



**SEAFDEC
ANNUAL REPORT 2009**

Southeast Asian Fisheries Development Center

Preparation and Distribution of this Document

SEAFDEC Annual Report 2009 was prepared by the Secretariat of the Southeast Asian Fisheries Development Center (SEAFDEC), in collaboration with the SEAFDEC Departments, namely: the Training Department (TD); the Marine Fisheries Research Department (MFRD); the Aquaculture Department (AQD); and the Marine Fishery Resources Development and Management Department (MFRDMD). The document is distributed to SEAFDEC Member Countries, its Departments, partner agencies and other fisheries-related organizations, and to the public to promote the activities and visibility of the Center.

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EXECUTIVE SUMMARY

SEAFDEC programs and activities implemented in the year 2009 were formulated and implemented in-line with the policy directives and priority actions guided by the SEAFDEC Member Countries. The programs were categorized into: Departmental Programs (9 programs), ASEAN-SEAFDEC Strategic Partnership FCG Programs (22 programs) and Other Programs (5 programs); and could be grouped into various scopes, *i.e.*: i) Responsible Fishing Technologies and Practices; ii) Exploration and Monitoring of Fishery Resources, and its Utilization; iii) Management for Sustainable Fisheries; iv) Conservation and Management of Aquatic Species under International Concerns; v) Post-harvest Technology and Safety of Fish and Fishery Products; vi) Sustainable Aquaculture Development; vii) Fisheries for Food Security and Poverty Alleviation; viii) Addressing Emerging Fisheries-Related Issues; ix) Human Capacity Development in Fisheries; and x) Enhancing SEAFDEC Visibility.

In 2009, SEAFDEC also organized the Second Meeting of the Regional Advisory Committee for Fisheries Management in Southeast Asia (RAC) and came up with the Regional Policy Recommendations to Improve Fisheries Management in Southeast Asia for submission to the 42nd Meeting of the SEAFDEC Council in early 2010 for consideration and policy recommendations.

Throughout the year, SEAFDEC collaborated with several international/regional organizations as well as with non-Member Countries in the implementation of its activities. These include the ASEAN Foundation, Association of the Southeast Asian Nations, Australian Centre for International Agricultural Research (ACIAR), Evonik Degussa GmbH (EVONIK) Germany, Fisheries Research Agency (FRA) of Japan, Food and Agriculture Organization of the United Nations (FAO), Japan Society for the Promotion of Science (JSPS), National Fisheries University of Japan (NFU), National Training Institute University of Malaysia (NATC), Novus International Incorporated in USA, Swedish International Development Cooperation Agency, United Soybean Board, USA, Vocational Education Commission of Thailand, and the WorldFish Center.

This SEAFDEC Annual Report 2009 has summarized the achievements of activities implemented in 2009; and the planned activities together with the challenges for SEAFDEC in supporting the Member Countries in their efforts to achieve sustainable development of fisheries, enhancing the contributions from fisheries to national economy as well as food security and people's livelihood, and safeguarding the countries' interests and welfare within the emerging global concerns and requirements.

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ABOUT SEAFDEC

The Southeast Asian Fisheries Development Center (SEAFDEC) is an autonomous inter-governmental body established in 1967. The mandate of SEAFDEC as endorsed by the 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, the Philippines, Singapore, Thailand and Vietnam. The Center operates through the Secretariat located in Thailand and has four technical Departments, namely the Training Department, the Marine Fisheries Research Department, the Aquaculture Department, and the Marine Fishery Resources Development and Management Department.

The Secretariat

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

The Training Department (TD)

Established in Thailand in 1968, TD has been focusing 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. With the new TD Strategic Plan endorsed in 2006, TD’s structure and activities have been adjusted to emphasize on the promotion of coastal fisheries management to ensure responsible resource utilization and sustainable livelihoods of coastal communities; and the promotion of off-shore fisheries through the development of best fishing practices and energy optimization 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 of fishery post-harvest technology and practices, such as fish processing technology to maximize the utilization of harvested fish and enhancing the quality of 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)

AQD was established in the Philippines in 1973, and 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 aquaculture 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)

Established in Malaysia in 1992, MFRDMD is mandated to conduct activities on marine fisheries 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 information gathering of inland capture fisheries, and the use of indicators for sustainable development and management of fisheries.

