

SEAFDEC Annual Report

2011



Southeast Asian Fisheries Development Center

SEAFDEC

Annual Report 2011



Southeast Asian Fisheries Development Center

Preparation and Distribution of this Document

This SEAFDEC Annual Report 2011 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. 2012. SEAFDEC Annual Report 2011. Southeast Asian Fisheries Development Center, Bangkok, Thailand. 73 pp.

Notice of Copyright

Reproduction of this publication, in whole or in part, by any method or process, without written permission from the copyright holder is prohibited. Applications for such permission with a statement of the purpose and extent of the reproduction desired should be made in written to:

SEAFDEC Secretariat
Suraswadi Building
Kasetsart University Campus
P.O. Box 1046, Kasetsart Post Office
Bangkok 10903, Thailand.

All rights reserved
©SEAFDEC 2012

Executive Summary

In the year 2011, SEAFDEC implemented programs and activities that were formulated along line with the policy directives and priority actions steered by the Member Countries through the SEAFDEC Council and the SEAFDEC Program Committee. Through these programs which were categorized into: Departmental Programs (9 programs), Programs under the Fisheries Consultative Group of the ASEAN-SEAFDEC Strategic Partnership (25 programs), and Other Programs (3 programs), SEAFDEC was able to develop technologies that aim to achieve the goal of attaining sustainable development of fisheries. This has been realized through the implementation of program activities that have been grouped into scopes, namely: i) Development of Policy Framework on Sustainable Fisheries for Food Security; ii) Responsible Fishing Technologies and Practices; iii) Exploration and Monitoring of Fishery Resources, and Their Utilization; iv) Management for Sustainable Fisheries; v) Conservation and Management of Aquatic Species under International Concerns; vi) Post-harvest Technology and Safety of Fish and Fishery Products; vii) Sustainable Aquaculture Development; viii) Activities in Response to Emerging Needs and Concerns of the Region; and ix) Human Capacity Development in Fisheries.

Among the important activities undertaken by SEAFDEC in 2011, was the conduct of the ASEAN-SEAFDEC Conference on Sustainable Fisheries for Food Security Towards 2020 “Fish for the People 2020: Adaptation to a Changing Environment” in June 2011, where recommendations were imparted on how the current fisheries situation and emerging issues/challenges could be addressed. The Resolution and Plan of Action adopted during the Conference by the ASEAN-SEAFDEC Ministers responsible for fisheries would serve as guiding principles for the sustainable development of fisheries in the region through the coming decade.

Throughout 2011, SEAFDEC enhanced its collaboration with several international and regional organizations for the implementation of relevant activities. SEAFDEC also scouted for more support from various partners for the conduct of activities that are of common interest, and which could provide the maximum benefits to the Member Countries.

This SEAFDEC Annual Report 2011 summarized the activities undertaken by SEAFDEC and achievements during the year 2011, as well as the planned activities for 2012. We hope that this Annual Report would be informative and provide better picture on the roles and activities of SEAFDEC in supporting the Member Countries in their goals towards achieving sustainable development of fisheries.

CONTENTS

	Page
About SEAFDEC	1
SEAFDEC Council in 2011	3
SEAFDEC Senior Officials in 2011	6
Message from the Chairperson of the SEAFDEC Council	7
Message from SEAFDEC Secretary-General	8
Overview of SEAFDEC Activities in 2011	10
SEAFDEC Activities in 2011	13
1. Development of Policy Framework on Sustainable Fisheries for Food Security	13
2. Responsible Fishing Technologies and Practices	15
3. Exploration and Monitoring of Fishery Resources and Their Utilization	15
4. Management for Sustainable Fisheries	18
5. Conservation and Management of Aquatic Species under International Concerns	25
6. Post-harvest Technology and Safety of Fish and Fishery Products	31
7. Sustainable Aquaculture Development	35
8. Activities in Response to Emerging Needs and Concerns of the Region	53
9. Human Capacity Development in Fisheries	56
Cooperation with Donors and Partner Organizations in 2011	59
SEAFDEC Programs for 2012	67
Enhancing SEAFDEC Visibility	69
SEAFDEC Revenues and Expenditures in 2011	72

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 41st Meeting of the SEAFDEC Council is *“to develop and manage the fisheries potential of the region by rational utilization of the resources for providing food security and safety to the people and alleviating poverty through transfer of new technologies, research and information dissemination activities”*. 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.



SEAFDEC Secretariat



SEAFDEC/TD

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.



SEAFDEC/MFRD



SEAFDEC/AQD

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 coastal fisheries management to ensure responsible resource utilization and sustainable livelihoods in coastal communities, and the promotion of off-shore fisheries



SEAFDEC/MFRDMD



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 2011

Chairperson of the SEAFDEC Council for the Year 2011-2012:

Dato' Ahamad Sabki bin Mahmood

SEAFDEC Council and Alternate Council Directors:

Brunei Darussalam

Council Director: Hajah Hasnah binti Ibrahim (*until November 2011*)
Director, Department of Fisheries
Abdul Halidi bin Mohd. Salleh (*from December 2011*)
Acting Director, Department of Fisheries

Alternate Council Director: Abdul Halidi bin Mohd. Salleh (*until November 2011*)
Deputy Director, Department of Fisheries
Haji Sabri Mohd. Taha (*from December 2011*)
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. Martani Huseini (*until January 2011*)
Director-General of Fisheries Product Processing and Marketing
Dr. Endhay Kusnendar (*from February 2011*)
Chairman of the Agency for Marine and Fisheries Research

Alternate Council Director: Dr. Made L. Nurdjana (*until January 2011*)
Director-General of Aquaculture
Dr. Dedi Sutisna (*from February 2011*)
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: Dr. Somphanh Chanphenxay (*until February 2011*)
Deputy Director-General, Department of Livestock and Fisheries
- Mr. Bounthong Saphakdy (*from March 2011*)
Director of Fisheries Division

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. Malcolm I. Sarmiento, Jr. (*until May 2011*)
Director, Bureau of Fisheries and Aquatic Resources
- Atty. Asis G. Perez (*from June 2011*)
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: Ms. Tan Poh Hong (*until October 2011*)
Chief Executive Officer, Agri-Food & Veterinary Authority of Singapore
- Mr. Lee Kwong Weng (*from November 2011*)
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. Somying Piumsombun (*until November 2011*)
Director-General, Department of Fisheries
Dr. Wimol Jantrarotai (*from December 2011*)
Director-General, Department of Fisheries
- Alternate Council Director: Dr. Nuntiya Unprasert (*until October 2011*)
Deputy Director-General, Department of Fisheries
Mr. Chirdsak Vongkamolchoon (*from November 2011*)
Deputy Director-General, Department of Fisheries

Vietnam

- Council Director: H.E. Dr. Luong Le Phuong
Vice Minister, Ministry of Agriculture and Rural
Development
- Alternate Council Director: Dr. Chu Tien Vinh (*until October 2011*)
Director-General, Department of Capture Fisheries and
Resources Protection
(*Vacant from 2 October 2011*)



SEAFDEC Senior Officials in 2011

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

Deputy Chief

Dr. Teruo Azuma

Marine Fishery Resources Development and Management Department (MFRDMD)

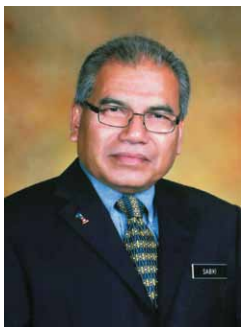
Chief

Ms. Mahyam Mohd. Isa

Deputy Chief

Dr. Masaya Katoh

Message from the Chairperson of SEAFDEC Council For the Year 2011-2012



First of all, let me express with much gratitude, my delight for having served as the Chairperson of the SEAFDEC Council for the Year 2011-2012. We have seen that 2011 was one of the most significant years of SEAFDEC especially that several activities had been pursued in collaboration with the Member Countries, to enhance and ensure sustainable fisheries for food security in the Southeast Asian region.

While several important activities had been continued during the year, SEAFDEC had exerted much efforts in preparing for the organization of the ASEAN-SEAFDEC Conference on Sustainable Fisheries for Food Security Towards 2020 “Fish for the People 2020: Adaptation to a Changing Environment” in June 2011 in Bangkok, Thailand. During this Conference, the current fisheries situation and emerging issues/challenges that are likely to impede the sustainable development and the contribution of fisheries to food security in the ASEAN region were discussed. One of the most relevant outputs of the Conference was the adoption of the Resolution and Plan of Action on Sustainable Fisheries for Food Security for the ASEAN Region Towards 2020 by the ASEAN-SEAFDEC Senior Officials and Ministers responsible for fisheries of the Member Countries. I would therefore wish to take this opportunity to congratulate SEAFDEC for the implementation of various activities during the year and especially the successful conduct of the ASEAN-SEAFDEC Conference. In addition and on behalf of all Council Directors, I would also wish to express our appreciation to the Government of Thailand for hosting the Conference and for the kind hospitality extended to the participants. As the 2011 Resolution and Plan of Action are intended to serve as regional policy framework and guiding principles for the ASEAN Member States in achieving sustainable fisheries for food security during the coming decade, I would therefore wish to encourage the countries to implement activities in line with the Resolution and Plan of Action. As for SEAFDEC, I would also wish that it would continue to provide technical supports to the countries to ensure that the sustainable contribution from fisheries to food security is enhanced in the coming decade.

As my term as the Chairperson of the SEAFDEC Council ends in early 2012, I would like to express my sincere gratitude to all the Council Directors for their supports and cooperation. I am also very grateful to the Secretary-General of SEAFDEC as well as to the staff of the SEAFDEC Secretariat and Departments for the good progress made throughout the year. I hope that SEAFDEC would continue to provide assistance to the Member Countries and to implement programs and activities that support the sustainable development of fisheries for the improvement of the countries’ economies and enhancement of the well-being of the people in the Southeast Asian region.

A handwritten signature in black ink, consisting of a series of loops and strokes, characteristic of a cursive or semi-cursive style.

(Dato' Ahamad Sabki bin Mahmood)
SEAFDEC Council Director and Director-General of
Department of Fisheries Malaysia

Message from SEAFDEC Secretary-General



During the past decade, the fisheries sector of the Southeast Asian region has been confronted with harsh changes especially in terms of the state of aquatic resources which has been deteriorating as a result of over-exploitation and habitat degradation. While the region's human population continues to grow, competition for the limited water and fishery resources has also been escalating. Such situation calls for better recognition of the countries in the region on the need to ensure sustainable utilization of the resources for the future generations.

Along this line, SEAFDEC has continued its efforts in developing technologies and good fishery practices to support sustainable development of fisheries and aquaculture in the region. Specifically for 2011, SEAFDEC placed more focus in strengthening the capabilities of the Member Countries to enable the countries to address various issues/challenges of common interest. Thus, activities had been pursued with emphasis on the need for better understanding, management and sustainable exploitation of the fishery resources through the conduct of resources exploration, promotion of sub-regional collaboration and management, combating IUU fishing, conservation and management of aquatic species under international concerns, and enhancing the preparedness of countries in addressing relevant issues that emerged and discussed at the international arena.

A very important activity of SEAFDEC in 2011 was the conduct of the ASEAN-SEAFDEC Conference in collaboration and with the involvement of the Member Countries starting from the technical preparatory phase until the Conference proper. Without the strong commitment from the countries, the great success of the Conference could have not been possible. On behalf of SEAFDEC, I therefore wish to take this opportunity to express our utmost appreciation to the countries for providing guidance and support, and in particular to the Government of Thailand for the hospitality and arrangements for the Conference, as well as to the ASEAN through the ASEAN Secretariat for co-organizing the Conference. Along the line with adoption of the Resolution and Plan of Action by the ASEAN-SEAFDEC Ministers and Senior Officials during the Conference, we wish to ensure the countries that SEAFDEC would continue to make use of our technical expertise to support the initiatives and activities of the Member Countries in order that sustainable development of fisheries could be attained and the contribution of fisheries to food security and the well-being of the people is enhanced.

While the roles and functions of SEAFDEC have been widely recognized by the regional and international communities, it should be recalled that SEAFDEC has not been working alone. Several other institutions and organizations are also working towards the common goal of achieving sustainable fisheries in this region and in a wider global context. I therefore wish to also take this opportunity to express our appreciation to our collaborating partners for joining hands and working together with us through the years. In particular, I wish to express our appreciation to the Government of Japan, the Swedish International Development Cooperation

Agency (SIDA), and the ASEAN Foundation, as well as the many other agencies for providing the continual support to the activities and operations of SEAFDEC. For such continued support, I would like to assure the Member Countries and our partner organizations that we would do our best to provide the necessary technical services to the Member Countries in order to attain sustainable development of fisheries in our region in the coming decade.



(Dr. Chumnarn Pongsri)
SEAFDEC Secretary-General



Overview of SEAFDEC Activities in 2011

The activities of SEAFDEC in 2011 were implemented in line with the policy directives given by the SEAFDEC Member Countries during SEAFDEC annual meetings, *i.e.* the 33rd Meeting of the SEAFDEC Program Committee (30 November-2 December 2010, Thailand), 13th Meeting of the Fisheries Consultative Group of the ASEAN-SEAFDEC Strategic Partnership (FCG/ASSP) (3-4 December 2010, Thailand), and the 43rd Meeting of SEAFDEC Council (4-8 April 2011, Malaysia).

Formulation and development of the programs and activities implemented by SEAFDEC in 2011 had been guided mainly by regional and international fisheries policy frameworks, particularly the Resolution and Plan of Action on Sustainable Fisheries for Food Security for the ASEAN Region adopted by the ASEAN-SEAFDEC Ministers during the ASEAN-SEAFDEC Millennium Conference in 2001. Moreover, after the establishment of the ASEAN-SEAFDEC Strategic Partnership (ASSP) in 2007, SEAFDEC has been implementing activities to support the ASEAN in its efforts towards the realization of ASEAN Economic Community, particularly the ASEAN Roadmap for Integration of the Fisheries Sector, the ASEAN Integrated Food Security (AIFS) Framework, and the ASEAN Community Building which is expected to be achieved by 2015.

In 2011, SEAFDEC in collaboration with the ASEAN and the Department of Fisheries of Thailand convened the ASEAN-SEAFDEC Conference on Sustainable Fisheries for Food Security Toward 2020 “Fish for the People 2020: Adaptation to a Changing Environment” in June 2011 in Bangkok, Thailand. The new decade Resolution and Plan of Action were adopted by the ASEAN-SEAFDEC Member Countries during the said Conference, to serve as new policy framework for the development of sustainable fisheries and in enhancing the contribution of fisheries to food security, starting from 2011 through the coming decade.

The progress of the programs and activities implemented in 2011 has been approved and endorsed by the 34th SEAFDEC Program Committee Meeting held in the Philippines on 14-16 November 2011, and the 14th Meeting of the Fisheries Consultative Group of the ASEAN-SEAFDEC Strategic Partnership (FCG/ASSP) on 17-18 November 2011, also organized in the Philippines.

The programs and activities implemented by SEAFDEC in 2011 included:

Departmental Programs

1. Center-wide Information Network (Secretariat);
2. Information and Communication Technology (TD);
3. Tailor-made Training and Study Tour (TD);
4. Integrated Mollusk Production (AQD);
5. Mud Crab and Shrimp Domestication (AQD);
6. Marine Fishes (AQD);
7. Small-holder Freshwater Aquaculture (AQD);
8. Seaweed Strain Improvement (AQD); and
9. Aquatic Ecology (AQD).

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

1. Assistance for Capacity Building in the Region to Address International Trade-related Issues (Secretariat);
2. Improvement of Statistics and Information for Planning and Management of Fisheries in the ASEAN Region (Secretariat);
3. Activities Related to Climate Change and Adaptation in Southeast Asia with Special Focus on the Andaman Sea (Secretariat);
4. ASEAN-SEAFDEC Conference on Sustainable Fisheries for Food Security Towards 2020 (Secretariat and all Departments);
5. Strengthening SEAFDEC Network for Sustainable Fisheries and IUU Fishing Related Countermeasures (Secretariat);
6. Responsible Fishing Technologies and Practices: *Fishing in Harmony with Nature* (TD);
7. Sustainable Utilization of Potential Fisheries Resources and Reduction of Post-harvest Losses (TD);
8. Fisheries Resource Survey and Operational Plan for the M.V. SEAFDEC 2 (TD);
9. Deep Sea Fisheries Resources Exploration in Southeast Asia (TD);
10. Collection of Information on Highly Migratory Species in Southeast Asian Waters (TD);
11. Development of Regional Database for Fishery Management (TD);
12. Promotion of Rights-based Fisheries and Co-management Towards Institution Building and Participatory Mechanism for Coastal Fisheries Management (TD);
13. Rehabilitation of Fisheries Resources and Habitats/Fishing Grounds through Resource Enhancement (TD);
14. Improvement of Information Gathering System for IUU Fishing Related Countermeasures in Southeast Asia (TD);
15. Promotion on Fishing License, Boats Registration, and Port State Measures (TD);
16. Human Resource Development for Sustainable Fisheries (TD);
17. Chemical and Drug Residues in Fish and Fish Products in Southeast Asia: Biotoxins Monitoring in the ASEAN (MFRD);
18. Traceability Systems for Aquaculture Products in the ASEAN (MFRD);
19. Utilization of Freshwater Fish for Value-added Products (MFRD);
20. Promotion of Sustainable and Region-oriented Aquaculture (AQD);
21. Resource Enhancement of Internationally Threatened and Over-exploited Species in Southeast Asia through Stock Release (AQD);
22. Accelerating Awareness and Capacity-building in Fish Health Management in Southeast Asia (AQD);
23. Food Safety of Aquaculture Products in Southeast Asia (AQD);
24. Tagging Program for Economically-important Pelagic Species in the South China Sea and Andaman Sea (MFRDMD in collaboration with TD); and
25. Research and Management of Sea Turtles in Foraging Habitats in Southeast Asian Waters (MFRDMD).



Non-funded FCG/ASSP Programs

1. Use of Indicators for Sustainable Development and Management of Capture Fisheries in the ASEAN (MFRDMD);
2. Development of Integrated Inland Fisheries Management in ASEAN Countries (MFRDMD); and
3. Capacity Improvement of Fisheries Community for Fisheries Management and Alleviation of Poverty (TD and Secretariat).

Other Programs

1. Cetacean Research in Southeast Asian Waters: Cetacean Sighting Program;
2. Promotion of Inland Small-scale Fisheries Management through Rights-based Fisheries and Co-management Towards Institution Building and Participatory Approaches; and
3. Safety at Sea for Small Fishing Boats.

