey for coastal fisheries; ii) Biological resource survey; iii) Environment assessments and ecosystem health survey; iv) Human capability survey for coastal area; v) Development of acoustic survey equipment and systems for shallow waters; vi) Community-based set-net introduction for coastal management and HRD; vii) Community-based fishery resource rehabilitation for coastal management and rural development; and viii) Database construction, workshops and wrap-up activities.

### **Swedish International Development Cooperation Agency (Sida)**

SEAFDEC received financial support from the Swedish International Development Cooperation Agency (Sida) for the project entitled “Activities Related to Climate Change and Adaptation in Southeast Asia with Special Focus on the Andaman Sea” from 2009 to 2011, and extended until the end of 2012. The project aimed to support long-term sustainability of fisheries and reduce the vulnerability from possible impacts from climate change to livelihoods of fisher-folk in ASEAN and around the Andaman Sea. The Project activities primarily focused on: 1) building up of the capacity for management of fisheries and important coastal habitats (*refugia*) and the protection against natural hazards around the Andaman Sea (integration of habitat and fisheries management); 2) strengthening of capacity and improvement of systems to monitor, record and control active fishing efforts (large- and small-scale) as a basis for development for coordinated plans and management actions on fishing capacity around the Andaman Sea and among ASEAN-SEAFDEC Member Countries; and 3) providing support to policy development and the process to establish a regional fisheries management mechanism and sub-regional agreements for/in the ASEAN region including development of consensus on key fisheries management issues.

### **University of the Sunshine Coast**

SEAFDEC/AQD and University of the Sunshine Coast (Australia) forged an Agreement on 26 September 2012 to jointly implement the project on 'Preliminary Trials on Giant Grouper Maturation, Spawning and Juvenile Production in Vietnam, Philippines and Australia' from 1 June 2012 until 31 May 2013. The University is a recipient of a grant Agreement with the ACIAR to conduct this particular research project.

### **Vocational Education Commission of Thailand**

Under the MOU between SEAFDEC and the Vocational Education Commission of Thailand, a four-month Training Course on Fishing Vessel Operation was conducted from 3 October 2012 to 24 February 2013 for the Tinsulanonda Fisheries College of Songkhla Province. The training course, which aimed to provide skills to students and share to them some experiences which they can use for their work in the future, consisted of six subjects, namely: Ship Construction and Stability, Marine Communication, Laws and Regulations of Navigation, Navigation Technology Practices, Marine Machinery Technology and Practices, and Fishing Gears Technology and Practices. Moreover, as part of their practical training, the students had the opportunity to acquire hands-on experience and practice onboard the M.V. SEAFDEC and M.V. Plalung, and to join the study tours to areas that have relevance to the said training course.





## SEAFDEC Programs for 2013

In 2013, SEAFDEC would continue to implement activities that focus on the development and management of fisheries and aquaculture to support the sustainable development of the fisheries sector. Particular priority would be on promoting responsible fisheries in line with the Code of Conduct for Responsible Fisheries; enhancing the contribution of fisheries to food security, poverty alleviation and improved livelihood; as well as in strengthening the region's fisheries towards global competitiveness. The formulation of SEAFDEC programs of activities for 2013 took into consideration the Resolution and Plan of Action on Sustainable Fisheries for Food Security for the ASEAN Region Towards 2020, adopted by the ASEAN-SEAFDEC Ministers and Senior Officials responsible for fisheries during the ASEAN-SEAFDEC Conference in June 2011, as well as the recommendations made during the Technical Session of the Conference.

The SEAFDEC programs of activities proposed for 2013 were assessed during the 35<sup>th</sup> Meeting of SEAFDEC Program Committee (26-28 November 2012, Thailand) and endorsed for submission to the 45<sup>th</sup> Meeting of the SEAFDEC Council in 2013, for consideration. The programs include:

### A. Departmental Programs

1. Tailor-made Training Programs (TD);
2. Promotion and Enhancement Fisheries Information (TD);
3. Improvement of Fisheries Technology and Reduction of the Impact from Fishing (TD);
4. Adapting to Climate Change Impacts (AQD);
5. Healthy and Wholesome Aquaculture (AQD);
6. Maintaining Environmental Integrity through Responsible Aquaculture (AQD);
7. Meeting Socio-economic Challenges in Aquaculture (AQD); and
8. Quality Seed for Sustainable Aquaculture (AQD).