SEAFDEC COUNCIL IN THE YEAR 2009

Chairperson of the SEAFDEC Council: Mr. Jun Yamashita

SEAFDEC Council and Alternate Council Directors

Brunei Darussalam

Council Director: Dayang Hasnah binti Ibrahim
Director, Department of Fisheries
Alternate Council Director: Abd. Halidi bin Mohd. Salleh
Deputy Director, Department of Fisheries

Cambodia

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

Indonesia

Council Director: Dr. Martani Huseini
Director-General of Fisheries Product Processing and Marketing
Alternate Council Director: Dr. Made L. Nurdjana
Director-General of Aquaculture

Japan

Council Director: Mr. Jun Yamashita
Deputy Director-General, Fisheries Agency
Alternate Council Director: Mr. Kozo Honsei (until July 2009)
Director, First Country Assistance Planning Division, Economic Cooperation Bureau
Mr. Shigeo Shimizu (since July 2009)
Director, First Country Assistance Planning Division, Economic Cooperation Bureau

Lao PDR

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

Malaysia

Council Director: Dato' Junaidi bin Che Ayub
Director-General of Fisheries Malaysia
Alternate Council Director: Mr. Ahamad Sabki bin Mahmood
Deputy Director-General of Fisheries Malaysia

Myanmar

Council Director: Mr. Khin Maung Aye (until July 2009)
Director-General, Department of Fisheries
Mr. Khin Ko Lay (since July 2009)
Director-General, Department of Fisheries
Alternate Council Director: Mr. Khin Ko Lay (until July 2009)
Deputy Director-General, Department of Fisheries
Mr. Kyaw Myo Win (since October 2009)
Deputy Director-General, Department of Fisheries

Philippines

Council Director: Atty. Malcolm I. Sarmiento, Jr.
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: Dr. Chua Sin Bin (until May 2009)
Chief Executive Officer, Agri-food & Veterinary Authority
Ms. Tan Poh Hong (since May 2009)
Chief Executive Officer, Agri-food & Veterinary Authority

Alternate Council Director: Mr. Leslie Cheong
Director, Food Supply & Technology Department

Thailand

Council Director: Dr. Somying Piumsombun
Director-General, Department of Fisheries

Alternate Council Director: Dr. Wimol Jantararothai
Deputy Director-General, Department of Fisheries

Vietnam

Council Director: H.E. Dr. Luong Le Phuong
Vice Minister, Ministry of Agriculture and Rural Development (MARD)

Alternate Council Director: Dr. Chu Tien Vinh
Director General, Department of Capture Fisheries and Resources Protection (DECAFIREP)

SEAFDEC SENIOR OFFICIALS IN THE YEAR 2009

Secretary-General

Dr. Siri Ekmaharaj (until September 2009)
Dr. Chumnarn Pongsri (since October 2009)

Deputy Secretary-General

Mr. Hideki Tsubata

Training Department (TD)

Chief

Dr. Siri Ekmaharaj (until September 2009)
Dr. Chumnarn Pongsri (since October 2009)

Deputy Chief

Mr. Hideki Tsubata

Marine Fisheries Research Department (MFRD)

Chief

Ms. Tan-Low Lai Kim (until October 2009)
Mr. Yeap Soon Eong (since November 2009)

Aquaculture Department (AQD)

Chief

Dr. Joebert D. Toledo

Deputy Chief

Dr. Hiroshi Ogata (until March 2009)
Dr. Teruo Azuma (since April 2009)

Marine Fishery Resources Development and Management Department (MFRDMD)

Chief

Ms. Mahyam Mohd. Isa

Deputy Chief

Dr. Osamu Abe

MESSAGE FROM THE CHAIRPERSON OF SEAFDEC COUNCIL



Fisheries is one of the important sub-sectors providing substantial contribution to economic development, people's well-being and food security for countries in Southeast Asian region. During the past years, efforts have been made by the countries in ensuring sustainable development with SEAFDEC providing technical support in line with the priority and needs of the countries. SEAFDEC has also made several progressive steps in supporting Member Countries, particularly in providing technical expertise to support sustainable fisheries development in the Member Countries, and address the important roles and contribution from fisheries to food security and poverty alleviation. On behalf of all the SEAFDEC Council Directors, I would like to take this opportunity to express our appreciation to SEAFDEC for the support and activities extended to all Member Countries during the past year 2009.