SEAFDEC Activities in 2011

The programs and activities implemented by SEAFDEC in 2011 could be broadly grouped into nine categories to appropriately respond to the requirements of the Member Countries as stipulated in the new decade Resolution and Plan of Action.

1. Development of Policy Framework on Sustainable Fisheries for Food Security

The fisheries sector of the Southeast Asian region has been widely recognized as one of the important sectors providing substantial contributions to food security for the countries in the region. In order to sustain such condition, the need to address the concerns confronting the fisheries sector and the emerging issues and challenges that could impede the sustainable development and the contribution of fisheries to food security in the region, had been recognized. Thus, SEAFDEC in collaboration with the ASEAN co-organized the ASEAN-SEAFDEC Conference on Sustainable Fisheries for Food Security Towards 2020 “Fish for the People 2020: Adaptation to a Changing Environment” in Bangkok, Thailand on 13-17 June 2011, which was hosted by the Government of Thailand through its Department of Fisheries.

During the preparatory works for the Conference, several technical consultations were conducted by SEAFDEC, ASEAN and the Member Countries at regional, sub-regional and national levels involving fisheries-related organizations/agencies and the stakeholders. The outputs from the consultations served as technical inputs for the planning and conduct of the Conference, specifically for the Technical Session and also as basis for the development of the draft Resolution and Plan of Action which were subsequently considered and adopted by the ASEAN-SEAFDEC Member Countries. The Conference was attended by more than 500 participants and fisheries experts from the ASEAN-SEAFDEC Member Countries as well as from other parts of the world, regional and international organizations, and the Senior Officials and Ministers from the ASEAN-SEAFDEC Member Countries who are responsible for fisheries.



Technical exhibition showcasing the activities and achievements of SEAFDEC and the ASEAN-SEAFDEC Member Countries in enhancing sustainable development of fisheries

During the Technical Session of the Conference, important fisheries-related issues and concerns were discussed under eight thematic panel sessions, namely: 1) Enhancing Governance in Fishery Management; 2) Sustainable Aquaculture Development; 3) Ecosystem Approach to Fisheries; 4) Post-harvest and Safety of Fish and Fisheries Products; 5) Emerging Requirements for Trade in Fish and Fisheries Products; 6) Climate Change Adaptation and Mitigation Towards Food Security; 7) Livelihood among Fishing Communities and Prospects of Employment in Fisheries-related Activities; and 8) Sustaining Food Supply from Inland Fisheries.



Representatives from the ASEAN-SEAFDEC Member Countries with the SEAFDEC Secretary-General and the representative from ASEAN during the Inaugural Ceremony of the Conference

The preparations and conduct of the panel sessions were carried out in collaboration with the Member Countries and relevant regional/international organizations. As a result, the Conference came up with momentous recommendations that should be taken into consideration by the countries in the Southeast Asian region for the sustainability of the fisheries sector. Specifically, the major outputs of the Conference included significant suggestions during the Technical Session; the adopted “Plan of Action on Sustainable Fisheries for Food Security for the ASEAN Region Towards 2020” and “Concept Notes on the Conference Follow-up Program” (5-year plan) by the ASEAN-SEAFDEC Senior Officials; and the adopted “Resolution on Sustainable Fisheries for Food Security for the ASEAN Region Towards 2020” by the ASEAN-SEAFDEC Ministers. The Conference also paved the way for enhancing closer cooperation and partnership among the ASEAN-SEAFDEC countries, relevant regional/international organizations, and stakeholders for the implementation of activities to support the sustainable development of fisheries for food security in the region.

Immediately after the Conference, follow-up activities were undertaken by SEAFDEC starting with the “Inception Workshop on Follow-up Activities to the ASEAN-SEAFDEC Conference” which was conducted on 4-5 July 2011 in Bangkok, Thailand. The Inception Workshop aimed to raise the awareness of the ASEAN-SEAFDEC countries, relevant agencies/institutions/organizations and donor agencies on the new Resolution and Plan of Action adopted during the Conference; review the existing activities/initiatives undertaken in the region in line with the new Resolution and Plan of Action; and facilitate the planning and implementation of activities by relevant agencies, institutions and organizations at various levels in line with the new Resolution and Plan of Action in coordinated and harmonized manner. Then followed the publication of relevant outputs of the Conference, such as the adopted “Resolution and Plan of Action on Sustainable Fisheries for Food Security for the ASEAN Region Towards 2020”, and two volumes of the Conference Proceedings. In addition, SEAFDEC also made some adjustments where possible to its activities under the existing programs to accommodate the priority issues identified in the Resolution and Plan of Action as well as the recommendations from the Technical Session of the Conference and the Inception Workshop.

2. Responsible Fishing Technologies and Practices

In order to put an end to the deteriorating and declining fishery resources particularly in marine capture fisheries, the Training Department (TD) during the past decade, has been conducting activities that aimed to enhance responsible fishing technologies and practices. The activities implemented in 2011 continued to focus on the promotion of selective fishing gears and devices for the sustainable utilization of fishery resources and at the same time minimize the impacts of fishing activities to the coastal and marine resources and ecosystems. Building upon the progress of its past initiatives in promoting the use of the Juvenile and Trash Excluder Devices (JTEDs), TD provided technical assistance to the Philippine Bureau of Fisheries and Aquatic Resources (BFAR) during its National Seminar on “JTED in Bottom Trawl Fishery” held in the Philippines in January 2011. During the Seminar, the design and use of JTEDs were demonstrated to fishery extension officers and fishing gear technologists while the rationale and importance of installing JTEDs in trawlers were explained to fishing operators and fishers. After the Seminar, the resource persons from TD also took the opportunity to conduct an investigation of the use of baby shrimp trawl net in Tacloban City, Philippines.



Practice on the installation of Juvenile and Trash Excluder Device

Moreover, activities to promote the use of alternative energy sources and improve energy efficiency in fishing operations, particularly the use of light in squid/anchovy fishing, were also implemented. In September 2011, TD provided technical advice to the Department of Fisheries of Myanmar in planning and preparation of a national study on the impacts of the use of lights in squid fishing on the fishery resources and the ecosystem. In addition, TD also took the initiative of developing appropriate fish handling technologies, including the hygienic handling of fish onboard to improve the quality of catch in small- and medium-scale fishing boats and reduce post-harvest losses. In 2011, on-site training sessions on appropriate fish handling and optimum utilization of fuel for fishing operations, were conducted for fishers in Thailand and Vietnam.

3. Exploration and Monitoring of Fishery Resources and Their Utilization

Better understanding of the fishery resources and their status could be crucial for the development of appropriate policies and management plans by the countries in the region for the sustainability of fisheries. With such perception, TD had been collaborating with MFRDMD especially in providing technical assistance to the Member Countries in the conduct of fishery resources surveys in their respective national waters through the use of the M.V. SEAFDEC 2.

The activities focus not only in undertaking research to obtain data and information on the fishery resources, but also in promoting human resource development by giving opportunities for fishery officers from the Member Countries involved in such activities, to enhance their capacities.

3.1 Exploration and Fishery Resources Survey in Southeast Asian Waters

On 8-21 July 2011, TD in collaboration with the Department of Fisheries (DOF) of Brunei Darussalam carried out a fishery resources survey in Zone 2 located 3-20 nautical miles off the Brunei Darussalam coast. The survey was aimed at obtaining information on fishery resources in the trophic level, and scientifically verifying the impacts of fishing gears and methodologies on the marine environment. Through this collaborative survey, knowledge and experience of the technical staff of TD had been extended to the concerned fishery staff of Brunei Darussalam, particularly in the aspect of sampling gears and survey equipment, as well as in data analysis. During the survey, discussion was also made with the DOF of Brunei Darussalam on the possibility of conducting fishery resources survey of untrawlable grounds, and surveys of the deep-sea fishery and pelagic resources including ways and means of analyzing the data compiled from the surveys.

In addition to the collaborative resources surveys, TD also conducted activities that aim to enhance the capacity of fishery officers from the Member Countries in the identification of deep-sea species, which is very crucial in carrying out activities in the future that aim to collect information on deep-sea fishery resources. The activities included the Training Workshop on Identification of Deep-sea Benthic Macro-invertebrates Vulnerable to Fishing Gear on 11-15 July 2011 in Samut Prakan, Thailand; and the On-site Training on Identification of Deep-sea Fishes for 16 fishery biologists in Malaysia on 18-21 July 2011 using the specimens collected during the collaborative resource survey in the waters of Sabah-Sarawak in August 2010.



Fish species collected during the demersal resource survey onboard the M.V. SEAFDEC 2 in the waters of Brunei Darussalam



Participants analyzing samples during the Training Workshop on Identification of Deep-sea Benthic Macro-invertebrates Vulnerable to Fishing Gear

3.2 Collection of Information on Highly Migratory Species

One of the most economically important but highly migratory species in the Southeast Asian waters is tuna. However, the status of tuna stocks in the region is unclear considering that statistics on tuna production collected by most of the Member Countries are very scattered and are believed to have been collected based only on data at landing places without

information on the areas where the fish had been caught. In order to address this concern, TD initiated the program on “Collection of Information on Highly Migratory Species in Southeast Asian Waters” in 2008 to gain better understanding of the status of tuna fisheries in Southeast Asia, and develop a tuna database to facilitate the compilation of data collected through the program. In 2009, a one-year-cycle of information on tuna production at selected landing sites was developed and from 2009 to 2010, the catch data on tuna and neritic tuna species and their origins were collected by Indonesia, Philippines, Thailand, and Vietnam at their respective selected landing sites based on an agreed data collection framework. In 2011, the data compiled by the participating countries were presented during the Special Meeting on Improvement of Tuna Information Collection in Southeast Asia which was convened by SEAFDEC on 7-9 September 2011 in Songkhla, Thailand.

In addition, TD also initiated the collection of data/information on tuna from various tuna canneries in Thailand. The data derived from such initiative could be incorporated with other data and information on tuna including tuna statistics in order to come up with better understanding of the status of tuna stocks, fishing, fishing effort/capacity, and catch landing of tuna in the future.

3.3 Tagging of Important Pelagic Species

Pelagic fishes usually migrate over vast distances across the oceans for their spawning and feeding requirements, especially towards the required optimum environmental conditions, e.g. water current, temperature, salinity, plankton abundance. Tagging is one of the methods for studying the migratory patterns of small pelagic fishes. The information obtained from the tagging exercises could be used for the identification of small pelagic fish stocks as well as shared stocks. Thus, MFRDMD in collaboration with TD implemented since 2008 the “Tagging Program for Economically-important Pelagic Species in the South China Sea and Andaman Sea”.

The tagging activities which were conducted in collaboration with Brunei Darussalam, Cambodia, Indonesia, Malaysia, Myanmar, Philippines, Thailand, and Vietnam, were completed in mid 2011. The target species for the tagging activities in the South China Sea were the Japanese scad (*Decapterus maruadsi*), short mackerel (*Rastrelliger brachysoma*), shortfin scad (*D. macrosoma*), and the Indian mackerel (*R. kanagurta*). For the Andaman Sea area, the species tagged were the short mackerel (*R. brachysoma*) and Indian mackerel (*R. kanagurta*). In the tagging activities in the South China Sea, 71% of targeted number was tagged although it was only for the Japanese scad which the tagged fishes exceeded the target. Meanwhile, for the short mackerel only 85% of the target was tagged, 62% for shortfin scad and 36% for Indian mackerel. In the Andaman Sea area, 92% of targeted fish was tagged, comprising 98% of the target number for short mackerel and 88% for the Indian mackerel. Recovery of the tagged fishes was recorded at 1.2% for the South



Map showing the ten sampling sites for DNA study of Indian mackerel and Japanese scad in the South China Sea, and four sampling sites in the Andaman Sea for Indian mackerel



Participants in the 4th Meeting of Core Experts on Economically-important Pelagic Species held in Kuala Lumpur, Malaysia in September 2011

China Sea and 1.3% for the Andaman Sea. Such information could be used to provide an initial picture of the migratory pattern of the species.

After the tagging exercises, the focus of the program shifted to genetic study through DNA analysis of the Indian mackerel and Japanese scad. In order to conclude the previous activities and to introduce the new phase of the program, MFRDMD organized the “Fourth Meeting of Core Experts on Tagging Program for Economically-important Pelagic Species in the South China Sea and Andaman Sea” in Kuala Lumpur, Malaysia on 20-22 September 2011. The Meeting discussed the preliminary findings of the tagging exercises, and also the Standard Operating Procedure (SOP) for collecting tissue samples of the Indian mackerel and Japanese scad in sampling sites agreed upon during the Meeting.

4. Management for Sustainable Fisheries

For the effective management of fishery activities and in strengthening the sustainable exploitation of fishery resources, it is necessary to have a clear picture of the current status of fishing capacity in the respective waters of the countries in the region. Several relevant regional consultations have been convened in the past years where the recommendations emphasized on the need for the countries to improve their vessel registration and fishing licensing systems as means of combating IUU fishing in the region, and develop a mechanism for sharing the relevant information among the countries as appropriate.

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

TD and MFRDMD jointly organized the “Regional Core Experts Meeting on Fishing Licensing, Boats Registration and Information on Export of Fisheries Products in Southeast Asia” on 4-7 October 2011 in Bangkok, Thailand under the SEAFDEC program on “*Promotion of Fishing Licensing, Boats Registration and Port State Measures*”. The Meeting focused its discussion on the minimum requirements for fishing licensing and vessel registration in the region, which could serve as basis for the development of regional guidelines on fishing licensing and boats registration in the near future, and on the export of fishery products from the region. With regards to the export of fishery products from the countries in the region, the importance of value-adding was deemed necessary to increase the price and marketability of the region’s fish and fishery products.

Illegal, unreported and unregulated or IUU fishing is among the very important issues being addressed by the countries in the region. It is well recognized that several requirements and regulations imposed by major importing countries, *e.g.* countries in the EC and the USA, as well as the FAO Legally-binding Instrument on Port State Measures, are aimed at preventing the entry into importing countries' ports, products that have been derived from IUU fishing.

In an effort to enhance the adoption of responsible fisheries and combat IUU fishing in the Southeast Asian region, TD through the SEAFDEC program on "*Human Resource Development for Sustainable Fisheries*" organized the "Regional Workshop on HRD Programs for Sustainable Fisheries and Related Countermeasures to Combat IUU Fishing in Southeast Asia" on 6-8 July 2011. The Workshop had the main objective of identifying the needs and requirements for HRD programs in promoting sustainable fisheries and combating IUU fishing. TD also proposed to conduct new training programs designed to support IUU fishing countermeasures, where recommendations to improve the respective curricula of the training courses to be conducted in the future were made during the Workshop. Moreover, the HRD Network was also established and had since then been mobilized to facilitate the exchange of information and serve as forum to discuss relevant issues encountered by the countries in the region with regards to combating IUU fishing.

Following the recommendations of the HRD Workshop, TD packaged two new training courses. The "Regional Training for Trainers on Fishery Management to Combat IUU Fishing (mainly for fishery managers)" which was conducted on 6-15 September 2011 in Samut Prakan, Thailand, aimed to assist fishery managers in formulating policies and management plans to combat IUU fishing. The second was the "Regional Training for the Trainers on Ecosystem Approach to Fisheries and Extension Methodologies", which aimed to strengthen the awareness and knowledge of participants on the impact of IUU fishing on the marine ecosystems, and familiarize participants with the principles and concept of responsible fishing, sustainable fisheries development, and on the concept of ecosystem approach to fisheries (EAF) and its application in the Southeast Asian context, which was conducted from 22 November to 16 December 2011 in Samut Prakan, Thailand. In addition, TD also formulated other new training courses, such as the Regional Training Course on Effective MCS System, and the Regional Training for Trainers on Fishery Information and Statistics for Management of Marine (Coastal) Fisheries which would be launched in 2012.



Group discussion during the Regional Core Expert Meeting on Fishing Licensing, Boats Registration and Information on Export of Fisheries Products in Southeast Asia



Training Course on Fisheries Management to Combat IUU Fishing in the Southeast Asian Region

Moving towards the same goal of combating IUU fishing in the Southeast Asian region, the SEAFDEC-SIDA Project which is funded by the Swedish International Development Cooperation Agency, continued its efforts in enhancing the cooperation among Member Countries around the Andaman Sea for the improvement of fisheries management, which were fulfilled through a series of on-site workshops in specific sites, and Sub-regional Meetings of the Gulf of Thailand and the Southern Andaman Sea that were organized in 2011. During these events, the rules and regulations on the management of fishing capacity were discussed, and the need to reduce illegal and destructive fishing operations was recommended. While the events had provided relevant information on the ways and means of improving fisheries management in the region to combat IUU fishing, it was agreed that efforts with respect to “Monitor, Control and Surveillance”, “vessel records and inventory” and “port monitoring” should be sustained by building upon regional and sub-regional cooperation, and the need to monitor, assess and record the status of fisheries in the Gulf of Thailand, the Andaman Sea and the region’s waters as a whole, was also well recognized.

Meanwhile, in an effort to strengthen the cooperation among ASEAN-SEAFDEC Member Countries, SEAFDEC also kept track of the progress on the promotion of sub-regional and regional cooperation in fisheries management by taking part in various international and regional fora, such as the 3rd Meeting of the ASEAN Fisheries Consultative Forum (AFCF) in Cambodia (April 2011), the 4th Meeting of the Coordination Committee on Regional Plan of Action to Promote Responsible Practices Including Combating IUU Fishing in the Southeast Asian Region in Siem Reap, Cambodia (November 2011), and the Expert Consultation on Effect, Surveillance and Law Enforcement to Combat Illegal, Unreported and Unregulated (IUU) Fishing in Jakarta, Indonesia (December 2011), as well as in relevant events organized by FAO/Asia-Pacific Fishery Commission (APFIC).

4.2 Ecosystem Approach to Fisheries

In line with the promotion of the concept of ecosystem approach to fisheries (EAF) which is being promoted by FAO, the SEAFDEC-SIDA Project in cooperation with partners, has for six to seven years, been working towards building awareness on the need to integrate fisheries management into habitat management around the Andaman Sea through a sequence of On-site Workshops/Training Sessions (*e.g.* in Medan, Indonesia (2010); Langkawi, Malaysia (2010); Satun, Thailand (March 2011); Myeik, Myanmar (March 2011); and Ranong, Thailand (July 2011)). These activities were followed by Sub-regional Consultation in the Southern Andaman Sea (October 2011) in cooperation with the Bay of Bengal Large Marine Ecosystem (BOBLME) Project. The basic element in the plans is to promote sub-regional cooperation through dialogues among neighbouring countries, by providing special attention to shared ecosystems/habitats, shared (groups of) species, and fishing activities in trans-boundary areas including the need to combat illegal and destructive fishing. R&D on refinement of diagnostic methods and development of new prevention methods for aquatic animal diseases.