### B. Programs under the Fisheries Consultative Group of the ASEAN-SEAFDEC Strategic Partnership (FCG/ASSP)

Existing FCG/ASSP Programs

#### Thrust I: Developing and Promoting Responsible Fisheries for Poverty Alleviation and Food Security

1. Rehabilitation of Fisheries Resources and Habitat/Fishing Grounds for Resource Enhancement (TD);
2. Human Resource Development (HRD) Programs on Fisheries Management Approaches for Sustainable Fisheries (TD);
3. Strategies for Trawl Fisheries By-catch Management (TD);
4. Resource Enhancement of International Threatened and Over-exploited Species in Southeast Asia through Stock Release (AQD); and
5. Promotion of Sustainable and Region-oriented Aquaculture (AQD).

**Thrust II: Enhancing Capacity and Competitiveness to Facilitate International and Intra-regional Trade**

6. Chemical and Drug Residues in Fish and Fish Products in Southeast Asia: Biotoxins Monitoring in ASEAN (AZP, AZA and BTX) (MFRD);
7. Traceability Systems for Aquaculture Products in the ASEAN Region (MFRD);
8. Utilization of Freshwater Fish for Value-added Products (MFRD);
9. Accelerating Awareness and Capacity-building in Fish Health Management in Southeast Asia (AQD); and
10. Food Safety of Aquaculture Products in Southeast Asia (AQD).

**Thrust III: Improving Management Concepts and Approaches for Sustainable Fisheries**

11. Fisheries and Habitat Management, Climate Change and Social Well-being in Southeast Asia (Secretariat); and
12. Promotion of Countermeasures to Reduce IUU Fishing Activities (TD, in Collaboration with MFRDMD).

**Thrust IV: Providing Policy and Advisory Services for Planning and Executing Management of Fisheries**

13. Fisheries Resource Survey and Operational Plan for M.V. SEAFDEC 2 (TD); and
14. Research and Management of Sea Turtles in Foraging Habitats in the Southeast Asian Waters (MFRDMD, in collaboration with TD).

**Thrust V: Addressing International Fisheries-related Issues from a Regional Perspective**

15. Assistance for Capacity Building in the Region to Address International Trade-related Issues (Secretariat); and
16. Strengthening SEAFDEC Network for Sustainable Fisheries (Secretariat).

*New FCG/ASSP Programs*

1. Offshore Fisheries Resources Exploration in Southeast Asia (TD);
2. Optimizing Energy Use and Improving Safety in Fishing Activities (TD);
3. Enhancing the Compilation and Utilization of Fishery Statistics and Information for Sustainable Development and Management of Fisheries in the Southeast Asian Region (TD, in collaboration with Secretariat);
4. Combating IUU Fishing in the Southeast Asian Region through Application of Catch Certification for International Trade in Fish and Fishery Products (MFRDMD);
5. Comparative Studies for Management of Purse Seine Fisheries in the Southeast Asian Region (MFRDMD); and
6. Research and Management of Sharks and Rays in the Southeast Asian Waters (MFRDMD).

## Enhancing SEAFDEC Visibility

Since its establishment, SEAFDEC has implemented fisheries-related programs/projects covering wide aspects of research, training and information. Starting from 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 2012, the progress and achievements made by SEAFDEC in the implementation of the information activities during the year were monitored and discussed during the 13<sup>th</sup> Meeting of the Information Staff Program (ISP) on 23-24 October 2012 in Singapore. These have been categorized corresponding to the five Strategies as follows:

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

- Produced and disseminated 52 titles/issues of technical/scientific materials (10,939 copies produced; 3,717 copies distributed);
- Produced and disseminated 43 titles of technical/scientific articles (10 titles published in SEAFDEC publications and 33 titles published in non-SEAFDEC publications); and
- Recorded 1,312 queries for information through the SEAFDEC libraries, and 1,004 materials sold.

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

- Produced and disseminated 42 titles/issues of promotional materials (27,039 copies produced; 34,850 copies distributed);
- Established and administered SEAFDEC Websites and web blocks: SEAFDEC Departmental websites received a total of 140,002 unique visitors, made 10,337 links from other websites, and recorded 32,098 annual downloads;
- Took part in nine (9) exhibitions and related events with 52,050 visitors recorded at SEAFDEC exhibition booths and displays; and
- Officially released two (2) press statements, and recorded SEAFDEC appearances (143) in public media and websites.