Despite the effort made by SEAFDEC and Member Countries in ensuring sustainable development of fisheries, I would also like to emphasize that recently there are several issues and challenges emerging at the regional and global levels which may impede the sustainable development of fisheries of the region. These include the requirement for better management and utilization of aquatic resources, the increasing demand for quality and safety of fish and fishery products, and the competitive and conflict in the use of land and water resources, as well as the climate change and its unpredictable impacts on land/aquatic ecosystems. I truly believe that SEAFDEC would continue to extend its support to prepare the readiness of the countries in order to be able to cope with the emerging requirements and situation.

On behalf of all SEAFDEC Council Directors, I would like to again congratulate the activities and achievements made by SEAFDEC in the implementation of activities during the past year. I would also like to extend my gratitude for all Council Directors, SEAFDEC Secretary-General, including the former Secretary-General Dr. Siri Ekmaharaj, and his staff for the excellent support given to me during my term as the Chairperson of the SEAFDEC Council; and do hope that SEAFDEC would continue to exert its best effort to support Member Countries in achieving sustainable fisheries development in the years to come.

A handwritten signature in black ink, consisting of stylized characters that appear to be '山下 潤' (Yamashita Jun).

(Jun Yamashita)
SEAFDEC Council Director and Deputy
Director-General, Fisheries Agency of Japan,
Chairperson of SEAFDEC Council for 2009-2010

MESSAGE FROM THE SECRETARY-GENERAL



For more than forty years, SEAFDEC has been working towards the promotion of sustainable fisheries development in Southeast Asian region. Throughout 2009, SEAFDEC in collaboration with the Member Countries also continued the efforts in ensuring sustainable development of fisheries in the region, which could be visualized through the activities implemented by the SEAFDEC Secretariat and the four technical departments in research & development and dissemination of information and technologies in the promotion of responsible fishing operations, aquaculture and post-harvest technologies as well as conservation and management of fishery resources, of which the outcomes and achievements have been summarized in this Annual Report. The activities in improving management for sustainable fisheries have also been in progressive steps through the mechanism of the Regional Advisory Committee for Fisheries Management in Southeast Asia (RAC).

During the year, SEAFDEC has also placed emphasis in enhancing the contribution from fisheries to food security and improving livelihood of people in the region. In addition to the implementation of several relevant programs, SEAFDEC is also planning to organize the ASEAN-SEAFDEC Conference on Sustainable Fisheries for Food Security Towards 2020 in 2011 in Thailand. This ASEAN-SEAFDEC Conference is expected to come up with the Next Decade Resolution and Plan of Action for Sustainable Fisheries for Food Security which would serve as policy framework for the promotion of sustainable fisheries development and enhancing the contribution of fisheries to food security towards the year 2020.

I wish to take this opportunity to express my utmost appreciation to all the Council Directors in providing guidance and support, which make all the activities and initiatives of SEAFDEC possible. I wish also to express my gratitude to all partner organizations in collaborating with SEAFDEC in the implementation of activities and sharing/exchanging expertise during the past years, which has amplified the outcomes and achievements of SEAFDEC activities to wider group of beneficiaries both within and outside the region. With the continual support from the Member Countries, I would like to assure that SEAFDEC would do its utmost effort in providing technical services to Member Countries in making sustainable fisheries development.

A handwritten signature in blue ink, which appears to read 'Chum Pongri'.

(Chumnarn Pongsri, Ph.D.)
SEAFDEC Secretary-General

OVERVIEW OF SEAFDEC IN THE YEAR 2009

During the year 2009, the activities of SEAFDEC were implemented in line with the policy directives as given by the SEAFDEC Member Countries during the SEAFDEC annual meetings, *i.e.* the 31st Meeting of the SEAFDEC Program Committee (3-5 November 2008, Singapore), the 11th Meeting of the Fisheries Consultative Group of the ASEAN-SEAFDEC Strategic Partnership (FCG/ASSP) (6-7 November 2008, Singapore), and the 41st Meeting of SEAFDEC Council (7-10 April 2009, Japan). During the 41st Meeting of SEAFDEC Council, the Council endorsed the SEAFDEC Program Framework, with the program strategic objectives of: i) promoting the rational and sustainable use of fisheries resources in the region; ii) enhancing the capability of fisheries sector to address emerging international issues and for greater access to international trade; iii) alleviating poverty among the fisheries communities in Southeast Asia; and iv) enhancing the contribution of fisheries to food security and livelihood in the region.