These events had provided basis for common understanding, raising awareness and sharing of information on the importance of critical habitats to fishes (*e.g.* mangroves, coral reefs and sea grass beds) and related ecosystems, as well as information on migratory fish stocks (*e.g.* *Rastrelliger* spp.). During the said events, a set of criteria for development of larger fisheries management and conservation areas (building upon existing but smaller management areas) was introduced to local fishers and relevant local and central responsible institutions of the countries around the Andaman Sea.

Specifically during the Southern Andaman Sea Sub-regional Consultation in October 2011, which was attended by local fishers, local administration and other officers from relevant agencies in Indonesia, Malaysia and Thailand, the importance of developing joint/trans-boundary approaches for the management of migratory species such as the Indo-Pacific mackerel and Indian mackerel (*Rastrelliger* spp.) around the Andaman Sea, was highlighted. Moreover, in order to have better understanding and improve information on *Rastrelliger* spp., data to be collected could include fish spawning areas, feeding areas, and migration patterns as well as oceanographic information. The Southern Andaman Sea Countries (*i.e.* Indonesia, Malaysia and Thailand) expressed the need to compile scientific-based information required for the management of the species in the Southern Andaman Sea and other larger areas.

During the Third Gulf of Thailand Sub-regional Meeting in September 2011, the sub-regional cooperation among four countries, namely: Cambodia, Thailand, Malaysia, and Vietnam, was reactivated while the activities on the promotion of fisheries and habitat management around the Gulf of Thailand which were initiated by the UNEP/GEF/SCS in collaboration with SEAFDEC, was reintroduced. Specifically in the promotion of fisheries *refugia* and habitat management, the linkage of fish life cycle with their critical habitats was again stressed as an important focus area for continued research and management.

4.3 Habitat Conservation and Resources Enhancement

Deterioration of fishery habitats in coastal and inshore ecosystems is one of the major causes of the decline of the fishery resources in the Southeast Asian region. In order to address this issue, TD has implemented the program on “*Rehabilitation of Fisheries Resources and Habitat/Fishing Grounds for Resources Enhancement*” since 2010, which aims to identify appropriate resource enhancement tools, and develop strategies and guidelines for fishery resource enhancement in the region. Thus, artificial reefs (ARs) had been deployed to serve as resource enhancement tool in a pilot site in Rayong Province (near Samet Island) in Thailand since 2010. Activities to monitor the impacts of the artificial reefs on the fishery resources and the environment had also been carried out. The third survey was conducted on 8-12 August 2011 to investigate the fish species composition near the ARs using trammel net, giant trap, and juvenile fish trap, while underwater video recording was also undertaken to record the status of the resources near the deployed ARs.

With an objective of enhancing sea grass beds, surveys had been carried out by TD since 2010 in a pilot site in Krabi Province (near Andaman Sea) in Thailand to assess the status of sea grass beds which was then followed by the introduction of a rehabilitation program. The second survey on 19-24 July 2011 was aimed to diagnose the state of the fishing grounds and monitor the achievements of the rehabilitation program, *e.g.* investigating the fish species composition using juvenile fish traps and trammel net. In addition, two rearing cages were constructed in the pilot site for the culture of dog conchs



On-site study to evaluate resource enhancement practices including the impacts of artificial reefs to the fishery resources and the environment

as means of rehabilitating the snail resources in sea grass beds, and where the survival and growth rates of the snails were monitored every three months.

For resources enhancement in inland areas, Nam Houm Reservoir in Lao PDR was selected as a pilot site, where TD provided technical assistance in identifying and assessing the resources in the reservoir, as well as in evaluating the fisheries ecosystem and recommending the resource enhancement designs and practices appropriate for the area. The first survey was conducted on 25-29 April 2011 in collaboration with Department of Livestock and Fisheries of Lao PDR and concerned local fishers to identify the fish species composition and fish larvae, as well as collect information on the geographic aspects of the reservoir.

Furthermore, TD also organized the Workshop-Expert Consultation on the Identification of Critical Fishing Grounds and Regional Habitat Rehabilitation and Management Approaches on 11-13 October 2011 in Bangkok, Thailand. The Workshop outlined the information needed for identifying critical fishing grounds as well as the appropriate and effective resource enhancement tools, measures and rehabilitation plans for various fishing grounds and habitats. In addition to the compilation of scientific data and information, the Workshop highlighted on the application of local indigenous knowledge and on the active participation of local fishers in the resource enhancement activities as these are the major factors that could ensure successful rehabilitation, conservation and management of fishery habitats in the region.



Expert Consultation on the Identification of Critical Fishing Grounds and Regional Habitat Rehabilitation and Management Approaches

4.4 Promotion of Co-management and Rights-based Fisheries

Being characterized as mostly small-scale involving large numbers of fishers, the coastal and inland fisheries in the Southeast Asian region continue to face innumerable constraints that impede their sustainability, *e.g.* conflicts over resource uses either with large-scale fisheries or even with the non-fisheries sector. Fisheries co-management which aims to provide opportunities for user-based organizations in sharing and collaborating with government-based agencies to manage the fishery resources, is one of the practical approaches that could help in reducing conflicts among resource users. In addition to co-management, rights-based fisheries is another approach that could secure the privilege of resource users, particularly the small-scale fishers in accessing the right to fish and enhancing better management of fishing capacity and efforts.

TD in collaboration with Lao PDR and Myanmar, has implemented since 2008 the project on “*Promotion of Inland Small-scale Fisheries Management through Rights-based Fisheries and Co-management Towards Institution Building and Participatory Approaches*” with the main objective of fostering co-management and rights-based fisheries in inland fisheries. More specifically, the project was carried out in conjunction with the resources enhancement activities in Nam Ngum Reservoir in Lao PDR which focused on the demarcation of fish

conservation zones, and in Duya Inn Reservoir in Myanmar focusing on alternative and additional sources of employment such as fish culture and post-harvest practices. As part of the project activities, SEAFDEC organized the “Stakeholder of Duya Inn Reservoir Consultative Workshop” on 19-20 April 2011 in Duya Inn, Hinthada, Myanmar to enhance the understanding of local stakeholders on the concept of co-management and rights-based fisheries, and where appropriate, the establishment of institutions involving the stakeholders and local government agencies for the effective management of sustainable inland fisheries.

As a final activity, a Regional Workshop was organized on 14-15 September 2011 in Phetchaburi Province, Thailand, which mainly aimed to conclude the lessons learnt and experiences gained from the implementation of the project in Lao PDR and Myanmar, and to share the information with the other ASEAN Member States. The Workshop also came up with recommendations that should be considered in undertaking future initiatives on co-management and resources enhancement.



Regional Workshop on the Promotion of Inland Small-scale Fisheries Management through Rights-based Fisheries and Co-management Towards Institution Building and Participatory Approach



Interview with local officers in Cambodia, Indonesia, Malaysia and Philippines on rights-based fisheries and co-management

Moreover, TD also implemented since 2008 the project on “*Promotion of Rights-based Fisheries and Co-management Towards Institution Building and Participatory Mechanism for Coastal Fisheries Management*”, the focus of which is on coastal small-scale fisheries. In 2011, a questionnaire was designed to collect baseline information on small-scale coastal fishing communities, which cover wide aspects of information, *e.g.* demographics, fisheries in general, IUU fishing, and participation in enforcement of relevant regulations, job opportunities, climate change and adaptation. The socio-economic surveys were subsequently undertaken to collect information from 462 households in 7 countries, namely: Cambodia, Indonesia, Myanmar, Malaysia, Philippines, Thailand, and Vietnam. It was envisaged that from the results of the surveys, the status of small-scale coastal fisheries in the region would be clarified and could serve as basis for sustainable management of the coastal small-scale fisheries.

4.5 Fishery Statistics and Information

The SEAFDEC Secretariat continued to compile the regional fishery statistics, based on national statistics data provided by the Member Countries in line with the Regional Framework for Fishery Statistics of Southeast Asia, which contained standards, definitions and classifications of fishery statistics in the region that had been harmonized with those of FAO. The program on “*Improvement of Statistics and Information for Planning and Management of Fisheries in the ASEAN Region*” which has been implemented since 2007 continued to serve as a platform to support the Member Countries in improving their respective data and information collection systems as tools for development planning and management of fisheries. In addition, a number of technical programs and initiatives have been undertaken by TD and MFRDMD, such as data collection on sharks and tuna that are expected to contribute to improving the capacity of officers at the national/local levels in the collection of data and information; and eventually enhance the efforts of the countries in providing their respective fishery statistics to SEAFDEC for regional compilation.



The Special Meeting on Improvement of Tuna Information Collection in Southeast Asia, Songkhla, Thailand

Specifically in 2011, SEAFDEC exerted efforts to enhance the linkage between fishery statistics provided by the Member Countries with other data and information collected through the implementation of SEAFDEC projects or derived from other projects relevant to data/information collection. During the conduct of various fora, *i.e.* 1) Special Meeting on Improvement of Tuna Information Collection in Southeast Asia (7-9 September 2011, Songkhla, Thailand), 2) Special Meeting on Sharks Information Collection in Southeast Asia (15-17 September 2011, Bangkok, Thailand), and 3) Technical Consultation on Addressing Technical Issues on Selected Commercially-



The Special Meeting on Sharks Information Collection in Southeast Asia, Bangkok, Thailand

exploited Aquatic Species (18-20 October 2011, Bangkok, Thailand), the consensus specified that fishery statistics could provide indication on the status and trends of particular fish species. However, in several cases especially for aquatic species under international concerns, fishery statistics data could be very scattered and mostly collected as a group without detailed species classification. Thus, other non-routine data and information, e.g. collected from research projects, should be incorporated with fishery statistics in order to come up with clearer picture on the status and trends of the resources.

Parallel with the initiatives to improve fishery statistics and information, activities were also undertaken by TD to develop and improve regional databases under its program on “*Development of Regional Database for Fisheries Management*”. The program aims to make regional fishery statistics as well as data and information generated from other SEAFDEC programs and activities, not only accessible but also available for ready use by the public.

In addition to the above initiatives, TD also made efforts to improve the collection of information on small-scale coastal and inland fisheries, taking into consideration the fact that data and information on small-scale fisheries particularly in terms of fishery statistics are very scattered in view of the complexity of the system. Activities were therefore undertaken to enhance the national capacities of the Member Countries in improving and producing better quality and timely fishery information. In 2011, review exercises were undertaken on the tools and methodologies for collecting and compiling information and statistics on inland capture fisheries in Cambodia and Thailand. These were meant to come up with appropriate tools and methodologies that could improve the collection of fishery data in the future.

SEAFDEC also embarked on another initiative in 2011 which aims to establish the status and trend of fisheries in the region. As a pilot exercise, the development of the “*Southeast Asian State of Fisheries and Aquaculture*” or “*SEASOFIA*” was undertaken by mobilizing available fishery data and information, e.g. fishery statistics, outputs and information from various regional consultations and projects, in order to come up with better picture of the status and trends of fisheries and aquaculture in the Southeast Asian region, as well as the issues/and challenges being encountered by fisheries in the region.

5. Conservation and Management of Aquatic Species under International Concerns

SEAFDEC through TD and MFRDMD continued to promote the conservation and management of aquatic species under international concerns, such as sea turtles, sharks, and cetaceans. Moreover, AQD also embarked on stock enhancement activities through stock release of internationally threatened species such as seahorses and the Napoleon wrasse, and of regionally over-exploited species such as the abalone, sea cucumber and mud crab.

5.1 Sea Turtles

MFRDMD has been conducting activities on the conservation and management of sea turtles since 1999, where the first phase of the program focused on sea turtle hatchery management and defining the migratory routes of sea turtles through tagging experiments using the Inconel tags. Later, the study focused on tagging through the use of passive integrated transponder (PIT) tags and satellite telemetry, as well as on the collection of tissue samples to identify

the sea turtle populations in the region. From 2010 onwards, the program on “*Research and Management of Sea Turtles in Foraging Habitats in the Southeast Asian Waters*”, which aims to come up with biological and ecological information of sea turtles and their foraging habitats, had been carried out by MFRDMD in collaboration with TD.



Measuring the length of the curved carapace



Getting a green turtle attached with PTT ready for release into the Lawas foraging habitat



Tagging sea turtle using Inconel tag

Monitoring of the sea turtles tagged with Inconel tags was continued at the nesting sites of sea turtles in Malaysia, Myanmar, Philippines, and Vietnam, while the use of satellite telemetry to monitor migratory routes and foraging habitats was also continued by releasing a juvenile green turtle installed with Platform Terminal Transmitter (PTT), into the Lawas foraging habitat of Sarawak in February 2011. The initial result showed that after 154 days from release, the juvenile green turtle was only 32 km from the releasing point, suggesting that Lawas with abundant sea grass beds could be one of the important foraging habitats for this sea turtle species.

For the genetic analysis to study the sub-populations of sea turtles, tissue samples of sea turtles from foraging habitats in Lawas, Sarawak were collected on two occasions, on 7-10 January and 12-15 February 2011. A special drift net locally called *belat* which is approximately 1000 m long was used to catch the sea turtles in the sea grass area in Lawas waters. Sea turtles that fed on sea grass during high tide at night were trapped during the low tide in the morning. As a result, a total of 28 different sizes and ages of green turtles were caught, and their tissue samples were collected for the population study.



Assembling the drift net

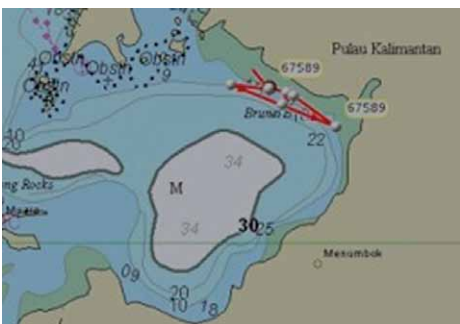
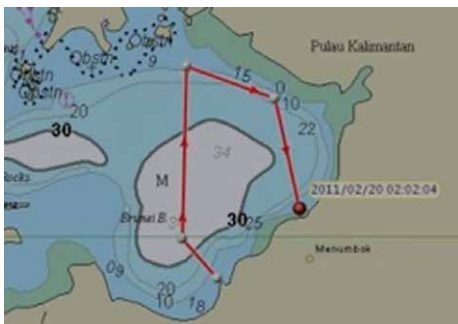


Collecting tissue samples



Measuring the length and width of the carapace

Moreover, MFRDMD in collaboration with Sabah Park and the Department of Fisheries (DoF) Malaysia also conducted the Training on Scientific Survey in Sea Turtle Foraging Habitats in Mabul and Sipadan Islands of Malaysia from 26 September to 1 October 2011. The training aimed to build the capacity of the Member Countries in undertaking surveys and other initiatives/activities relevant to conservation and management of sea turtles. From the 81 green turtles and 3 hawksbill turtles of various sizes caught at 8 sampling sites in the waters of Sipadan Island, information on biological parameters such as curved carapace length (CCL), curved carapace width (CCW), weight, and tissue samples for DNA and genetic analysis, were collected as well as water quality parameters at the sampling sites. In addition, information on the interaction between sea turtles and fishing activities was also collected from local communities at Mabul Island, Malaysia through a questionnaire survey.



Position of the green turtle on 20 February (above) and on 18 July 2011 (below) at Lawas foraging habitat

Making use of the results of its study on sea turtle foraging habitats, MFRDMD conducted the “Regional Workshop on Management of Sea Turtle Foraging Habitats in the Southeast Asian Waters” on 1-3 November 2011 at Kuching, Sarawak Malaysia. The Workshop came up with the draft “Standard Operating Procedure for Conducting Scientific Survey in Sea Turtle Foraging Habitats” and the draft “Guidelines to Develop Management Plan for Foraging Habitats of Green Turtles (*Chelonia*



Weighing the sea turtles



Interview with member of local community

mydas)” which would be used as reference for the conduct of relevant activities in the future.

In addition to the studies undertaken by MFRDMD, TD also carried out an experiment to investigate the response and reaction of sea turtles to different sound frequencies at the Sea Turtle Conservation Center in Munnai Island, Rayong Province in Thailand. Once it is established that certain sound stimuli affect the behavior of sea turtles, the information could be used as basis for the development of equipment that could reduce by-catch of sea turtles in the region. TD also continued to conduct activities aimed at promoting and raising awareness on the use of Circle-hook in hook-and-line fishing in the Member Countries in order to reduce mortality of sea turtles incidentally caught during fishing operations.



Collecting water quality parameters



Participants in the Regional Workshop on Management of Sea Turtle Foraging Habitats in the Southeast Asian Waters

5.2 Sharks

Although not considered as among the most commercially-important marine fishery commodities of the Southeast Asian region, sharks and rays are usually caught by artisanal small-scale capture fisheries as non-target species. This results in their declining population and as a consequence, several species of sharks have been proposed for listing in the CITES Appendices. Such action by CITES could create huge impacts to the fisheries sector of the region. It has therefore become necessary for countries in the region to collect relevant data and information that could serve as basis for the development of appropriate measures for the conservation and management of sharks and rays, and also as justification during the negotiations in relevant international fora including the CoP-CITES.

Information on shark production, utilization and trade are essential for the development of appropriate policies and plans for the conservation and management of sharks. However, the currently available data and information on sharks in the region are very scattered. TD therefore organized the “Special Meeting on Sharks Information Collection in Southeast Asia” in Bangkok, Thailand, on 15-17 September 2011, to update the current available information on shark fisheries in the region, and to exchange views among experts on the ways and means of ensuring the sustainable utilization of sharks. The conduct of a regional study on stock assessment was recommended during the Meeting, where pragmatic indicators such as changing of fish size, CPUEs, length at first sexual maturity, among others, should be used to analyze the data that are already available in the SEAFDEC database. Meanwhile, the use of logbook or server program should be promoted as this could also provide useful data to support stock assessment of important species of sharks and rays. In addition, countries were encouraged to improve the collection of data on sharks and rays, either through long-term statistics data collection, or non-routine data and information collection, using the standard information collection format, which had been agreed upon by the countries in the region.

5.3 Cetaceans

Cetaceans are among the aquatic species under international concerns, where large cetacean species which are highly migratory inhabiting the oceans are not commonly found around the continental shelf or coastal areas in the Southeast Asian waters, although occasional stranding had been recorded. This results in the very limited information on the distribution of cetacean species in the region. Although, certain systematic studies on the biology of whales and dolphins in the region had been conducted in early 1990s by foreign researchers,



Dolphins coming near to coastal areas in the Southeast Asian waters

the information currently available had been generally based on the stranded specimens and through direct sighting surveys, which are being collected and compiled by responsible national agencies.