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

- Continued to maintain the libraries of the SEAFDEC Secretariat and Departments, and provide library services;
- The SEAFDEC libraries acquired a total of 1,408 issues of newsletters/serial publications, 761 titles of technical publications and 68 items of audio-visual materials;



- Sustained cooperation and exchange of materials with 408 network libraries within and outside the region;
- Disseminated 92 titles (with 3,145 copies) of technical materials, and 53 titles (with 15,035 copies) of promotional materials to target groups;
- Made accessible 2,496 downloadable materials and 20 databases in SEAFDEC websites;
- Enhanced the use of e-mail systems (including e-groups) to facilitate communications both among SEAFDEC staffs and with other concerned personalities;
- Recorded a total number of 27,011 direct visitors to SEAFDEC Secretariat and Departments which had been increasing;
- Dispatched 275 SEAFDEC officials to participate in 109 events organized by other organizations (73 events at regional/international levels, and 36 at national local levels);
- Organized SEAFDEC events, which include:
  - Regional/International meetings, seminars, workshops (20 meetings with a total of 816 participants)
  - National/local meetings, seminars, workshops, consultations (11 meetings with a total of 1,158 participants)
  - International/regional training courses (28 courses with a total of 617 trainees)
  - National, on-site training courses (26 courses with a total of 503 trainees)
  - Study tours (80 programs with a total of 434 trainees)
  - Internships (17 groups with 34 persons)
  - On-the-job training (42 colleges with a total of 257 students)
  - Internal meetings (10 meetings with a total of 647 participants);
- Facilitated the participation of officials from Member Countries to events organized by SEAFDEC:
  - Regional/International meetings, seminars, workshops (332 participants)
  - National/local meetings, seminars, workshops, consultations (1,126 participants)
  - International/regional training courses (563 trainees)
  - National, On-site training courses (520 trainees)
  - Study tours (403 trainees)
  - Internships (34 persons)
  - On-the-Job training (249 students);
- Established the networking and cooperation mechanisms with 28 fisheries-related organizations for the implementation of collaborative activities at national, regional and international levels; and
- Received support from other organizations and donor agencies for relevant activities in the total amount of US\$ 3,046,209 representing the non-regular sources of funds for the activities of SEAFDEC.

**Strategy 4: Strengthening SEAFDEC capability in information-related activities**

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

**Strategy 5: Regular monitoring and evaluation of information activities**

- Monitored the audience' feedback on publications produced by SEAFDEC, *i.e.* the Special Publication "Fish for the People", Fishery Statistics Bulletin of Southeast Asia, and the Southeast Asian State of Fisheries and Aquaculture (SEASOFIA) 2012; and
- Organized the Thirteenth Meeting of the SEAFDEC Information Staff Program (ISP) to monitor the implementation of information-related activities, in accordance with the Information Strategies for Enhance SEAFDEC Visibility and Communication.



## SEAFDEC Revenues and Expenditures in 2012

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

	2012 (Un-audited)	2011 (Audited)
<b>REVENUES</b>		
Contributions from :-		
Member governments	8,003,456	7,749,268
Other sources	2,367,335	1,795,060
<b>Total Revenues</b>	<b>10,370,791</b>	<b>9,544,328</b>
<b>EXPENDITURES</b>		
Operating and Capital Expenditures		
Research	2,940,545	3,074,799
Training	995,820	1,045,954
Information	790,891	839,547
Collaborative	177,863	140,327
Others	388,005	414,960
Administrative	3,412,844	4,234,104
<b>Total Expenditures</b>	<b>8,705,968</b>	<b>9,749,691</b>
<b>SURPLUS (DEFICIT), For the year</b>	<b>1,664,823</b>	<b>(205,363)</b>
<b>FUND BALANCE, Beginning of year</b>	<b>4,965,312</b>	<b>4,969,560</b>
<b>FUND ADJUSTMENT</b>		<b>43,976</b>
<b>FUND BALANCE, End of year</b>	<b>6,630,135</b>	<b>4,808,173</b>
<b>REPRESENTED BY:</b>		
Cash and cash equivalents	6,170,246	4,515,665
Other receivables and Advances	572,122	256,794
Supplies Inventory	121,405	66,357
Fuel oil for vessels	215,076	114,258
Prepayments	15,282	13,761
<b>Total current assets</b>	<b>7,094,131</b>	<b>4,966,835</b>
Reserved budget for vessel periodic maintenance	70,068	68,599
Termination indemnity fund	1,953,013	1,888,776
Other assets-Net	803,714	622,515
<b>Total Assets</b>	<b>9,920,926</b>	<b>7,546,725</b>
Less : Liabilities		
Accrued payable	301,236	638,506
Contribution received in advance	760,373	0
Funds held in trust	276,169	211,270
Provision for termination indemnity	1,953,013	1,888,776
<b>Total Liabilities</b>	<b>3,290,791</b>	<b>2,738,552</b>
<b>NET ASSETS</b>	<b>6,630,135</b>	<b>4,808,173</b>