The formulation and implementation of the SEAFDEC programs of activities in 2009 were guided by the new SEAFDEC Program Framework, as well as the 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 Conference on Sustainable Fisheries for Food Security in the New Millennium: “Fish for the People” in 2001 and the Code of Conduct for Responsible Fisheries (CCRF, 1995) and its corresponding International Plan of Actions. In addition, since the establishment of the ASEAN-SEAFDEC Strategic Partnership in 2007, SEAFDEC also supported the ASEAN in implementing activities that aim to contribute to achieving the ASEAN goal in the realization of ASEAN community, particularly on the ASEAN Roadmap for Integration of Fisheries Sector as well as the ASEAN Integrated Food Security (AIFS) Framework and Strategic Plan of Action on Food Security in the ASEAN Region (SPA-FS).

The programs implemented by SEAFDEC in 2009 include:

Departmental Programs

1. Center-wide Information Network (Secretariat)
2. Information and Communications 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)
9. Aquatic Ecology (AQD)

ASEAN-SEAFDEC FCG/ASSP Programs

1. Regionalization of the Code of Conduct for Responsible Fisheries (Secretariat)
2. Assistance of Capacity Building in the Region to Address International Trade Related Issues (Secretariat)
3. Improvement of Statistics and Information for Planning and Management of Fisheries in the ASEAN Region (Secretariat)
4. Environmental Related Tasks in Southeast Asia (Secretariat)
5. Support to Tsunami Rehabilitation of Affected Countries (Secretariat)
6. Promotion of “One Village, One Fisheries Products (FOVOP)” System to Improve the Livelihood for the Fisheries Communities in ASEAN Region (Secretariat)
7. Human Resource Development (HRD) for Poverty Alleviation and Food Security by Fisheries Intervention in the ASEAN Region (Secretariat)
8. Information Collection of Highly Migratory Species in the Southeast Asian Waters (Secretariat)
9. Responsible Fishing Technologies and Practices (Fishing in Harmony with Nature) (TD)

10. Sustainable Utilization of Potential Fisheries Resources and Reduction of Post-harvest Losses (TD)
11. Capacity Improvement of Fisheries Community for Fisheries Management and Alleviation of Poverty (TD)
12. Fisheries Resource Survey and Operational Plan for M.V. SEAFDEC 2 (TD)
13. Deep Sea Fisheries Resources Exploration in Southeast Asia (TD)
14. Development of Regional Database for Fishery Management (TD)
15. Promotion of Rights-based Fisheries and Co-management Towards Institutional Building and Participatory Mechanism for Coastal Fisheries Management (TD)
16. Quality Assurance Systems for Small- and Medium-sized Fish Processing Establishments in ASEAN Member Countries (MFRD)
17. Chemical and Drug Residues in Fish and Fish Products in Southeast Asia: Biotoxin Monitoring (MFRD)
18. Development of Technologies and Human Capacity Building for Sustainable Aquaculture (AQD)
19. Development of Fish Disease Surveillance System (AQD)
20. Research and Development (R&D) on Stock Enhancement for Species under International Concerns (AQD)
21. Research for Stock Enhancement of Sea Turtles (MFRDMD)
22. Tagging Program for Economically Important Pelagic Species in the South China Sea and Andaman Sea (MFRDMD)

Other Programs

1. Promotion of Set-Net: an Eco-friendly Fishing Gear of Sustainable Coastal Fisheries Management (TD)
2. Information Collection for Economical Important Species as Surimi Raw Materials (TD)
3. Cetacean Research in Southeast Asian Waters: Cetacean Sighting Program (TD)
4. Promotion of Sustainable Freshwater Aquaculture for Rural Communities (Secretariat)
5. Promotion of Inland Small-scale Fisheries Management through Rights-based Fisheries and Co-management Towards Institutional Building and Participatory Approaches (TD)

The progress of the program activities implemented during the year 2009 has been approved by the 32nd SEAFDEC Program Committee Meeting (16-18 November 2009, Kota Kinabalu, Malaysia) and the 12th Meeting of the Fisheries Consultative Group of the ASEAN-SEAFDEC Strategic Partnership (FCG/ASSP) (19-20 November 2009, Kota Kinabalu, Malaysia).