In order to better understand the distribution of cetaceans in the region, TD conducted the “*Cetacean Research in Southeast Asian Waters: Cetacean Sighting Program*” since 2008, which aims to gather relevant information on large/small marine cetaceans as well as freshwater cetaceans. During the past years, cetacean sighting activities had been incorporated as part of the collaborative research studies using the research vessels of SEAFDEC and those of the Member Countries, such as the M.V. SEAFDEC 2, M.V. DA-BFAR of the Philippines, and the R.V. Chulabhorn and F.R.V. Mahidol of Thailand. A series of technical meetings and on-the-job training sessions on cetacean research and survey methodologies such as cetacean species identification were conducted in the Member Countries to enhance the capacity of vessel crew and fishery officers in the conduct of the sighting surveys.

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

Since several commercially-exploited species have been listed or proposed for listing under the CITES Appendices affecting one way or another, the sustainability of the region’s fisheries, AQD initiated research activities which aim to develop seed production technologies and release strategies for some species of international concerns through the project “*Resource Enhancement of Internationally Threatened and Over-exploited Species in Southeast Asia through Stock Release*”. More particularly, the project focused on internationally threatened species such as the seahorse (*Hippocampus* spp.) and Napoleon wrasse (*Cheilinus undulatus*), as well as the regionally over-exploited species such as sea cucumber (*Holothuria scabra*), donkey’s ear abalone (*Haliotis asinina*), and mud crabs (*Scylla* spp.).

In 2011, significant technological advancements had been accomplished under the project. For the seahorse (*H. comes*), there was no significant difference in the daily growth rate among the groups reared in illuminated sea cages. However, the highest and lowest daily growth rates were observed in groups stocked at 25/m² and 50/m², respectively. For the Napoleon wrasse, information on broodstock maintenance and larval rearing for the development of seed production technology for Napoleon wrasse (*C. undulatus*) had been exchanged with the Research Institute for Mariculture in Gondol, Bali, Indonesia, and updated accordingly.

Meanwhile, broodstock of sea cucumber (*H. scabra*) from the study site in Molocaboc Island, Negros Occidental, Philippines were brought to the hatchery facilities of SEAFDEC in Tigbauan, Iloilo for induced spawning and juvenile production, where two larval batches were produced and reared to juvenile stage (length: >5 mm). Moreover, a floating ocean nursery (hapa netcages) and broodstock pen were established in Daku, Molocaboc in collaboration with the Barangay Fisheries and Aquatic Resources Management Council (BFARMC), where about 3,470 juveniles (0.02-1.20 g) were stocked in the hapa netcages. After 1.5 months, 147 juveniles were transferred from the nursery cages to a monitoring pen where the juveniles grew from 10 to 47 g with 26.5% retrieval.

From the 55 pieces of abalone (*H. asinina*) collected from 10 transects in the study site, 56.4% were wild, 1.8% was recaptured-wild and 41.8% were recaptured-hatchery bred which were

released in August 2010. Wild abalone stocks were recaptured up to a maximum of 278 days post release while the second released abalone, up to 294 days. All recaptured abalones were caught from the transect sites where they were originally released. This indicated that parallel with previous findings, the abalone habitat preference had high positive correlation with dead branching corals with encrusting algae.

As for mud crab, *Scylla* spp., assessment of the study site for stock enhancement was made through monthly monitoring of mud crab landings. A total of 9,137 crabs collected from the wild have been identified, measured and weighed. Mud crab yield from 100 days of sampling was 1.26 tons and individual daily yield ranged from 0.09 kg to 7.18 kg. Analysis of all crabs sampled showed that catch per unit effort (number and biomass) and yield were not correlated with moon phase, water temperature and salinity. Catchability of *S. olivacea* was positively correlated with soaking time, number of gears deployed and moon phase while *S. tranquebarica* had significantly negative correlation with these factors.

Moreover, an activity on community-based resource enhancement was conducted in the demonstration site in Molocaboc Island, Negros Occidental to improve awareness and participation of stakeholders in resource enhancement. Drafting of guidelines and schedule for managing and “guarding” the abalone (514, 460, and 1,040 tagged individuals were released in June, September, and December 2011, respectively) and sea cucumber in the demonstration site was carried out in April. The participants in this activity were the staff of Sagay Marine Reserve, Molocaboc local government units, SEAFDEC/AQD, and representatives of BFARMC comprising the officers, fishers, men and women of the Barangay.

Furthermore, activities were also undertaken to disseminate the project outputs. For instance, the results of the research were discussed during the ‘International Training Course on Community-based Resource Enhancement’ which was conducted on 12-20 July 2011, while two scientific articles were published in 2011.



Community-based resource enhancement activities in Molocaboc Island, Sagay, Negros Occidental

6. Post-harvest Technology and Safety of Fish and Fishery Products

Post-harvest and safety of fish and fishery products encompasses all aspects of fishery post-harvest technology through the production and distribution chain, from handling the fish onboard fishing vessels, onshore during landing, until processing and/or marketing. MFRD had been assisting the Member Countries in developing technologies that would optimize

the utilization of catch, reduce post-harvest losses, and improve the quality of fish and fishery products, as well as in instituting measures to comply with international food safety requirements.

6.1 Monitoring of Biotoxins in Fish and Fishery Products in Southeast Asia

Biotoxins are poisonous substances naturally present in fish and fishery products or accumulated by the animals feeding on toxin producing algae or in water containing toxins produced by such organisms (*Codex Alimentarius* Commission). Consumption of a variety of shellfish and fish could lead to an increasing number of human intoxications due to the presence or contamination of biotoxins. In addition, biotoxins could also cause mass killings of fish and shellfish, and death of marine mammals and birds after consuming food that contains biotoxins. Considering the possible impacts of biotoxins in fish and fishery products to human health, MFRD has implemented the program on “*Chemical and Drug Residues in Fish and Fish Products in Southeast Asia*” since 2009, under the new phase which focused on “*Biotoxins Monitoring in Fish and Fish Products in Southeast Asia*”.

There are several limitations in monitoring toxicity such as variations in the toxin contents between individual shellfish, different detection and even extraction methods for the various toxins requiring a decision which toxins should be tested for, and the frequency of sampling to ensure that toxicity does not rise to dangerous levels in temporal or spatial gap between sampling times or locations. The activities undertaken by MFRD therefore aimed to develop the methodologies for biotoxins analyses, enhance the capacity of Member Countries in the analysis through training, and obtain better understanding of the levels of occurrence and incidence of biotoxins in fish and fishery products in the region. It is envisaged that these activities would enhance the attention of responsible authorities in expanding and improving initiatives to monitor, detect and share information on marine biotoxins in order to reduce the public health risks associated with the consumption of contaminated shellfish and fish in the future.

After the “Regional Training Course in Biotoxins Analysis” held in Singapore in 2010, the Member Countries were asked to set up their respective analytical methods and facilities for biotoxins analysis. In this connection, Indonesia, Malaysia, Myanmar, Singapore, and Thailand incorporated the high-performance liquid chromatography (HPLC) analytical method into their testing protocols. Nine participating countries (10 ASEAN Member States except Brunei Darussalam) also submitted their survey proposals, and started undertaking surveys in 2011, which focused on the monitoring of paralytic shellfish poisoning (PSP) in green mussel (*Perna viridis*) with the exception of Indonesia and Vietnam, which focused more on PSP monitoring in baby clam (*Meretrix* spp.). Myanmar and Singapore had also expanded the scope of their surveys to include monitoring of the amnesic shellfish poisoning (ASP) and diarrhetic shellfish poisoning (DSP) in green mussels. Although most of the countries conducted their own analysis, *e.g.* using mouse bioassay as the screening method and HPLC as the confirmation method, Cambodia and Lao PDR sent their samples to Vietnam and Thailand for analysis, respectively, due to lack of resources and facilities. The results of the PSP analysis in the species surveyed have been negative in all the participating countries.

6.2 Traceability Systems for Aquaculture Products in the ASEAN Region

Traceability, defined by the *Codex Alimentarius* Commission as “the ability to follow the movement of a food through specified stage(s) of production, processing and distribution”, has become a major concern of the aquaculture industry, considering that it is a legitimate requirement in major international markets such as the EU and the USA. Traceability has also been considered as an important tool in dealing with concerns of food safety, quality assurance, risk prevention, and gaining consumers’ trust.

Aquaculture has rapidly developed in the Southeast Asian region during the last decade with its production increasing from less than 4 million metric tons to more than 12 million metric tons, with large portion of the production aimed at the export markets. As aquaculture becomes more market- and consumer-driven, great pressure has been placed on product traceability by the general consuming public. For example, consumers are now getting more and more concerned on what they eat – whether the food comes from safe and sustainable sources, and whether production, transportation, and storage conditions could guarantee food safety. In order to address such concerns and requirements, MFRD with the collaboration of AQD initiated in 2010 the five-year project on “*Traceability Systems for Aquaculture Products in the ASEAN Region*” with the main objective of enhancing the capacity of the region’s aquaculture industries to implement appropriate traceability systems for their products to meet international traceability requirements in the network of aquaculture production, marketing, and trade. Taking into consideration the available expertise in the region and suitable sites for the on-site training sessions identified during the 2011

Consultation, MFRD organized the “*First On-site Training Workshop in Traceability Systems for Aquaculture Products*” on 28-30 November 2011 in Ho Chi Minh City, Vietnam, in collaboration with the Ministry of Agriculture and Rural Development (MARD) of Vietnam. The Training Workshop which comprised lectures delivered by resource speakers and on-site visits, had provided opportunities for the participants from ten ASEAN Member States to discuss and exchange information on the aquaculture products supply chain in their respective countries, and the basic elements needed in traceability systems for aquaculture products as well as the issues and challenges in the implementation of traceability systems.



Participants of the 1st On-site Training Workshop in Traceability Systems for Aquaculture Products in the ASEAN Region



Group discussion during the 1st On-site Training Workshop in Traceability Systems for Aquaculture Products in the ASEAN Region

6.3 Utilization of Freshwater Fish for Value-added Products

In the Southeast Asian region, freshwater fish is very important in providing substantial sources of animal protein, and serving as raw materials for the processing of various traditional fish products. Freshwater fish products are largely processed as traditional products of the region by household producers and small- and medium-sized establishments which are usually family-owned operations with little mechanization. Upgrading of the processing and packaging technology for the freshwater fish products is therefore necessary to improve products quality and safety with the possibility of commercialization.

The importance of freshwater fish is very prominent in many countries of the region, *i.e.* Cambodia, Lao PDR, Myanmar, and Vietnam. In 2003-2004, MFRD implemented a project to “*Maximize the Utilization of Fish Catch*”, the activities of which were implemented only in Cambodia due to the resource limitations. MFRD therefore initiated another program on “*Utilization of Freshwater Fish for Value-added Products*” starting in 2011, of which the activities involved Lao PDR, Myanmar, Vietnam, and Indonesia. This is aimed at enhancing the utilization of freshwater fish species for development of value-added products, and assisting the participating countries in upgrading their respective processing and packaging technologies for freshwater fish products.

During the “Project Inception and Planning Meeting” in Singapore on 26-27 April 2011, with the participation of Indonesia, Lao PDR, Myanmar, and Vietnam, the project activities were planned and scheduled, while the freshwater fish species to be used and the types of value-added products to be developed by each country were identified. Subsequently, the “Regional Training Course on Processing of Value-added Products from Freshwater Fish” was conducted in



Hands-on practical session during the Regional Training Course on Processing of Value-added Products from Freshwater Fish



Participants of the Regional Training Course on Processing of Value-added Products from Freshwater Fish

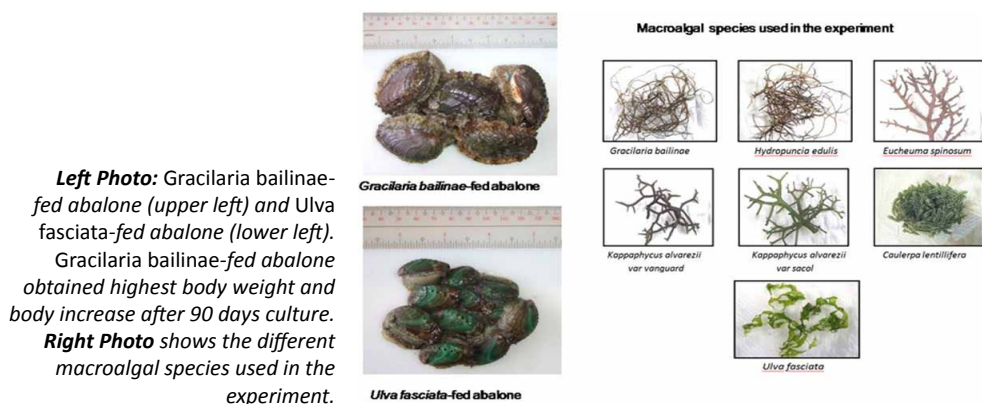
Singapore on 18-21 October 2011. Lectures and hands-on practical sessions were provided on the processing of value-added products (including snack products and frozen comminuted fish products) as agreed during the Project Inception and Planning Meeting. The introduced processing techniques involved the use of simple and inexpensive equipment, and technology suitable for the village level and small- to medium-sized industries. The participants also experienced the conduct of shelf-life studies and sensory analyses on the fish products. In addition, good manufacturing practices were also emphasized to ensure product safety and quality.

7. Sustainable Aquaculture Development

AQD continued to conduct studies on important mollusks especially on the seed production of the donkey's ear abalone for stock enhancement and development of grow-out culture technologies. AQD also conducted studies on the selective breeding and on the improvement of husbandry techniques in all phases of culture of shrimps and mud crabs; breeding and seed production and grow-out for the culture of regionally-important freshwater commodities, improvement of seaweed strains for commercial purposes, and assessment of the impacts of aquaculture on the aquatic ecology. Moreover, AQD also fostered institutional and human capacity building in aquaculture through partnerships with the private sector and stakeholders, as well as continued the activities to accelerate the awareness and capacity in fish health management and promote the food safety of aquaculture products in Southeast Asia. These activities were aimed at addressing the requirements in the aquaculture-related provisions stipulated in the 2011 Resolution and Plan of Action.

7.1 Integrated Mollusk Production

In 2011, AQD continued to conduct a number of studies on the donkey's ear abalone, *H. asinina* for stock enhancement and grow-out culture. Results of experiments conducted to mass produce and utilize diatom diets (*Cocconeis* spp./*Nitzschia* spp.) for settlement rate and growth, and to develop a microparticulate diets for the young post-larvae of abalone to reduce dependence on diatoms, showed that daily feeding of the larvae with microparticulate diet was best in terms of larval settlement. While improving quality of abalone seeds had been pursued, a strategy for genetic management of abalone is being developed, and the role of biota in abalone hatchery has also been studied.



Studies aimed at finding other suitable macroalgae as alternative feeds for abalone juveniles and breeders besides *Gracilaria bailinae* have been continued. However, highest daily increase in shell length and body weight in both juveniles and adults were still attained by abalones given *G. bailinae*. Meanwhile, a study to use the marine thraustochytrid *Schizochytrium* spp. as source of lipid/DHA for the artificial diet of abalone juveniles was also carried out, as well as studies aimed at developing broodstock diets with varying protein/energy ratios to improve spawning frequency and quality of the larvae during hatchery phase.



Under selective breeding study, hatchery-bred abalone (left photo) are bigger than the F_1 stocks from Palawan (right photo)

The financial viability of using various types of nursery cages (black box, round mesh cage, prefabricated, black plastic tray and blue box) and stocking density of 500 and 1,000 pieces/m² shelter surface area in nursery rearing of abalone was assessed. Abalone juveniles reared in black boxes had the highest average body weight (8.3 g) and lowest in blue boxes (6.9 g). To demonstrate AQD's developed technologies for seed production and culture, large-scale production of *H. asinina* juveniles was continued. In another experiment, the performance of abalone hybrids growth in sea-based cages and the quality of meat were evaluated and compared with the pure *H. asinina*. The F_1 of HAFGM (*H. asinina* female x *H. glabra* male) presumptive hybrids grew better than the pure *H. asinina* strain. Pure *H. asinina* was however found to be superior in taste compared to the two presumptive hybrids (HAFGM and HAFPM-*H. asinina* female x *H. planata* male).

7.2 Mud Crab and Shrimp Domestication

AQD continued to conduct studies on selective breeding of indigenous species of shrimps and mud crab, *Scylla serrata* for sustainable production of good quality broodstocks and seeds. Stock assessment and socio-economics of each culture phase were also carried out to evaluate the impacts of adopting the generated technologies. For shrimps, studies were conducted to refine the methods involved in the domestication of *Penaeus monodon* and *P. indicus*. An initial result from the genetic characterization of *P. monodon* broodstock through microsatellite DNA analysis indicated no significant difference in the genetic variability among populations collected from many areas in the Philippines. In another study, F_1 adults of *P. indicus* were reared in captivity and stocked with those from other families for reciprocal mating. At least 7 mass pairings involving five families were done to produce F_2 . Hatching rates greatly varied and ranged from 23 to 92%.

Mud crab studies in 2011 focused on improvement of survival and quality of *S. serrata* produced in the hatchery, nursery and grow-out phases. The efficiency of formulated feed in reducing the occurrence of the molt death syndrome, one of the major causes of mortality at zoea 5 to megalopa, was investigated, and also the use of high temperature to enhance the molting of zoea 5 to megalopa and improve survival at the hatchery phase. When the newly molted zoea 5 were reared until megalopa in seawater with constant temperature levels of

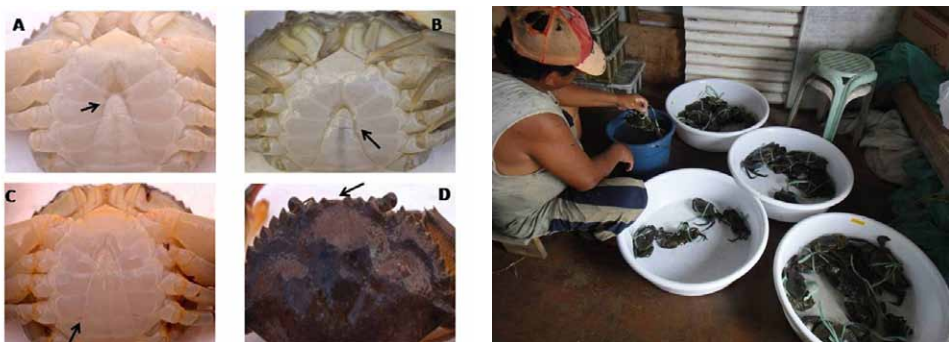
27°C, 29°C (ambient), and 31°C, survival was significantly lower at 27°C than at 29°C and 31°C. However, when Zoea 3 were fed different diets to test the efficiencies of formulated feeds as supplements or partial substitutes for *Artemia* and to reduce mortalities attributed to the molt death syndrome, the mean survival rates from 2.67 to 4.67% were similar in all treatments.