**Remark:**

<sup>1/</sup> Difference of US\$ 157,139 is a result of change of rate in US\$ transaction

### Un-audited Contribution Received by SEAFDEC from Member Countries and Other Sources of Funds for the Year 2012 (In US\$)

Sources	Secretariat	TD	MFRD	AQD	MFRDMD	Total	
						In US\$	%
Brunei Darussalam	7,000					7,000	0.07
Cambodia	6,000					6,000	0.06
Indonesia	26,000					26,000	0.25
Japan	280,000					280,000	2.70
Lao PDR	4,000					4,000	0.04
Malaysia	10,000				1,043,205	1,053,205	10.16
Myanmar	10,000					10,000	0.10
Philippines	15,000			4,025,689		4,040,689	38.96
Singapore	8,000					8,000	0.08
Thailand	20,000	2,534,562				2,554,562	24.62
Vietnam	14,000					14,000	0.13
Sub-total	400,000	2,534,562	0	4,025,689	1,043,205	8,003,456	77.17
Other Sources <sup>2/</sup>	50,703	1,108,098		1,208,534		2,367,335	22.83
<b>Total</b>	<b>450,703</b>	<b>3,642,660</b>	<b>0</b>	<b>5,234,223</b>	<b>1,043,205</b>	<b>10,370,791</b>	<b>100</b>

**Remark:**

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

### Other Contributions Received by SEAFDEC in 2012 (In US\$)

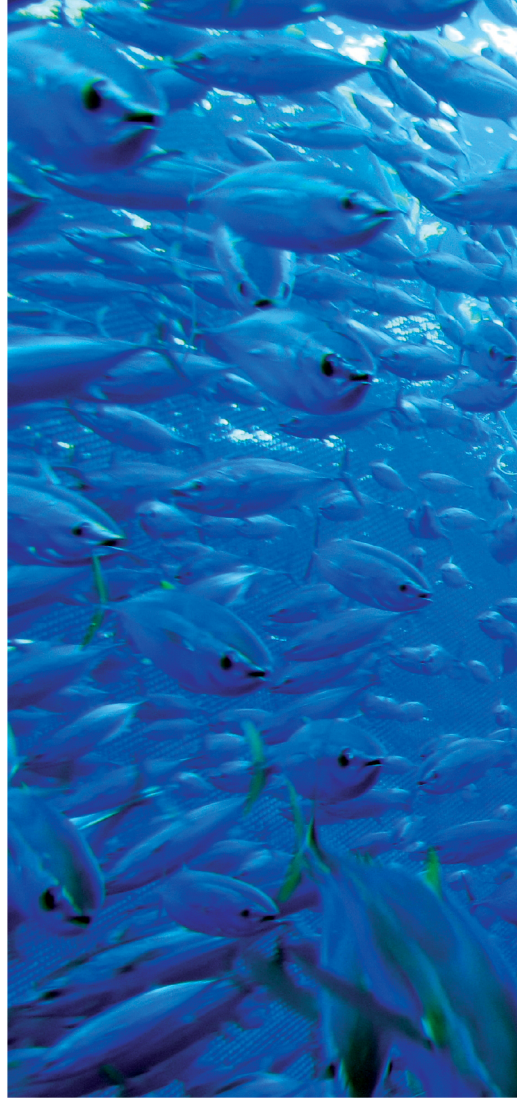
Sources	Amount in US\$ <sup>3/</sup>
Fisheries Agency-Japan(TF-II)	1,009,994
Fisheries Agency-Japan (TF-V)	748,602
Swedish International Development Cooperation Agency (Sida)	69,000
<b>Total</b>	<b>1,827,596</b>

**Remark:**

<sup>3/</sup> Other sources of contribution which are not reported in the SEAFDEC Financial Statement







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