SUMMARY OF SEAFDEC ACTIVITIES IN THE YEAR 2009

1. Responsible Fishing Technologies and Practices

In the year 2009, TD carried out activities to promote responsible fishing operations in the Southeast Asian region under the program on “Responsible Fishing Technologies and Practices (Fishing in Harmony with Nature)”. The assessment on the use of Juveniles and Trash Excluder Devices (JTEDs) was conducted in the Philippines, Indonesia and Vietnam in July, August and September 2009, respectively. Questionnaire on the use of crab trap and its impacts to fishery resources was developed, and interviewing exercise with fishers in Thailand was conducted in June 2009.

For the assessment of impacts of various kinds of fishing gear and practices on the fisheries resources, sea beds, environment and ecosystem, experimental research studies were carried out in Thailand and Indonesia in June and October 2009, respectively, to investigate the impacts of light intensity and color on fishing operations; while, for Malaysia, the survey on light fishing planned for December 2009 was postponed to January 2010. The study and survey on attitude of fishers to trap was also conducted in Eastern Thailand in July 2009. Moreover, TD also organized the Regional Workshop on the Reduction of Impacts of Fishing in Coastal and Marine Environments in the Southeast Asian Waters on 13 - 15 January 2009 in Bangkok, Thailand

TD also implemented activities that address the interaction between threatened species of international concern, particularly sea turtles, and fishing activities. A one-day Workshop on Sea Turtle interaction was organized on 12 January 2009 in Bangkok, Thailand. In addition, in order to exchange information with networks concerned, a representative from TD participated in the Technical Workshop on Mitigating Sea Turtle Interaction in Coastal Fixed and Drift Gillnet and Pound Net Fisheries and the 29th Sea Turtle Symposium as well as other associated meetings held in Australia during 20-22 January and 13 -19 February 2009, respectively.

Under the same program, TD also conducted the study and activities to promote the use of energy saving technology and alternative energy sources for fishing operations in the region. The study on the use of natural gas for small fishing boats was carried out. The use of alternative solar energy (e.g. solar cell) for aquaculture was explored. On-site training and workshop to promote and demonstrate the use of wind energy for sail boats to fishers and the Department of Fisheries of Thailand as well as Myanmar were also organized.



Discussion during the Regional Workshop on the Reduction of Impacts of Fishing in Coastal and Marine Environments in the Southeast Asian Waters



Promotion of sail boats for fishing operations

2. Exploration and Monitoring of Fishery Resources, and Its Utilization

2.1 Exploration and Fishery Resources Survey in the Southeast Asian Waters

During the year 2009, TD conducted a series of fishery resources surveys in the waters of Brunei Darussalam from 6 March to 11 April 2009, and in Indonesia from 23 April to 22 May 2009, respectively, under the program on “Fisheries Resource Survey and Operational Plan for M.V. SEAFDEC 2”. For Brunei Darussalam, the survey was conducted in collaboration with the Department of Fisheries in the deep waters (within Zone 3 and Zone 4) of Brunei Darussalam to conduct an acoustic survey, oceanographic survey (for plankton and sediment), demersal fish sampling (using bottom trawl), and large pelagic fishing trial (using pelagic longline). For Indonesia, the survey was undertaken in collaboration with RIMP/ANFR/MMAF of Indonesia, in Bitung, where an acoustic survey, oceanographic survey, and cetacean sighting program were conducted during the cruise.