Enrichment of 3-5 day old *Artemia* before feeding to crab larvae was tried to determine if this will improve the performance of mud crab larvae. Survival rates from zoea 4 to megalopa were compared among larvae fed *Artemia* enriched with SEAFDEC formulation or Selco for 8 and 15 hours or algae (control). Growth was faster when larvae were fed *Artemia* enriched with either Selco or SEAFDEC formulation than with algae-fed *Artemia*. Experiments were also conducted to determine if survival, growth or occurrence of morphological abnormalities are affected by the use of antibiotics during larval rearing. Larvae, megalopa and crab instar/juveniles were treated with different levels of oxytetracycline or OTC (0, 3.0, 6.0, 9.0, and 12.0 ppm) and furazolidone (0, 0.5, 1.0 and 1.5 ppm), two antibiotics commonly used in hatcheries. Growth was significantly faster and occurrence of abnormalities was lesser in crabs previously exposed to lower concentrations of either OTC or furazolidone.

The incorporation of the amino acid, tryptophan (Trp) in the formulated diet to reduce the aggressive behavior in juvenile crabs was further assessed. Results of incorporating high levels of Trp in crab feeds during nursery rearing showed that survival of crablets was significantly higher in stocks fed with diet containing 0.75% Trp than in stocks fed with diet containing 0.32% Trp. Similar result was also obtained in another experimental run conducted for crab instars.

Milkfish fingerlings (500 pieces, 3 inches length) and *Scylla serrata* crablets (850 pieces, 3.5-4 cm internal carapace width) were stocked in brackishwater pond for grow-out. After 180 days polyculture of mud crab with milkfish given a formulated grow-out diet (36.5% protein), the total mud crab biomass was 50 kg with an average body weight of 430 g and survival rate of 13%. Milkfish gave a total biomass of 84 kg with an average body weight of 206 grams and survival rate of 100%.

A series of study was also undertaken on fishmeal replacement in mud crab feed. Experiments to develop cost effective diets for mud crab through replacement of soybean meal with copra meal were also initiated. The diets given to crabs had fish meal replaced by 35% soybean meal



Left Photo: Deformities observed in crablets treated during larval stage with high doses of oxytetracycline or furazolidone: A. depressed abdominal flap; B. unsymmetrical flap; C. gaps between sternites; D. fused frontal spines; and **Right Photo:** Sorting of harvested mud crabs

and copra meal protein replacing the soybean meal protein at 0 (control, no copra meal), 20, 40, 60, 80 and 100% levels. Study was also undertaken using freeze-dried marine annelid or sandworm *Perinereis quatrefagesi* meal as replacement for marine protein sources in juvenile crustacean diet formulations, of which the results indicated that lower levels of incorporation (1.5 to 3% level in the diet) of *P. quatrefagesi* meal, squid meal and their 1:1 combination resulted in higher growth in white shrimp and mud crab juveniles than those given the control diet (no annelid and squid meal), but survival was not affected by the diets.

7.3 Marine Fishes

AQD has developed several technologies for breeding, seed production, nursery and grow-out culture of various marine fish species that have already been adopted by the fish farmers. Although these technologies are already working, they are continuously improved. Various research studies have therefore been conducted for sustainable aquaculture development, poverty alleviation in the countryside, conservation and reinforcement of aquatic resources, and ensuring food security in the Southeast Asian region, especially for such marine fish species as milkfish, grouper, sea bass, mangrove red snapper, rabbit fish, pompano, kikeru (scat), Napoleon wrasse, and hybrid red tilapia, and seahorses. Thus, experiments were conducted to ensure consistent supply of seeds for commercially-important species, by developing reliable captive breeding techniques for pompano (*Trachinotus* spp.), scat (*Scatophagus* spp.) and the Napoleon wrasse (*C. undulatus*).

Seed production techniques for various marine fish species have been continuously carried out to increase survival in hatcheries and improve the quality of seeds. In milkfish, improving the nutritional quality of the broodstock feed by adding more micronutrients, and improving the quality of the live feeds during the first feeding period have been pursued. For the Napoleon wrasse, research continued to focus on ensuring the availability of live food with the appropriate size that will fit the size of the mouth of the larvae during the first feeding stage.

Experiments were also conducted to improve production performance of sea bass in net cages in brackishwater ponds during nursery and grow-out phases using AQD-formulated feed with higher energy level. Another verification study evaluated the use of commercially available feeds and AQD feeds (with varying ratio of percent crude protein and crude fat) on pompano juveniles cultured in ponds. Since polyculture of fish/organisms in single rearing system could



Semi-intensive production of pompano in ponds in Dumangas Brackishwater Station of SEAFDEC/AQD

increase pond production and optimize utilization of nutrient wastes, intensive polyculture of milkfish and mud crab have been carried out, as well as the polyculture of red tilapia hybrid and siganid (*Siganus guttatus*) in brackishwater ponds.

Results of the study on the digestibility and effective level of meat and bone meal (MBM) in formulated feed for milkfish grown in freshwater and seawater environments as determined in sub-adult milkfish (60-90 g) showed that the assimilation efficiencies of diets with different levels of MBM were similar and seemed to decrease as dietary MBM increased. The use of soybean meal and soy protein concentrates as alternatives to fishmeal in practical feeds for milkfish was also tried.



Milkfish harvests from the study on soybean replacement in milkfish diets at Igang Marine Station of AQD



Semi-intensive production of rabbitfish in ponds at AQD's Dumangas Brackishwater Station (above); and harvest of rabbitfish by seining (below)

As for seahorses, experiments were continued to develop an acceptable formulated feed for the adult stage, while the design of tanks and aeration system to keep the formulated feed suspended in the water column, had been improved. Furthermore, since understanding the immune system of farmed species is crucial to develop control methods against specific pathogen infestation for better fish health management, preliminary intra-specific pathogen transmission trials were conducted by artificially infecting sea bass with naturally infected rabbitfish.

Recognizing the pressing need to address issues on climate change, investigations on the effects of increased temperature rearing water and acidity on the reproductive performance in early larval development of important tropical aquaculture fish species (e.g. tilapia, rabbitfish, sea bass and milkfish), have also been undertaken by AQD. Results from preliminary runs on both milkfish and sea bass showed very much reduced survival of larvae after 10 days of rearing in the test

temperatures (29°C, 31°C and 33°C). Survival of milkfish fry in 31°C and 33°C were $1.32 \pm 0.49\%$ and $0.78 \pm 0.43\%$, respectively, compared to $20.38 \pm 1.57\%$ in ambient or 29°C. For sea bass, survival after 10 days of rearing in 33°C was $6.45 \pm 2.6\%$ whereas in 29°C it was $61.2 \pm 6.7\%$.

7.4 Small-holder Freshwater Aquaculture

The optimal breeding, seed production and grow-out culture strategies for regionally-important freshwater commodities such as the giant freshwater prawn, Asiatic carps, tilapia, catfish and indigenous freshwater fish species, are being developed by AQD. Improved production and husbandry schemes had been packaged into aquaculture business technologies, while efforts were continued to implement effective health management strategies for the sustainable production of various farmed species.

For the development of genetically enhanced giant freshwater prawn (*Macrobrachium rosenbergii*) with improved production traits, the first of two broodstock management schemes that would improve the reproductive performance of domesticated *M. rosenbergii* broodstock and the growth of their progenies was evaluated. The breeding scheme, which makes use of females from one line crossed with males of another line and *vice versa* was tested as a method that could minimize the adverse effects of long-term domestication on growth and reproduction in broodstock of giant freshwater prawn. Spawning sets composed



Experimental set-up for tank culture (left) and cage culture (right) of freshwater prawn post larvae *M. rosenbergii*

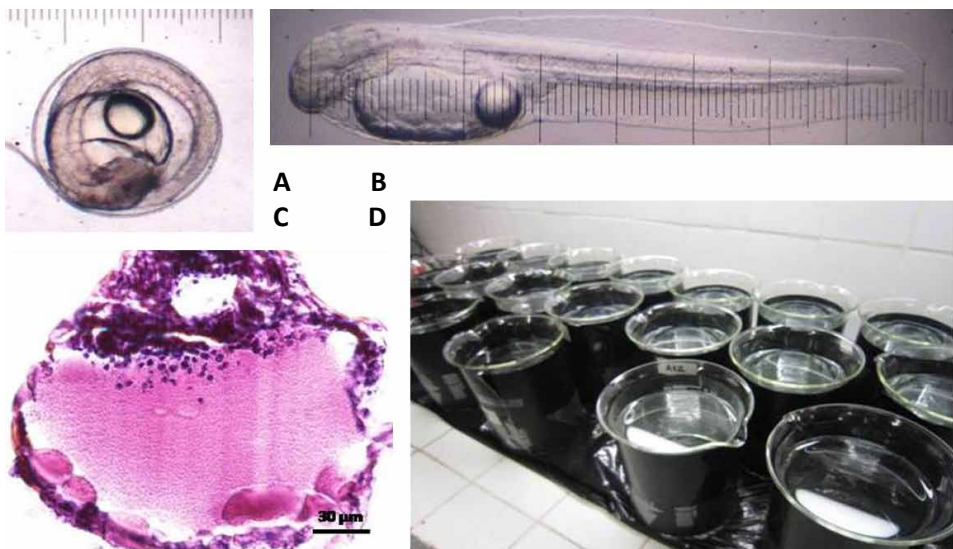


Experimental set-up for breeding (left) and larval rearing (right) of *M. rosenbergii*

of specific crosses between similarly aged stocks of Old Calumpit (OC) and New Calumpit (NC) *M. rosenbergii* were used. The cross that will show the best performance in terms mainly of seed production and subsequent growth in tested progenies shall be noted. Reproductive efficiency data have already been collected from ten monthly samplings, while growth trials comparing progenies from all four crosses (OCxOC, OCxNC, NCxOC and NCxNC) were conducted in cages and tanks. Growth and survival rates were better in progenies from either the OCxNC and NCxOC crosses in both the tank and cage trials.

In order to determine the effect of partial fishmeal protein replacement with cowpea meal protein in post larvae and juvenile diets, prawn post-larvae were fed four isonitrogenous and isocaloric diets with different levels of protein substitution (0% or control, 15, 30 and 45%). After 29 days of culture, the maximum average body weight varied from 0.65 to 0.76 g and survival was from 78 to 85%. As for their reproductive performance, results from another experiment showed that broodstock fed 20% cowpea meal-based diet produced better results in terms of berried females, weight of eggs/female and larval survival.

In the development of methods for improved seed production and lake-based cage culture of the giant freshwater prawn, rearing trial to determine the ideal stocking for the nursery rearing of prawn post-larvae was conducted. The results suggested that stocking density of 300 post-larvae/m² could be used for the first month of rearing and subsequent reduction in stocking densities to obtain larger sized juveniles. Results of the evaluation of different grow-out management strategies to improve cage-based production of marketable-sized giant freshwater prawn, showed that providing substrate could improve production of giant freshwater prawn in lake-based cages making higher stocking densities possible compared to those without substrate. The growth and survival performances of ablated and unablated prawns were also evaluated, but no significant differences were found in their performances.



Silver therapon embryo 20 hours post-fertilization (A); newly hatched larvae (B); histological section of newly-hatched larvae showing the yolk sac reserves (C); and experimental set-up for the larval rearing experiment of silver therapon (D)

In order to improve and promote production technologies for bighead carp, tilapia, and prawn, induced spawning of carp and the production of advanced bighead carp fingerlings had been carried out. The stocks nursed to fingerlings from the first and second spawning episodes have been sold to fish farmers. Meanwhile, the development of saline tolerant tilapia species or strains with enhanced traits had been continued to identify which among the currently available species/strains are suitable for brackishwater culture. Results of experiments in brackishwater tanks showed that both the red and Nile tilapia species generally had better growth and morphometric traits than the Mozambique tilapia stocks. Two stocks of the BEST strain Tilapia from BFAR were used for growth comparison trials. With regards to tilapia mass seed production at AQD stations (Binangonan Freshwater Station and Tigbauan Main Station), Nile and red tilapia fry stocks were fed diets with methyltestosterone to produce sex-reversed fingerlings.

In an experiment to co-culture tilapia and giant freshwater prawn using AQD formulated diets in cages in a freshwater reservoir in Dingle, Iloilo, the results showed that tilapia stocks fed the AQD formulated diet grew better than those fed the commercial diet. The absolute growth rate of prawns fed the AQD formulated diet did not differ significantly from prawns fed the commercial diet. For the development of culture techniques for indigenous freshwater species in the region, domestication and evaluation of the culture potential of an indigenous freshwater prawn species, *Macrobrachium lar* were continued. Newly hatched larvae from wild-sourced berried females collected from Sorsogon and reared at different salinities (6, 12, 18 and 24 ppt) had poor survival although larvae reared in 24 ppt survived until the zoea IV stage. Morphometric characterization of wild-caught adult *M. lar* is ongoing.

Breeding and larval rearing methods for several locally-important fish species with aquaculture potentials have also been studied by AQD. Studies on the reproductive biology of silver therapon (*Leiopotherapon plumbeus*) collected from selected habitats and larval rearing requirements were carried out. Meanwhile, the reproductive biology of the climbing perch, *Anabas testudineus* was likewise studied.

7.5 Seaweed Strain Improvement

AQD continued to conduct studies on seaweed strains, such as tissue culture of *Kappaphycus* for the development of 'new' and improved varieties, improvement of the efficiency of *Gracilaria* (other seaweeds) as biofilter, and evaluation of the anti-microbial properties of commercially-important seaweeds against common fish (and human) pathogens.

For the development of new strain through tissue culture, sporulation and protoplast fusion techniques, the conditions for protoplast isolation were optimized for *Kappaphycus alvarezii* and *K. striatum* and the effect of plant growth regulator (PGR) was tested for the regeneration of the protoplasts. When different mannitol concentrations and use of PGR and fertilizers were tested in newly isolated protoplasts, the results indicated that higher concentration of mannitol was more effective in maintaining stability of the cell membrane, while the use of PGR showed higher survival after 2 weeks of protoplast culture. In another study, pre-treatment of fresh and powdered seaweed samples with cellulase or a combination of cellulase and carrageenase have been tested to determine if degradation of cell wall by polysaccharidases will result to higher total cellular DNA yield that is amenable to PCR amplification.



Left Photo: The effect of fertilization on the growth of *K. alvarezii* (vanguard) was monitored every 15 days (left); and **Right Photo:** *K. alvarezii* fertilized with ASL and NaNO_3 cultured in net cages in Igang Marine Station

The efficiency of *Gracilaria* and other seaweeds as biofilter has been continuously improved, especially the *Gracilaria bailinae* which can take up as much as 80% of total ammonia and ammonium in the water after 1 hour and almost 95% after 2 hours, while total ammonia and ammonium in the water could remain low or below determinable value after 6 hours. However, when *Caulerpa lentillifera* was used, the results had been erratic. Experiments were also conducted to determine the uptake rate of *G. bailinae* of the dissolved nutrients present in an intensive shrimp culture. *Kappaphycus* was grown in a net cage using different fertilizers (Acadian seaplant, sodium nitrate and without fertilizer) along fish cages in Igang Marine Station. Results showed that fertilization could affect the quantity of the semi-refined carrageenan of *Kappaphycus*.

The anti-microbial property of seaweeds has also been explored by AQD, where a total of 14 and 10 crude ethanol and water extracts, respectively, from seven varieties of *Kappaphycus* and *Eucheuma* species have been screened for antibacterial activities against four fish and three human bacterial pathogens. The results suggested that one preparation of the crude ethanol extract of *K. alvarezii* (vanguard) variety showed promising antimicrobial activity against the human bacteria *S. aureus* and its multidrug-resistant strain, MRSA.



Effect of fertilization on the photosynthesis of *K. alvarezii* was determined using the 'Light and Dark Bottle' method

7.6 Aquatic Ecology

In 2011, AQD continued to assess the impacts of aquaculture on the environment including different practices on biodiversity in ponds and adjoining mangroves and shores, and develop bioremediation measures to mitigate the negative impacts of aquaculture to the environment.

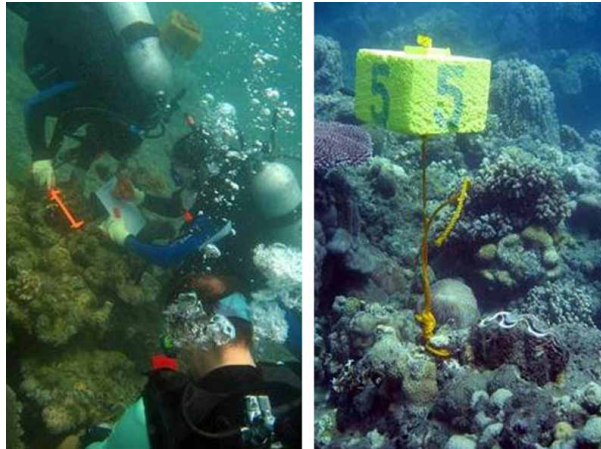
For the assessment of biodiversity in marine cages and platforms for aquaculture in Igang, Guimaras biodiversity baselines were collected around AQD's own research stations comparing with later time periods when environmental conditions change for better or worse, through rapid assessment. Documentation on the flora and fauna in, on, and around the cages was carried out and also in the adjoining sea grass beds and rocky islets of Igang Marine Station (IMS) and Igang Mariculture Park. So far, some 438 species in 182 families in 13 major taxa have been collected and photographed for development of a complete species list.

Different species combinations were found in different types of habitats, which seem to suggest the positive effect of aquaculture on biodiversity. Cage structures provide additional habitat for attachment of seaweed spores and settlement of planktonic larvae of various sponges, tunicates, bryozoans, mollusks, and other invertebrates that otherwise could not find space in the occupied adjoining habitats. However, thick coating of cage biofoulants was noted which inhibits good water flow into the cages and add to the biological oxygen demand.

An experiment was initiated to identify invertebrate and bivalves that could be used in an integrated multi-trophic aquaculture (IMTA) system, focusing on sandfish and bivalves as bio-remediators in intensive cage culture system. For the first run, sandfish (*Holothuria scabra*), mangrove clam locally known as "imbao" (*Anodontia philippiana*), and window-pane shell



Installation of nursery cages and stocking of clam juveniles



Monitoring and marking
of wild giant clams

locally known as “lampirong” or “kapis” (*Placuna placenta*) were reared either in an open area without cage (no feeding); beneath a fish cage right after harvesting milkfish (no feeding); or beneath a fish cage rearing snapper *Lutjanus argentimaculatus* (with feeding). After eight weeks, 100% mortality was observed in all treatments. After 22 weeks of monitoring the water parameters, results indicated that temperature, salinity and dissolved oxygen did not significantly differ between treatments.

The optimal conditions for growth and survival of sandfish juveniles for culture were explored through an experiment that evaluated the substrate preference of sandfish. The results showed poor performance of sandfish in terms of growth and survival in mudflat in Igang Marine Station (IMS) and in pond muddy substrate at Dumangas Brackishwater Station (DBS). Pond with sandy substrate showed the best potential for sandfish culture. Initial experiment was also done to test the tolerance of sandfish juveniles to different salinity levels (15, 20, 25 ppt) together with the control (ambient salinity of 30 ppt). Initial findings showed that sandfish in the 15 ppt treatment had the most behavioral changes, indicating high stress levels for the animals, while the salinity threshold for sandfish was observed to be between 18 and 20 ppt.

In the trial culture of sandfish juveniles in pens aimed to compare the performance of ponds (DBS) versus open sea pens (IMS), the results showed that IMS stocks gradually increased in body weight (*i.e.* from 0.3 g/day to 0.11 g/day) after six weeks before shrinking slowly after ten weeks. This suggested that available food in ponds (DBS) were readily available but were easily consumed by the sandfish within 2 weeks even at the very low stocking density of 35 g/m², while natural food supply in the open sea pen can sustain sandfish population longer (6 weeks). For the optimal stocking density of sandfish for pond culture, initial results showed that stocking density of more than 200 g/m² is not ideal for culture with natural food alone. The decline in growth even for lower densities, further indicate the need for efficient feeding schemes after 2 weeks culture of juvenile sandfish.

Studies to identify the fish species suitable for polyculture with sandfish were conducted, starting with a study on fish: sandfish ratio and size at stocking with snapper (*Lutjanus argentimaculatus*) which was successfully completed. The results suggested that culture

of sandfish with snapper could be possible provided the snapper is maintained at proper stocking density and graded routinely. Current production runs in pens in IMS making use of 5-6 inch milkfish (*Chanos chanos*) initially resulted in good growth and survival of the milkfish.

Polyculture of tiger prawn *Penaeus monodon* and sandfish *Holothuria scabra* was also tried. The initial results showed that neither growth rate nor survival rate of the shrimp was significantly affected by the presence of sandfish, while dissolved inorganic nitrogen levels, dissolved oxygen level, pH and salinity of the rearing water and organic matter in the sediment were also not affected. The mean oxidation reduction potential of sediment pore water and mean acid volatile sulfur were significantly higher in tank with sandfish than in a tank without sandfish, suggesting that while sandfish could cause bio-deposition of sulfur to the sediments, but could also maintain the sediment quality in better condition.

For the integrated multi-trophic aquaculture (IMTA) techniques for improved livelihood, preliminary experiments were conducted in DBS ponds, such as the pond polyculture of Asian sea bass (*Lates calcarifer*), oyster (*Crassostrea iredalei*), sandfish (*Holothuria scabra*), and seaweeds (*Gracilaria heteroclada*). In terms of energy budget, the polyculture with feeding only the sea bass was feasible, although the sea bass tended to nip the seaweeds and get entangled with the straw holding the seaweeds. Inorganic nutrient provided to the seaweeds could not be determined due to the disturbance by sea bass. However, phytoplankton production seemed high enough to support the growth of the oysters, while sandfish mortality was high in sediments with higher silt content. Meanwhile, the apparent digestibility coefficient (ADC) of animal (shrimp and mussel) and plant (diatom and seaweed) sources of nutrients (protein, carbohydrate and organic matter) were determined in sandfish. Nutrients from animal source have higher ADC compared to the nutrients from plants, indicating that nutrients from animals can be better assimilated by sandfish and thus could lead to better growth.

In order to quantify the organic load by cage culture of milkfish to adjacent areas, periodic monitoring of water current, dissolved oxygen, chlorophyll a, inorganic nitrogen and phosphorus in the water column, carbon and nitrogen content, acid volatile sulfur and organic matter content in the sediments were conducted. The nutrient flow and accumulation in the system will be determined by a mathematical model analysis.



'By-catch' species harvested from a fish cage in AQD's Igang Marine Station

7.7 Other R&D Activities

Institutional Capacity Development on Sustainable Aquaculture (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 the aquaculture technologies developed by AQD and for building the capacity of beneficiary communities. The Petron-supported ICDSA project on Milkfish Cage Culture as a Livelihood Option for Guimaras Fisherfolks was a learning experience for researchers, development workers and the fishing communities. Milkfish cage culture technology was found to be a viable technology based on the test trials conducted at the IMS facilities with trained fish farmers as the operators. However, transferring this technology to the fishing communities could be the most challenging part. A “mariculture park” concept will be proposed in order to sustain the initial efforts in ensuring that milkfish cage culture is a sustainable livelihood for fisherfolk communities. Another project being developed is a 2-3 year Mariculture Project in Romblon, Philippines in partnership with Romblon Agricultural Improvement for Sustainable Economic Development, with funding support from Winrock International. In another development, the Dumarao freshwater aquaculture project had attracted interests not only from the originally targeted rural folks but also the private investors, where tilapia culture is being practiced as a viable enterprise in the locality.



Members of the small-scale fish farmers' group in Dolores (KAMAMADO) feed milkfish in cages in Igang Marine Station



Members of the KAMAMADO install nets for the milkfish cages in Igang Marine Station

ABOT (Agree-Build-Operate-Transfer) AquaNegosyo aims to disseminate AQD's science-based aquaculture technologies to encourage private sector investments in aquafarming for livelihood generation and food security. In 2011, the ABOT AquaNegosyo Program served several clients on different activities/projects which earned for AQD a gross income of about PhP 198,000 or US\$ 4,700 (US\$ 1.00 = PhP 42.00). One of the important clients served during the year was the ACDI/VOCA (USA), a non-profit international development organization which is implementing a USDA-funded Mud Crab/Fish Cultivation Project in Timor-Leste. AQD provided the expertise for developing a feasible technical approach to implement viable commercial mud crab culture and hatchery set-up in Timor-Leste. Another activity done under ABOT was the promotion of giant freshwater prawn farming in cages in Laguna de Bay as part of a livelihood development project for the local water cooperative in Binangonan, Rizal in Central Philippines.

7.8 Promotion of Sustainable and Region-oriented Aquaculture

In 2011, AQD pursued activities on the genetic improvement of commercially-important species and development of hatchery technology, formulation of environment-friendly feeds using regionally available ingredients, establishment of management technology for disease tolerance and sustainable aquaculture environment, socio-economic assessment and impact analysis of transfer and adoption of sustainable aquaculture technology, and technology extension and demonstration.

Studies that would assess the quality of mud crab and shrimps to be used in selective breeding experiments were conducted. Zoea 1 of *Scylla serrata* exposed to 30 and 40 ppm formalin solution for 3 hours proved to be a good method for batch quality assessment. Since dose dependent cumulative mortality was confirmed by injection of *Vibrio harveyi* in the range of 0 - 10⁸ CFU/ml to mud crab juveniles, the challenge test using *V. harveyi* could also be an effective method for quality assessment. The challenge test using *V. harveyi* for black tiger shrimp *Penaeus monodon* juvenile (2-3 g), gave a computed median lethal dose of 3x105.65 CFU/ml shrimp, indicating that this test could be effective for quality assessment of *P. monodon* (CFU refers to cell forming unit).

A broodstock management scheme comprising reciprocal mating where males from line one are paired off with females from other lines and *vice versa* with frequent broodstock replenishment, was used to improve or minimize the impact of inbreeding on the giant freshwater prawn *Macrobrachium rosenbergii* hatchery stocks.

In improving the culture conditions of *Kappaphycus* spp., explants from tissue cultured seaweeds and spores were grown in the laboratory, tanks, cages (multi-step culture method). In the laboratory, propagules were cultured while in cages, propagules were tied in lines. About 6,000 individuals (seaweeds seedlings) are now cultured in cages in Igang.

Preliminary experiments on administering hormone to pompano (*Trachinotus* spp.) showed that the highest fertilization rate was obtained in 500 IU. For the optimum salinity requirement for larval rearing, different salinities were tested for newly hatched pompano larvae (up to day 5). The results showed that highest survival rates were observed at 25 ppt and 30 ppt. For the feeding experiments to investigate the effect of partial replacement of fishmeal with cowpea meal (0, 15, 30, and 45%) in diets of grow-out *M. rosenbergii*, preliminarily results indicated that although no significant differences were found among treatments but prawns fed the 45% cowpea meal-based diet had the best performance for all the parameters evaluated (*i.e.* mean final weight, % weight gain, SGR and survival rate).

The proximate nutrient component analyses for fishmeal samples obtained in Palawan showed high proportions of crude protein (>50%), ash content (>35%) with crude fat levels of less than 4%. Sample feeds from Myanmar showed a variety of ingredients of plant origin, including steamed and full-fat soybean meals and peanut cakes (where crude fat had been removed or extracted), sesame seeds, and groundnut. Feed ingredients from Myanmar of plant origin were found to contain high crude protein and crude fat but the sources are not commonly found in the Philippines. In another development, tank experiments confirmed that low temperature and low salinity are white spot syndrome virus (WSSV) risk factors. Viral load in WSSV experimentally infected shrimp *Penaeus monodon* cultured in small tanks with



The International Training Course on Mud Crab Culture at Chaung Thar, Myanmar, organized by AQD in collaboration with Department of Fisheries of Myanmar

tilapia decreased from 101 to 100 WSSV/mg sample while those in control increased to 105 WSSV/mg sample.

Technology extension and demonstration had also been promoted by AQD through the conduct of six international training programs in 2011 which included: 1) Giant Freshwater Prawn Production Training Program (21 March-1 April 2011, 7 participants); 2) Distance Learning Course on Principles of Aquaculture Nutrition or Aqua-Nutrition Online (21 March-22 July 2011, 10 participants); 3) Marine Fish Hatchery Training Program (20 June-26 July 2011, 10 participants); 4) Abalone Hatchery and Grow-out Training Program (7-27 July 2011, 9 participants); 5) Regional Dissemination of Mud Crab Farming Program (26 September-1 October 2011, 6 participants and 11 observers); and 6) Community-based Freshwater Aquaculture for Remote Areas of Southeast Asia (22 November-1 December 2011, 10 participants). Moreover, to sustain the dissemination of information, one scientific paper was published in the peer-reviewed journal.

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

As follow-up to the project “*Development of Fish Disease Surveillance System*” which was implemented from 2005 to 2009, the project on “*Accelerating Awareness and Capacity-building in Fish Health Management in Southeast Asia*” has been pursued by AQD starting from 2010. The activities in 2011 focused on accelerating awareness of technologically deprived countries on fish health management through industry-wide capacity building and innovative research to guarantee food safety and sustainable production.

Following the survey in Myanmar in 2010, a parallel survey was conducted in four regions in Luzon, Philippines. As in Myanmar, the Luzon survey confirmed the lack of proper awareness among small-scale fish farmers of fish health management concepts as well as environmental and food safety issues. The surveys also highlighted the need for hands-on training to build the technical capacities of the fish farmers. Thus, new information was disseminated through on-site training courses conducted in Myanmar on parasite detection with emphasis on zoonotic pathogens/parasite fauna with zoonotic potentials.

Tissue filtrates in tilapia in the Philippines showed negative results for zoonotic parasites. A survey for fish borne zoonotic trematodes (FZTs) metacercariae in farmed fish was also carried out in selected fish farms in Vientiane Municipality, Lao PDR. A total of 120 fish samples comprising six species (*Barbodes gonionotus*, *Oreochromis niloticus*, *Cyprinus carpio*, *Clarias* spp., *Hypophthalmichthys molitrix*, and *Ctenopharyngodon idellus*) collected from four fish and local markets were analyzed for the presence of FZT infection. Results showed that an unidentified FZT metacercariae species was present in (2.5%) of the fish samples (*B. gonionotus*) from a local market. No metacercariae were recovered in all fish samples collected from the different fish farms.

The plasmids of DNA viruses like the white spot syndrome virus (WSSV), Iridovirus and Koi Herpes Virus (KHV) that could serve as positive controls have already been developed while that of the ribonucleic acid (RNA) viruses is still on-going. Optimization of the quantitative real time polymerase chain reaction (q-PCR) methods for WSSV, Iridovirus and KHV using infected tissues was already completed but using the plasmids is still on-going. WSSV isolate was already tissue-passed thrice and the infected tissue material is ready for the preliminary infection experiment in determining the threshold level of the virus and in the susceptibility of different shrimp species.

Although spawned eggs from both matured vaccinated and unvaccinated sea bass injected with luteinizing hormone-releasing hormone (LHRH) were negative for betanodavirus detection, eggs from unvaccinated fish were found positive. To test the protective effect of the maternal antibodies present in vaccinated larvae, newly-hatched larvae from vaccinated fish group were also challenged with 10⁶ tissue culture infectious dose 50 (TCID₅₀ assay per ml) of betanodavirus. No significant differences in mortality rates were noted in the virus-challenged vaccinated and unvaccinated larvae.

A 2010 trial showed improved survival to a formalin-inactivated WSSV vaccine. In 2011, tank trials were conducted to test the different delivery vehicles for a recombinant sub-unit vaccine. To prepare laboratory-scale quantities of the recombinant vaccine for the various vaccine + carrier complexes, a transformed strain of *Escherichia coli* (BL21) cells was produced. Upon induction with Isopropyl- β -D-thio-galactoside (IPTG), the bacterial cells were able to produce the recombinant VP28 protein in a previous trial. Although in a preliminary test run previously conducted the vaccine without carrier could be protective, but the delivery needs optimization.



Parasitic and shell disease of abalone (above); routine diagnostic activity at AQD's Fish Health Section Laboratory (right)



Abalones cultured in cages and wild stocks were examined for the presence of parasites and shell diseases. Shells fouled with burrowing polychaetes (58%), Spionidae (55 and 20%) and Dorveillidae (76 and 30%) were found in cultured and wild stocks. The condition index was significantly low in abalone with shell-boring worms. Commingle tests with infested abalone showed borers in uninfested abalone within 48-72 hrs.



In an effort to extend the technology in analyzing parasitic diseases in aquatic animals, AQD conducted an "On-site Basic Training on Freshwater Fish Health Management" on 11-14 October 2011 in Lao PDR in collaboration with the Department of Livestock and Fisheries (DLF) of Lao PDR to enhance knowledge and skills of freshwater fish health workers, particularly focusing on zoonotic parasitic diseases. Ten staff of the DLF and 10 observers from private farms attended the course, where the trainees had hands-on practice in parasite detection/identification and disease management.



On-site Basic Fish Health Management Training Course conducted in Lao PDR

Four papers by AQD researchers were also published in scientific journals to enhance dissemination of findings and technologies to relevant stakeholders.

7.10 Food Safety of Aquaculture Products in Southeast Asia

AQD continued to conduct activities that aim to ensure food safety of aquaculture products in the region. These included an assessment of the withdrawal period of oxytetracycline (OTC) administered in hybrid red tilapia at a dose of 75 mg/kg fish per day which was found to be 26 days while that of oxolinic acid (OXA) given at a dose of 30 mg/kg fish per day was in 17 days. Body weight of the test animals was 120.32 ± 31.5 g and the medicated diet feeding for each treatment was 10 days.

Residues of commonly used antibiotics, OTC and OXA, and organochlorine pesticides (OCPs) were examined in aquaculture products samples such as milkfish, grouper, snapper, sea bass, rabbit fish, black tiger shrimp, and tilapia obtained in various areas in the Philippines. One out of 40 samples analyzed was positive for OTC while five samples were positive for OXA. Four OCPs were detected in 6 out of 14 samples analyzed with levels ranging from 0.00066 to 0.02719 ppm. Methoxychlor was detected in three out of six samples found positive for OCPs. The exposure limits levels in OCPs were in the range below the Permissible Exposure Limits (PEL) values. For methoxychlor the PEL value is 0.70734 ppm TWA (8-hr time weighted average), while for OTC, it is 0.02460 ppm TWA. No PEL has been established yet for OXA.



Participants of the International Seminar on Food Safety in Aquaculture in Southeast Asia



Samples of aquaculture products (e.g. milkfish) cultured in ponds and cages were analyzed for residues of antibiotics and pesticides

Under this project, AQD would come up with the Guidelines on Chemical Use in Aquaculture in the ASEAN, taking into consideration the draft ASEAN guidelines for chemical use in the ASEAN region which is being developed by the Department of Fisheries (DoF) Malaysia. Specifically, to avoid duplication, the draft of the DoF Guidelines was also used as reference during the international seminar on 'Food Safety in Aquaculture in Southeast Asia' conducted on 22 January 2011 at AQD in Iloilo, Philippines which was attended by 51 participants from six Member Countries of SEAFDEC.



Detection of antibiotic residues in aquaculture products using the High Performance Liquid Chromatography (HPLC)

8. Activities in Response to the Emerging Needs and Concerns of the Region

SEAFDEC continued to conduct activities that aim to respond to emerging fishery issues and concerns faced by the countries in the region including the requirements in fish trade, that tend to hinder the sustainable development of the region's fisheries. Moreover, in the advent of the changing climate which has affected the fisheries sector, SEAFDEC in collaboration with partners had been conducting activities that aim to enhance the capacities of the countries in adapting to climate change.

8.1 International Fisheries-related Issues

In 2011, SEAFDEC organized the ASEAN-SEAFDEC Regional Technical Consultation (RTC) on International Fisheries-related Issues (18-20 January 2011 in Bangkok, Thailand) to provide forum for discussion among the Member Countries on relevant issues as recommended during the 13th Meeting of the FCG/ASSP in November 2010. Such important international fisheries-related issues included among others, the Technical Guidelines on Aquaculture Certification, catch certification scheme, quality and safety issues relevant to international trade, sustainability of small-scale fisheries, the FAO Legally-binding Instruments on Port State Measures for Combating IUU Fishing, fisheries subsidies, CITES-related matters, and the Global Record of Fishing Vessels. As a result, the Executive Report on International Fisheries-related Issues (2010-2011) reflecting coordinated positions of the Southeast Asian countries in addressing the issues was submitted to the 43rd Meeting of the SEAFDEC Council and the 19th Meeting of the ASWGF. The coordinated positions were also reflected in the statement of SEAFDEC during the 29th Session of FAO/COFI (31 January - 4 February 2011, Rome).