In addition, under the program on “Deep-sea Fisheries Resources Exploration in the Southeast Asian Waters” and “Sustainable Utilization of Potential Fisheries Resources and Reduction of Post-harvested Losses”, TD in collaboration with the SEAFDEC Member Countries also implemented activities that aim to explore the areas with underutilized fishery resources, (*e.g.* deep sea areas, untrawlable grounds and trans-boundary areas), and develop the appropriate fishing gears and technologies appropriate to such areas (*e.g.* trap and hook-and-line for untrawlable ground), as well as fishing handling technologies to minimize post-harvest losses and maximize the utilization of catch. The Regional Workshop on Standard Operation Procedure and Development/Improvement of Sampling Gears for the Deep-Sea Resource Exploration from 26 to 28 May 2009, and the Standard Operation Procedure (SOP) for deep-sea resources exploration was developed through the workshop. To verify and transfer the technologies developed under the program, fishing trials on fishing gear efficiency and on-the-job training on research methodologies and analysis in the conduct of fisheries resources survey were conducted onboard the M.V. SEAFDEC 2 and the R.V. Chulabhorn.

To improve the utilization of catch, TD undertook research to develop appropriate fish handling techniques in collaboration with the Department of Fisheries (DOF) of Thailand, and develop/review the fish freshness detection in collaboration with Kasetsart University of Thailand. On-site training sessions on environmental/users friendly fish handling and preservation techniques were also organized in Surat Thani Province in Thailand and in Phu Yen in Vietnam to transfer the technologies developed under the programs.



Activities during the Workshop on Development of the Standard Operation Procedure (SOP) for Deep-sea Resources

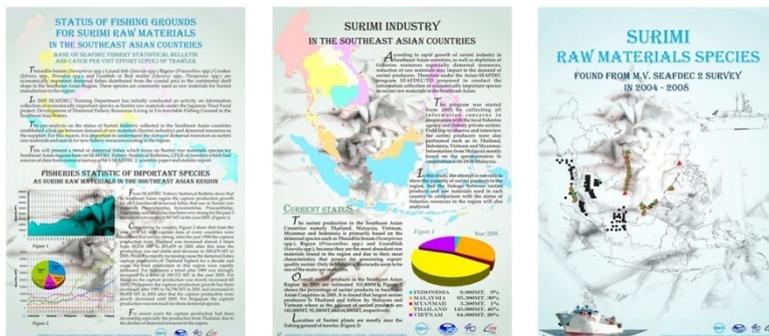
2.2 Information Collection of Highly Migratory Species

Tuna species are among the highly migratory species with the greatest commercial value of which the tunas and billfish resources are the most important in the World. However, the stock structures of tuna distributed in the region, particularly in the South China Sea are currently unclear. SEAFDEC therefore implemented the program on “Information Collection of Highly Migratory Species in Southeast Asian Waters” to develop the data collection framework through the use of fishing data logbook to collect data on tuna fishing areas, and to support four countries, namely Indonesia, the Philippines, Vietnam and Thailand, in collecting tuna production data in each sub-regional sea areas such as in Celebes Sea, Sulu Sea and some parts of the South China Sea. The information is expected to provide better understanding on the status of tuna fisheries/production in the Southeast Asian waters in order to support better tuna fishery management in these sub-regional areas.

The 2nd meeting of the working groups on tuna was held on 13-16 July 2009 in Hanoi, Vietnam in order to update the project implementation on tuna data collection. Based on the data collection throughout the year, a preliminary analysis on the trends of tuna fisheries in the Southeast Asia waters was carried out, and the tuna database system is being developed.

2.3 Information Collection for Economically Important Species as Surimi Raw Materials

Under the program on “Information Collection for Economic Important Species as Surimi Raw Materials”, TD since 2006 has undertaken surveys to collect information on surimi industry in the Southeast Asian countries, namely Indonesia, Malaysia, Myanmar, Thailand and Vietnam. As 2009 was considered as the final year of the project, TD organized the End-of-Project Meeting on Information Collection of Economically Important Species as Surimi Raw Materials in the Southeast Asian Region on 1-2 July 2009. The report, featuring the status and trends of surimi raw materials in region, was also prepared based on the outcomes from the survey activities.