With regards to issues on commercially-exploited aquatic species, SEAFDEC attended the 8th Meeting of the ASEAN Expert Group on CITES (8-10 February 2011, Brunei Darussalam), where updated information on the status and relevant initiatives for various species were discussed, especially for the Napoleon wrasse, sharks, tuna, and seahorses. Later in 2011, a series of RTCs was conducted to discuss particular species in a more detailed manner, namely: 1) the Special Meeting on Improvement of Tuna Information Collection in Southeast Asia (7-9 September 2011, Songkhla, Thailand); 2) Special Meeting on Sharks Information Collection in Southeast Asia (15-17 September 2011, Bangkok, Thailand); and 3) the Technical Consultation on Addressing Technical Issues on Selected Commercially-exploited Aquatic Species (18-20 October 2011, Bangkok, Thailand). During these consultations, existing data, and the status



ASEAN-SEAFDEC Regional Technical Consultation on International Fisheries-related Issues



RTC on Addressing Technical Issues on Selected Commercially-exploited Aquatic Species

and trend of relevant species were discussed, while gaps were identified where data collection should be improved and other recommendations for better conservation and management of the species were also raised. Specifically during the RTC on Selected Commercially-exploited Aquatic Species, the technical problems related to CITES encountered by the countries in the region were identified which should be conveyed to the CITES Secretariat.

Furthermore, the 14th Meeting of the FCG/ASSP (17-18 November 2011, Manila, Philippines) also identified areas where efforts should be exerted to safeguard the interest of the Member Countries in the future. These included combating IUU fishing in the region, and the possible development of the ASEAN Catch Certificate in line with the EC Catch Certificate.

8.2 Climate Change and Fisheries

In order to address the emerging concerns on the impacts from climate change to fisheries, SEAFDEC implemented the program on “*Activities Related to Climate Change and Adaptation in Southeast Asia with Special Focus on the Andaman Sea*” since 2009. The program is specifically aimed at improving the capacity of participating countries and enhancing coordination on fisheries and habitat management; maintaining ecosystems’ health and increased resilience among coastal fishing communities; improving cooperation on the management of fishing capacity; and supporting the processes of establishing regional/sub-regional fisheries and habitat management mechanisms, as well as agreements that could contribute to strengthening the fisheries sector and its adaptive capacity in response to climate change and its possible impacts. The Program has been pursuing the approach towards building awareness in specific areas at the provincial, sub-regional and regional levels to demonstrate that better organization at local level; improved habitat management and restored habitats; reduction of destructive fishing; improved registration of vessels, licensing to fish, developing MCS networks; and safety at sea are among the factors that could build adaptive capacity and mitigate possible impacts of climate change. Subsequently, capacity building with specific focus on building up resilience and protection against natural hazards and effects of climate change are incorporated in the context of coordinated habitat and fisheries management, larger fisheries resources conservation areas (*refugia*), and management of fishing capacity to include safety standards as well as the preparedness and ability of crew-members.



On-site Workshops on Activities Related to Climate Change and Adaptation in Southeast Asia in Myeik, Myanmar (above); and in Ranong Province, Thailand (right)



In 2011, a series of on-site workshops was organized in Myeik, Myanmar (March 2011), Satun, Thailand (March 2011) and Ranong, Thailand (July 2011) with funding support by the Swedish International Development Cooperation Agency (SIDA) through the SEAFDEC-SIDA project on *“Activities Related to Climate Change and Adaptation in Southeast Asia with Special Focus on the Andaman Sea”*. The workshops provided the fora for coastal communities, local and central government relevant agencies to address the issues on integration of fisheries and habitat management, and improved MCS and MCS networks, vessel records, port monitoring, and local/traditional knowledge. The workshops also enhance the awareness of participants of adaptive capacity to response to the changes in weather patterns and climate change, their possible impacts and increasing importance. Through this project, SEAFDEC had been able to make efforts in strengthening and building up cooperation at sub-regional and regional levels to address the issues on climate change.

In another initiative to enhance better understanding on the impact of climate change, especially to the marine environments, TD developed a program since 2009 to monitor sea surface temperature through the use of satellite images. Together with other fishery data and information such as those from research surveys conducted by SEAFDEC, the data obtained through this monitoring exercise could be used in coming up with better understanding of climate change in relation to fisheries.

Moreover, in relation to enhancing the preparedness of countries in the region on the impacts brought about by climate change, and mitigating the possible impacts from fisheries to climate change, TD implemented the project on *“Safety at Sea for Small Fishing Boats”*. The project aimed to improve safety at sea for small fishing boats, address issues related to the

working conditions of fishing crews onboard fishing boats, and promote energy optimization. Moreover, the “Third Workshop on Safety at Sea and Optimize Energy Use for Small Fishing Boats” was organized in Samut Prakan, Thailand on 19-22 December 2011, where the minimum safety requirements and working standards for small fishing boats and fishers were identified. A reporting mechanism that could be used for documenting accidents at sea of small fishing boats in the region was also concluded while energy optimization options were also discussed. Furthermore, the Network for “Safety at Sea for Small Fishing Boats in Southeast Asia” or the “SOS” Network, was also established during the said Workshop.

9. Human Capacity Development in Fisheries

With the objective of compiling information on the current status and gaps in human resources of the countries in the region particularly in the government sector, SEAFDEC conducted a survey from 2010 until early 2011 on the “Existing Human Resources and Expertise in Fisheries in the ASEAN Member Countries”. The results showed that the areas with high number of human resource expertise were in aquaculture, fisheries management and capture fisheries. Meanwhile, the areas where scarcity of expertise is clear especially in the government sector were in basic fisheries biology subjects, and in the cross-cutting/emerging new issues. The limited availability of human resources in these areas could create impact on the development of fisheries in a long-term basis, especially under the situation where several issues and challenges have emerged in the global arena.

In order to enhance the development of human capacity and support 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 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 2011 is summarized in **Table 1**.

Specifically for TD, TD organized several training courses under a wide range of programs, including the tailor-made training programs where curricula could be developed in accordance with the needs of trainees. Other training courses were also conducted to enhance the capacity of the Member Countries in effective fisheries management, as well as in undertaking resources survey and exploration in collaboration with SEAFDEC. TD also embarked in 2011, a newly developed training course on Ecosystem Approach to Fisheries, which aims to enhance the understanding of relevant officers of the Member Countries on the concept of Ecosystem Approach to Fisheries or EAF.

MFRD conducted training courses to enhance the capacity of Member Countries in the areas of fish processing and post-harvest technologies. During the Regional Training Course on Processing of Value-added Products Using Freshwater Fish, the processing techniques involved the use of simple, inexpensive equipment and technology that are suitable for village level and small- to medium- sized industries. The On-site Training Workshop in Traceability Systems for Aquaculture was conducted by MFRD in collaboration with the Ministry of Agriculture

Table 1. Number of participants from Member Countries in SEAFDEC activities in 2011

Category	Participants from Member Countries (persons)										
	Brunei	Cambodia	Indonesia	Japan	Lao PDR	Malaysia	Myanmar	Philippines	Singapore	Thailand	Vietnam
SEAFDEC regional/international meetings, seminars, workshops	25	35	73	58	29	96	69	67	20	150	56
SEAFDEC national/local meetings, seminars, workshops, consultations	0	0	0	4	0	16	0	0	0	20	0
International/regional training courses	10	10	12	0	3	71	7	50	3	14	27
National, on-site training courses	0	0	4	8	20	3	39	146	0	341	1
Study tours	0	0	0	22	0	35	5	69	0	0	0
Internships	0	0	0	3	0	0	0	24	0	0	1
On-the-job training	0	0	0	0	0	0	0	194	0	15	0
TOTAL	35	45	89	95	52	221	120	550	23	540	85

and Rural Development (MARD) of Vietnam, and attended by representatives from the 10 ASEAN countries.

AQD continued to conduct HRD activities 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. In 2011, AQD conducted 15 local and international training courses under various thematic areas and has trained a total of 179 participants. Apart from the regular training courses on aquaculture, AQD also conducted a special training course on 'Capacity Building on Information Dissemination and Data Management' for the information officers of SEAFDEC Secretariat and Departments, as well as internship programs for 22 foreign and local interns and supervised the on-the-job training of 167 students from 22 schools.



Participants from SEAFDEC Secretariat and Departments during the Training Course on 'Capacity Building and Information Dissemination and Data Management'



Moreover, MFRD and MFRDMD also conducted several capacity building activities on the subject related to their respective programs/projects, aiming to improve research capacity of the Member Countries.

In addition to the training activities, SEAFDEC Secretariat and Departments also developed a number of technical and promotional materials as well as articles on various fisheries-related subjects published in the SEAFDEC and non-SEAFDEC publications. While aimed at enhancing the visibility of SEAFDEC, these activities were also aimed at widening the scope of dissemination of research findings and technologies of SEAFDEC to target audience, as well as strengthening the capacity of fisheries-related officers in the Member Countries.

The SEAFDEC Secretariat continued to host the Regional Fisheries Policy Network (RFPN) where the members are nominated from each Member Country to be involved in the activities on regional fisheries policy related issues, and enhance closer coordination and communication between SEAFDEC and the Member Countries. In 2011, the RFPN members comprised those from Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, Philippines, Thailand, and Vietnam. The establishment of the RFPN also gives opportunities for fishery officials from the Member Countries to be acquainted with fisheries policy-related issues of the region, and to take part in several programs and activities undertaken by SEAFDEC which could contribute to their capacity development.

Cooperation with Donors and Partner Organizations in 2011

In 2011, SEAFDEC continued to establish collaborative arrangements, and undertook collaborative activities with other donors and partner organizations.

ACDI/VOCA, Washington DC, USA

SEAFDEC/AQD forged a Contract Agreement with ACDI/VOCA (USA), a non-profit international development organization, which is implementing a USDA-funded Mud Crab/Fish Cultivation Project in Timor-Leste. The agreement was signed on 19 August 2011 and was completed on 30 September 2011. Based on the provisions in the Agreement, SEAFDEC/AQD provided expert or consultant to work with ACDI/VOCA's Program Manager, Fisheries Cooperative Development Managers and Chief of Party in developing a feasible technical approach to implement viable commercial mud crab culture and hatchery. The consultant had worked within the context of aquaculture business, social, economic and environmental realities of Timor-Leste.

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.

ASEAN Foundation

In 2010, SEAFDEC and the ASEAN Foundation signed a project contract to collaborate in the organization of the ASEAN-SEAFDEC Conference on Sustainable Fisheries for Food Security Towards 2020 "Fish for the People 2020: Adaptation to a Changing Environment" which was organized on 13-17 June 2011. In particular, the assistance from the ASEAN Foundation focused on providing support to the participation of representatives from the ASEAN-SEAFDEC Member Countries to the Conference proper. The conduct of this Conference had promoted the interaction and exchange of information on various fisheries-related issues among the ASEAN Member Countries, and helped bridging the gap between the developing and developed countries of the ASEAN. In addition, the Conference also helped the ASEAN Foundation in fulfilling its mandate of creating greater awareness of ASEAN as an organization, which would contribute to the establishment of the ASEAN Community by the year 2015.

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 as the ASEAN-SEAFDEC Strategic Partnership (ASSP). In 2011, SEAFDEC implemented 25 programs under the FCG/ASSP framework, the progress of which was reported to the Fourteenth Meeting of the Fisheries Consultative Group of the ASEAN-SEAFDEC Strategic Partnership (17-18 November 2011 in Manila, Philippines). Out of 25 programs in 2011, 24 programs (except the Program on the ASEAN-SEAFDEC Conference which was completed in 2011) would be continued in 2012. The activities undertaken under these SEAFDEC regional programs had contributed to the implementation 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.

- **Collaboration in the preparation and conduct of the ASEAN-SEAFDEC Conference**

ASEAN and SEAFDEC jointly organized the ASEAN-SEAFDEC Conference on Sustainable Fisheries for Food Security Towards 2020 “Fish for the People 2020: Adaptation to a Changing Environment”, on 13-17 June 2011 in Bangkok, Thailand. The technical preparatory works for this Conference were mainly undertaken by SEAFDEC through several technical consultations conducted since 2009. The technical inputs had served as basis in the preparation of the Draft Resolution and Plan of Action, as well as for the conduct of the Technical Session of the Conference. The major outputs from the Conference included: recommendations from the Technical Session, the “Resolution on Sustainable Fisheries for Food Security for the ASEAN Region Towards 2020” adopted by the ASEAN-SEAFDEC Ministers, and the “Plan of Action on Sustainable Fisheries for Food Security for the ASEAN Region Towards 2020”, adopted by the ASEAN-SEAFDEC Senior Officials responsible for fisheries. These outputs would serve as policy frameworks for undertaking activities both at the national and regional levels, and enhance the sustainable development of fisheries and the contribution of fisheries to food security towards the coming decade.

Under the ASEAN-SEAFDEC Conference framework, SEAFDEC also established partnerships with several other organizations and institutions. Such arrangements and collaboration focused mainly in providing technical inputs to the preparation of the Conference, providing expert(s) to serve as resource persons or deliver statements during the Conference, among others. The collaborating partners for the Conference included:

- Food and Agriculture Organization of the United Nations (FAO);
- Mekong River Commission (MRC);
- Asian Institute of Technology (AIT);
- Network of Aquaculture Centres in Asia-Pacific (NACA);
- WorldFish Center, based in Penang, Malaysia;
- Coastal Development Center (CDC), based at Kasetsart University, Bangkok, Thailand;
- Fisheries Research Agency (FRA), Japan;
- Hokkaido University, Japan;

- Japan International Research Center for Agricultural Sciences (JIRCAS);
 - National Fisheries University (NFU), Japan;
 - Tokyo University of Marine Sciences and Technology (TUMSAT), Japan;
 - Faculty of Fisheries, Kagoshima University, Japan;
 - School of Marine Science and Technology, Tokai University (TUMST), Japan;
 - Hiroshima University, Japan;
 - Research Institute for Humanity and Nature (RIHN), Japan; and
 - Marine Institute of the Memorial University of Newfoundland (MI), Canada.
- **Other ASEAN-SEAFDEC Collaboration**

In 2011, SEAFDEC took active role and provided inputs to several ASEAN Meetings, such as the ASEAN Expert Group on CITES (8-10 January 2011 in Brunei Darussalam); Preparatory Meeting for the ASEAN-SEAFDEC Conference (25 April 2011, Cambodia); Third Meeting of the ASEAN Fisheries Consultative Forum (26 April 2011, Cambodia); 19th Meeting of the ASWGF (27-29 April 2011, Cambodia); and the Second ASEAN Maritime Forum (18-19 August 2011, Thailand).

Australian Centre for International Agricultural Research

SEAFDEC through the Aquaculture Department (SEAFDEC/AQD) continued the collaboration with the Commonwealth of Australia represented by the Australian Centre for International Agricultural Research (ACIAR), by forging a contract agreement on 30 May 2011. The agreement which will take effect until 31 May 2015 stipulates that SEAFDEC/AQD as a collaborating institution, would implement the project on 'Improved Seaweed Culture and Post-harvest Utilization in Southeast Asia'. Specifically, AQD is responsible for the conduct and arrangements of the Project including the management of Project funds provided by ACIAR.

Development Bank of the Philippines

The Development Bank of the Philippines, through a grant from the Norwegian Agency for the Development Cooperation (NORAD, Norway), has contracted the services of SEAFDEC/AQD to undertake a technical assessment of selected Mariculture Parks and help in establishing a framework and standards for the technical assessment of Mariculture Parks and related projects. The one-year project agreement on 'Sustainable Mariculture Investment Program' was signed on 3 March 2011.

Food and Agriculture Organization of the United Nations

SEAFDEC has been collaborating with 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 sustainable development of fisheries in the Southeast Asian region and ensuring better utilization of the world's fishery resources. In 2011, the important collaboration between SEAFDEC and FAO focused on:

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

Collaborative activities had been undertaken during the past years between SEAFDEC and the Bay of Bengal Large Marine Ecosystem (BOBLME) project of FAO, on various aspects of mutual interest. Among these was on the joint study of important critical habitats to fish and ecosystems for migratory fish stocks such as *Rastrelliger* spp. and related species in the Andaman Sea. In 2011, SEAFDEC took part in the BOBLME Thailand-Myanmar Workshop for Critical Habitat Management (18-19 January 2011), where SEAFDEC agreed to support relevant joint activities with the BOBLME, specifically on such areas as trans-boundary fisheries management, improvement of fishery statistics, capacity building on the Ecosystem Approach to Fisheries, conduct of fishery resources surveys in the Bay of Bengal areas possibly using the M.V. SEAFDEC, and development of the Regional Plan of Action for the conservation and management of sharks. Along this line, SEAFDEC in collaboration with BOBLME project organized the Sub-regional Consultative Meeting of the Southern Andaman Sea (20-22 October 2011, Thailand), where joint efforts in the management of trans-boundary fisheries such as that of the Indo-Pacific mackerel integrated habitat management in the Southern Andaman Sea/North Strait of Malacca, were discussed.

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

SEAFDEC continued its collaboration with the Coordinating Working Parties on Fishery Statistics (CWP) and Fisheries Resources Monitoring System (FIRMS) in fishery statistics and information. In 2011, SEAFDEC participated in the 7th Session of FIRMS Steering Committee held back-to-back with the Coordinating Working Party on Fishery Statistics (CWP) Inter-sessional Capture Group Meeting (12-16 December 2011 at FAO Headquarters). In the case of FIRMS, since SEAFDEC is not regional fisheries management organization where countries had the obligation to provide catch data other than fishery statistics, the contribution from SEAFDEC could include relevant data and information derived from projects that collect such information in an *ad-hoc* basis. For the CWP, SEAFDEC could also provide relevant data derived from its projects especially for the development of CWP Handbook for Capture Fisheries which include several new chapters, *e.g.* vessel-gears, socio-economics, ecosystem monitoring, and impacts on ecosystem.

Fats and Proteins Research Foundation, Inc. and National Renderers Association, Inc.

A Contract Research Agreement was forged between SEAFDEC/AQD and two institutions: Fats and Proteins Research Foundation, Inc. (USA) and the National Renderers Association, Inc. (Hong Kong) to jointly undertake a study on 'Digestibility and Effective Level of Meat and Bone Meal in Formulated Diet for Milkfish, *Chanos chanos* Forsskal Grown in Freshwater and Seawater'. The project which began in May 2010 ended in May 2011 with the objective of determining the effective level of meat and bone meal in milkfish practical diet formulation and apparent digestibility values of crude protein and crude ash of diets with meat and bone meal in milkfish reared in freshwater and seawater.

Freshwater Fisheries Research Center/Chinese Academy of Fishery Sciences, China

SEAFDEC/AQD and the Freshwater Fisheries Research Center/Chinese Academy of Fishery Sciences (FFRC/CAFS) have mutually agreed to strengthen their existing collaboration through the expansion of training, research activities and exchange of research staff by renewing the Memorandum of Understanding signed on 14 May 2009. The renewed MOU which commenced on 1 July 2011 and remains in effect for a period of two years, will involve collaboration in research, training, conduct of workshops, conferences, and lectures as well as exchange visit of staff. The specific collaborative activities are in the areas of feed development and disease control, genetic breeding, water environment for aquaculture activities, and socio-economics.

Hokkaido University, Japan

SEAFDEC and the Hokkaido University Faculty of Fisheries Sciences (HUFFS), Japan mutually agreed to extend the existing collaboration through a renewed five-year Agreement, which commenced on 25 February 2011 and will continue to focus on collaborative research, training and other activities in areas of mutual interest. The cooperation covers: 1) joint research and education/training; 2) visit or exchange of researchers and students for study, research, education and training to promote cooperation in areas of common concern that are mutually agreed upon; and 3) participation of researchers/students in conferences and meetings on matters of mutual interest.

Under the renewed collaborative framework starting from April 2011, SEAFDEC and the Hokkaido University would take part in the Asia-Africa Science Platform Program (AASPP) with financial support from the Japan Society for the Promotion of Science (JSPS). 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, technical staff from SEAFDEC Secretariat and Departments will have the opportunity to join the program as exchange fellows at the Hokkaido University under the guidance of Professors from the Faculty of Fisheries Sciences of the University. In 2011, one officer from the Secretariat conducted a study on the Japanese Fisheries Cooperative System and its Community-based Fisheries Management; another one from TD undertook a study on Fishery Information Factsheet as a Management Tool to Support Sustainable Fisheries, and Rights-based Fisheries in Japan; two from AQD studied SDS-PAGE as a protein analysis/profiling tool using *Artemia* as sample, and on the effect of environmental stress on the biochemical composition of *Artemia*; and one officer from MFRDMD conducted a study on Genetic Species Identification of Commercially-important Pelagic Fishes in the South China Sea and Andaman Sea. After completing their studies at HUFFS, the exchange fellows participated in the series of International Seminars organized by HUFFS to report on the accomplishments and conclusion of their respective research activities.



Japan International Research Center for Agricultural Sciences

To strengthen the collaboration between SEAFDEC/AQD and Japan International Research Center for Agricultural Sciences (JIRCAS) for the promotion of fisheries research and development in Southeast Asia, a Memorandum of Agreement was forged between the two parties on 14 July 2011. The collaboration which will remain effective until March 2016 will involve mutual planning and implementation of research projects of common interest in accordance with the intended cooperation. It will also facilitate the exchange of scientists through related research projects, seminars, training and site visits.

National Agriculture Training Council, Malaysia

Since 2009, SEAFDEC/TD established technical and training collaboration with the National Agriculture Training Council (NATC), a government agency under the Ministry of Agriculture and Agro-Based Industry of Malaysia. Through such collaborative agreement, SEAFDEC/TD organized three tailor-made training courses on a wide range of subjects which aim to enhance the capacity of fisheries officers from Malaysia. The subjects of the training included: 1) line fishing (26 September – 3 October 2011 in Labuan); 2) purse seine fishing (17-27 October 2011 in Lamut); and 3) trawl fishing (10-17 November 2011 in Kampong Ache). The lectures included topics on fishing gear materials, design and construction. Shipboard training also formed part of the curriculum for trainees to gain experience in undertaking actual fishing operations.

Nagasaki University, Japan

The Nagasaki University of Japan (School of Dentistry) and SEAFDEC/AQD entered into a Memorandum of Agreement last 5 January 2011 to implement a research project on 'Extraction of collagen from milkfish'. The project's main objectives are to extract acid soluble collagen from tropical fish (milkfish) and determine its suitability for medical application. This collaboration will remain in force for a period of two years.

North Carolina State University, USA

SEAFDEC/AQD continued its partnerships with North Carolina State University for the implementation of the project under the AQUAFISH Collaborative Research Support Program (CRSP), which is funded by the United States Agency for International Development (USAID). The joint cooperation covering the period from April 2007 to September 2014 focuses on improving the cost effectiveness and sustainability of aquaculture in the Philippines and Indonesia.

San Miguel Corporation, Philippines

SEAFDEC/AQD entered into a Contract Agreement with San Miguel Corporation of the Philippines on 15 March 2011 for a 12-month collaborative study on the 'Comparison of performance of formulated diets used for grow-out culture of shrimps, *Penaeus monodon* and *Penaeus vannamei*'. The collaboration involves conduct of trials for each shrimp species using the formulated diets provided by San Miguel Corporation.

Smith Bucklin Corporation, USA

Smith Bucklin Corporation (USA) representing the United Soybean Board (USA) continued its collaboration with SEAFDEC/AQD to complete the study on the 'Use of Soybean Meal and Soy Protein Concentrate as Alternatives to Fish Meal in Practical Feeds for Milkfish'. The 'end result contract agreement' for the period from 1 January to 31 December 2011 was signed in January 2011. The agreement requires SEAFDEC/AQD to submit the progress and final reports of the study as indicated in the Fiscal Year 2011 Action Plan. The study aimed to refine the optimal soy diet for milkfish and to conduct a pilot feeding trial in sea cages with optimal soy diet. The project would also support the strong R&D and extension activities of SEAFDEC/AQD and would promote sustainable milkfish aquaculture in the Philippines and in Southeast Asia.

Swedish International Development Cooperation Agency (SIDA)

The cooperation between SEAFDEC and the Swedish International Development Cooperation Agency (SIDA) was initiated since 2003. With the financial support from SIDA, SEAFDEC from 2009 to 2011 implemented project entitled "Activities Related to Climate Change and Adaptation in Southeast Asia with Special Focus on the Andaman Sea". The project aimed to support long-term sustainability of fisheries and reduce the vulnerability from possible impacts from climate change to livelihoods of fisherfolks 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. The period of this project had been extended until mid 2012, with possibility of further extension until the end of 2012.

Universiti Teknologi Malaysia, Malaysia

SEAFDEC/AQD entered into a three-year Memorandum of Understanding with Universiti Teknologi Malaysia (UTM) in December 2011 to collaborate in the following areas: 1) reciprocal exchange of faculty, staff and students, and training programs; 2) joint research projects; 3) exchange of academic publications and information; and 4) promotion of other academic activities. The collaboration is also expected to provide opportunities for UTM postgraduate students and undergraduate students to complete or carry out part of their studies and industrial practical training or research at SEAFDEC.

University of the Philippines in the Visayas

As part of the existing cooperation between SEAFDEC/AQD and University of the Philippines in the Visayas, a Memorandum of Agreement was signed on 1 June 2011 to jointly implement a project on the "Development of techniques for sustainable production of good quality captive *Penaeus monodon* broodstock and spawners, and high health fry". The three-year



collaboration from 1 June 2011 to 31 May 2014, would be executed under the research program 'Integrated and Sustainable Development Program for the Shrimp Industry' which has been approved for funding by the Department of Science and Technology through the Philippine Council for Aquatic and Marine Research and Development.

Vocational Education Commission of Thailand

The Vocational Education Commission of Thailand and SEAFDEC/TD entered into three-year collaboration for academic collaboration through a Memorandum of Understanding which was signed on 29 September 2011. The collaboration covers: 1) development of human resources in fisheries and fishing vessels through exchange of staff, experts, officers, lecturers, and students in meetings, workshops, seminars, and consultations; 2) promotion and development of joint research, education, and training; 3) exchange of data, documentation and research materials, and development of internet link; and 4) building of good connection and cooperation among public and private sectors and organizations.

SEAFDEC Programs for 2012

In 2012, SEAFDEC would continue to implement activities that focus on the development and management of fisheries and aquaculture to support sustainable development of the fisheries sector. Particular priority would be on 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 to be implemented in 2012 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, as well as the recommendations made during the Technical Session of the Conference.

The SEAFDEC programs of activities proposed for 2012 were scrutinized during the 34th Meeting of SEAFDEC Program Committee (14-16 November 2011, Philippines) and endorsed for submission to the 44th Meeting of the SEAFDEC Council in 2012, for consideration. The programs include:

Departmental Programs

1. Center-wide Information Network (Secretariat);
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).

Existing FCG/ASSP Programs

1. Assistance for Capacity Building in the Region to Address International Trade-related Issues (Secretariat);
2. Improvement of Fishery Statistics and Information for Planning and Management of Fisheries in the ASEAN Region (Secretariat);
3. Activities Related to Climate Change and Adaptation in Southeast Asia with Special Focus on the Andaman Sea (Secretariat)¹;
4. Strengthening SEAFDEC Network for Sustainable Fisheries and IUU Fishing Related Countermeasures (Secretariat);
5. Responsible Fishing Technologies and Practices: Fishing in Harmony with Nature (TD);
6. Sustainable Utilization of Potential Fisheries Resources and Reduction of Post-harvest Losses (TD);
7. Fisheries Resource Survey and Operational Plan for M.V. SEAFDEC 2 (TD);
8. Deep Sea Fisheries Resources Exploration in the Southeast Asia (TD);
9. Information Collection of Highly Migratory Species in Southeast Asia Waters (TD);
10. Development of Regional Database for Fishery Management (TD);

Remark:

¹ The program ended in 2011, but was extended until 2012



11. Promotion of Rights-based Fisheries and Co-management Towards Institutional Building and Participatory Mechanism for Coastal Fisheries Management (TD);
12. Rehabilitation of Fisheries Resources and Habitats/Fishing Grounds through Resource Enhancement (TD);
13. Improvement of Information Gathering System for IUU Fishing Related Countermeasures in the Southeast Asia (TD);
14. Promotion on Fishing License, Boats Registration, and Port State Measures (TD in collaboration with MFRDMD);
15. Human Resource Development for Sustainable Fisheries (TD);
16. Chemical and Drug Residues in Fish and Fish Products in Southeast Asia: Biotoxins Monitoring in ASEAN (MFRD);
17. Traceability Systems for Aquaculture Products in Southeast Asian Region (MFRD);
18. Utilization of Freshwater Fish for Value-added Products (MFRD);
19. Promotion of Sustainable and Region-oriented Aquaculture (AQD);
20. Resource Enhancement of International Threatened and Over-exploited Species in Southeast Asia through Stock Release (AQD);
21. Accelerating Awareness and Capacity-building in Fish Health Management in Southeast Asia (AQD);
22. Food Safety of Aquaculture Products in Southeast Asia (AQD);
23. Tagging Program for Economically-important Pelagic Species in the South China Sea and Andaman Sea (MFRDMD); and
24. Research and Management of Sea Turtles in Foraging Habitats in the Southeast Asian Waters (MFRDMD in collaboration with TD).

New FCG/ASSP Programs

1. Climate Change and Its Impacts on Sustainable Fisheries Aquaculture: Adaptation and Mitigation Towards Food Security;
2. Enhancing Coastal Community Resilience for Sustainable Livelihood and Coastal Resources Management; and
3. Strategies for Trawl Fisheries By-catch Management (REBYC-II CTI).

Other Programs

1. Cetacean Research in Southeast Asian Waters: Cetacean Sighting Program; and
2. Safety at Sea for Small Fishing Boats.

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 2011, the progress and achievements made by SEAFDEC in the implementation of the information activities during the year were monitored and discussed during the 12th Meeting of the Information Staff Exchange Program (ISEP) on 3-4 November 2011 in Kuala Lumpur, Malaysia.

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

- Production and dissemination of 37 titles/issues of technical/scientific materials (15,883 copies produced; 7,253 copies distributed);
- Production and dissemination of 58 titles of technical/scientific articles (17 titles published in SEAFDEC publications and 41 titles published in non-SEAFDEC publications); and
- Recorded 478 queries for information through SEAFDEC libraries, and 347 materials sold.

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

- Production and dissemination of 49 titles/issues of promotional materials (69,073 copies produced; 41,174 copies distributed);
- Establishment and administration of SEAFDEC Websites and web blocks: for SEAFDEC Departmental websites, total unique visitors: 141,684, links from other websites: 10,125, and annual downloads: 121,745;
- Taking part in 12 exhibition events with 58,839 visitors recorded at SEAFDEC exhibition booths and displays; and
- Officially released press statements: 11, and SEAFDEC appearances in public media and websites recorded: 122.

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

- Maintenance of SEAFDEC Secretariat and Department libraries, and providing library services;
- Acquiring a total of 1,111 issues of newsletters/serial publications, 426 titles of technical publications and 41 items of audio-visual materials by the SEAFDEC libraries;

- Cooperation and exchange of materials with 639 network libraries within and outside the region;
- Dissemination of 35 titles (with 5,034 copies) of technical materials, and 13 titles (with 18,700 copies) of promotional materials to target groups;
- Making accessible 1,198 downloadable materials and 15 databases in SEAFDEC websites;
- Enhancing the use of e-mail systems (including e-groups) to facilitate communications both among SEAFDEC staffs and with other concerned;
- Total number of 25,790 direct visitors to SEAFDEC Secretariat and Departments;
- Sending 147 SEAFDEC officials to participate in 87 events organized by other organizations (62 officials in events at regional/international levels, and 85 at national local levels);
- Organization of SEAFDEC events, which include:
 - Regional/International meetings, seminars, workshops (22 meetings with a total of 1,338 participants)
 - National/local meeting, seminars, workshops, consultations (3 meetings with a total of 90 participants)
 - International/regional training courses (22 courses with a total of 267 trainees)
 - National, on-site training courses (23 courses with a total of 604 trainees)
 - Study tours (17 programs with a total of 171 trainees)
 - Internships (18 groups with 35 persons)
 - On-the-job training (29 colleges with a total of 209 students)
 - Internal meetings (4 meetings with a total of 123 participants);
- Participation of officials from Member Countries to events organized by SEAFDEC:
 - Regional/International meetings, seminars, workshops (678 participants)
 - National/local meetings, seminars, workshops, consultations (40 participants)
 - International/regional training courses (207 trainees)
 - National, On-site training courses (562 trainees)
 - Study tours (131 trainees)
 - Internships (28 persons)
 - On-the-Job training (209 students);
- Establishment of agreements/arrangements with 28 fisheries-related organizations for the implementation of collaborative activities at national, regional and international levels; and
- Activities of SEAFDEC was recognized by other organizations and donor agencies, with funding support of US\$ 3,621,149 provided by non-regular sources to support activities of SEAFDEC.

Strategy 4: Strengthening SEAFDEC capability in information-related activities

- Enhancing staff capabilities in information-related activities through activities in HRD taking into account the scope and requirements of the staff, and during the annual ISEP Meeting; and
- Enhancing financial sustainability of the publication and information activities by selling technical publications and souvenir items under a cost-recovery basis.

Strategy 5: Regular monitoring and evaluation of information activities

- Organization of the Twelfth Meeting of the SEAFDEC Information Staff Exchange Program (ISEP) 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 2011

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

	2011 (Un-audited)	2010 (Audited)
REVENUES		
Contributions from :-		
Member governments	7,796,703	7,615,539
Other sources	1,859,625	1,575,446
Total Revenues	9,656,328	9,190,985
EXPENDITURES		
Operating and Capital Expenditures		
Research	949,371	953,076
Training	908,164	775,591
Information	685,079	734,724
Collaborative	140,327	141,591
Others	382,992	157,735
Administrative	5,653,611	5,969,473
Total Expenditures	8,719,544	8,732,190
SURPLUS (DEFICIT), For the year	936,784	458,795
FUND BALANCE, Beginning of year	4,992,354 ^{1/}	4,657,243
FUND BALANCE, End of year	5,929,138	5,116,038 ^{1/}
REPRESENTED BY:		
Cash at Bank	5,711,095	4,766,329
Receivables	45,715	101,663
Advances and Deposits	193,758	354,913
Supplies Inventory	50,102	57,903
Fuel oil for vessels	115,440	260,075
Prepayments	14,213	18,918
Total Current Assets	6,130,323	5,559,801
Reserved budget for vessel periodic maintenance	68,599	42,000
Termination indemnity fund	1,888,776	1,928,340
Other assets-Net	105,572	5,929
Total Assets	8,193,270	7,536,070
Less : Liabilities		
Accrued payables	375,356	491,692
Fund held in trust	0	0
Provision for termination indemnity	1,888,776	1,928,340
Total Liabilities	2,264,132	2,420,032
NET ASSETS	5,929,138	5,116,038

Remark:^{1/} The difference of US\$ 132,684 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 2011 (In US\$)

Sources	Secretariat	TD	MFRD	AQD	MFRDMD	Total	
						In US\$	%
Brunei	7,000					7,000	0.07
Cambodia	6,000					6,000	0.06
Indonesia	26,000					26,000	0.27
Japan	280,000					280,000	2.90
Lao PDR	4,000					4,000	0.04
Malaysia	10,000				927,103	937,103	9.70
Myanmar	10,000					10,000	0.10
Philippines	15,000			3,925,173		3,940,173	40.8
Singapore	8,000					8,000	0.08
Thailand	20,000	2,544,427				2,564,427	26.6
Vietnam	14,000					14,000	0.15
Sub-total	400,000	2,544,427	0	3,925,173	927,103	7,796,703	80.8
Other Sources ^{2/}	106,397	667,582		1,085,646		1,859,625	19.2
Total	506,397	3,212,009	0	5,010,819	927,103	9,656,328	100

Remark:

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

Other Contributions Received by SEAFDEC in 2011 (In US\$)

Sources	Amount in US\$ ^{3/}
Fisheries Agency-Japan(TF-II)	1,343,138
Fisheries Agency-Japan (TF-V)	779,451
Swedish International Development Cooperation Agency (SIDA)	435,484
Total	2,558,073

Remark:

^{3/} Including other sources of contribution which are not reported in the SEAFDEC Financial Statement

Southeast Asian Fisheries Development Center (SEAFDEC)

P.O. Box 1046, Kasetsart Post Office, Chatuchak, Bangkok 10903, Thailand

Phone: +66 2940 6326; Fax: +66 2940 6336

www.seafdec.org