Brochures to promote surimi raw materials

2.4 Tagging Program for Important Pelagic Species

Information on migration patterns of small pelagic fishes is an urgent subject for planning of the management of pelagic fish stocks which migrate in the trans-boundary waters of neighboring countries, and of related fisheries utilizing such resources. Tagging experiment is one of the methods used to study the migration patterns of small pelagic fishes for the identification of their sub-population structure and clarification of the shared stocks. Thus, MFRDMD since 2007 has undertaken the “Tagging program for economically important pelagic species in the South China Sea and Andaman Sea” in collaboration with TD and eight participating Member Countries, namely: Brunei Darussalam, Cambodia, Indonesia, Malaysia, Myanmar, the Philippines, Thailand and Vietnam. The target species being tagged are *Rastrelliger kanagurta* (Indian mackerel), *R. brachysoma* (Indo-pacific mackerel), *Decapterus macrosoma* (Short-fin scad), and *D. maruadsi* (Japanese scad), which are the major species exploited by the fisheries in the region, especially by purse seines. Tagging activities of these species were started in 2008 and would still continue until the end of 2010.

In the Andaman Sea, tagging operations were conducted in Indonesia, Malaysia, Myanmar, and Thailand, where a total of 11,351 tails of fish (4,310 *R. kanagurta*, 5,599 *R. brachysoma*, 614 *D. macrosoma*, and 828 *D. maruadsi*) were tagged and released in 2008 and 2009. For the South China Sea, tagging operations were conducted in Brunei Darussalam, Cambodia, Malaysia, the Philippines, Thailand, and Vietnam, where a total of 17,056 tails of fish (3,833 *R. kanagurta*, 2,405 *R. brachysoma*, 3,619 *D. macrosoma*, and 7,199 *D. maruadsi*) were tagged and released during the same period.

Information on tagged and recaptured fish has been verified and inputted into the dedicated database developed by TD. Currently, recovery was 426 tails: 13 *R. kanagurta*, 6 *R. brachysoma*, 266 *D. macrosoma*, and 141 *D. maruadsi*, which correspond to 1.5% of the tagged and released fishes. These recovery data will be utilized for further analysis of the migration and the other biological parameters of these economically important pelagic fish species.



Tagging of a small pelagic fish using T-bar tag

3. Management for Sustainable Fisheries

3.1 Supporting the Establishment of Regional Fisheries Management Mechanism

Since 2007, SEAFDEC has been implementing activities to supplement the establishment of regional fisheries management mechanisms for the Southeast Asian waters, with arrangements being targeted at the regional as well as sub-regional levels, *i.e.* the Gulf of Thailand, the Andaman Sea, the Lower Mekong Basin, the South China Sea, etc., in order to better address the area-specific circumstances such as habitats, fish species, fishing capacity and trans-boundary potential conflicts and opportunities.

For the Gulf of Thailand, the area features a large amount of smaller scale coastal fishing operations together with a significant large-scale fishing. IUU fishing is a problem in all types of fisheries with the smaller scale being unregulated rather than illegal (except when it comes to destructive fishing methods). Furthermore, unreported landings across boundaries shared by Cambodia, Malaysia, Thailand, and Vietnam (CMTV) are a problem defined by the countries. The initiative of SEAFDEC in the promotion of sub-regional arrangements to improve management of fisheries in the Gulf of Thailand started since 2008 with the organization of the First Sub-Regional Meeting on the Gulf of Thailand (28-29 March 2008). In 2009, the initiative was resumed with the Second Sub-Regional Meeting on the Gulf of Thailand organized from 24 to 26 February 2009 in Bangkok, Thailand. During the Meetings, fisheries management concerns in the Gulf of Thailand were discussed together with references to the fishery laws and legal matters relevant to the key issues of the sub-region. Recommendations on key fisheries management issues included: vessel registration; port monitoring and monitoring of landings by “non-national” vessels; development of MCS network; IUU fishing in the Gulf of Thailand and sub-regional cooperation for combating IUU fishing; and cooperation on trans-boundary fisheries and habitat management. The Meetings also agreed on moving towards the

establishment of the MCS Network among the concerned countries, starting with a vessel record and inventory.

For the Andaman Sea, the First Meeting of the Andaman Sea Sub-region was organized from 20 to 22 October 2009 in Phuket, Thailand. The Meeting explored the possibility of introducing larger fisheries resources conservation areas (*refugias*) and protection against natural hazards built up around the Andaman Sea, as well as monitoring of records and the control of active fishing effort as a basis for management of fishing capacity. In addition, the Meeting also agreed that an MCS Network should be developed for the Andaman Sea Sub-region.

In addition to the initiative on sub-regional fisheries management mechanisms, SEAFDEC also supported and facilitated the progress of the establishment of the ASEAN Fisheries Consultative Forum (AFCF) led by the Department of Fisheries of Thailand as an Interim Secretariat of the AFCF Body under the ASEAN framework. In 2009, SEAFDEC supported the organization of the Preparatory Meeting of the AFCF from 26 to 27 May 2009 in Bangkok, Thailand. The Meeting identified key clusters of cooperation of the region, and discussed the management framework and tentative work plan of the AFCF. The outcomes from the Meeting were submitted to the First Annual Meeting of the AFCF (1-2 June 2009, Hoi-an, Vietnam), and subsequently reported to the 17th ASWGF (3-5 June 2009, Hoi-an, Vietnam).

3.2 Promotion of Innovative Fisheries Management

To promote the use of innovative fisheries management, TD continued the implementation of the program on “Capacity Improvement of Fisheries Community for Fisheries Management and Alleviation of Poverty” in Thailand, Malaysia and Cambodia, particularly to follow-up and monitor the progress of activities. Two Training courses were conducted during the year to transfer knowledge to SEAFDEC Member Countries and interested stakeholders, namely the International Training Course on Coastal Fisheries Management for Fishery Managers (25 May - 3 June 2009) and the International Training Course in Coastal Fisheries Management and Extension Methodology (24 November – 17 December 2009). Moreover, TD also planned to organize the Regional Seminar on Integrated Coastal Resources Management Approaches in Southeast Asia: Review of the project in Cambodia from 26 to 27 January 2010.

Several activities were also implemented under the program on “Promotion of Rights-based Fisheries and Co-management Towards Institutional Building and Participatory Mechanism for Coastal Fisheries Management”. These include the Regional Training Course on Rights-based Fisheries and Co-management for Small-scale Fisheries and Management from 26 October to 4 November 2009, and the Regional Workshop on Institutional Design of Co-management for Promotion of Using Indicators and Participation from 5 to 7 November 2009, both organized in Thailand. Moreover, TD also conducted the First National Workshop on Guidelines and Standard Methods of Data Collection and Indicators in Myanmar from 25 to 29 August 2009. The workshop set up process of progressive practice of log sheets to recognize the problems; constraints and seek a proper and more applicable ways to develop the log sheets, the results of which were referred to during the concluding workshop from 7 to 11 December 2009. The workshop also agreed to establish a working group to undertake the necessary task in collaboration with relevant officials of the Department of Fisheries of Myanmar, the private fishing companies, Myanmar Fisheries Federation, as well as other relevant local management authorities.



Activities to promote innovative fisheries management

In 2009, TD also continued the implementation of the program on “Promotion of Inland Small-scale Fisheries Management through Rights-based Fisheries and Co-management Towards Institutional Building and Participatory Approaches” in Lao PDR and Myanmar. For Lao PDR, the program aimed to strengthen institutional capacity for fisheries management and establish fish conservation area in Nam Ngum Reservoir. In this regard, a series of activities were conducted in collaboration with the Department of Livestock and Fisheries (DLF), *i.e.* the Stakeholder Consultative Workshop on the Revitalization of Protected Areas Conservation in Nam Ngum Reservoir (20-21 March 2009 in Vientiane), the fish releasing ceremony using fingerlings provided by the Department of Fisheries Thailand (13 July 2009, at Nam Ngum reservoir), and the Workshop to Discuss and Define Principle, Criteria and Proper Manners for Strengthening Local/Indigenous Institution in Nam Ngum Reservoir (12-15 October 2009 in Vientiane Province). For Myanmar, the main objective was to strengthen institutional capacity and establish fish conservation area in Duya Inn Reservoir. The Workshop on Fish Conservative Areas for Sustainability of Inland Fisheries Resources was organized from 25 to 29 April 2009, and later the TD team in collaboration with the Department of Fisheries of Myanmar also carried out a bottom topographic survey (by using Hydro-acoustic equipments) in the Fish Conservation Area of the Duya Inn Reservoir from 27 September to 1 October 2009 to obtain the information on bottom profile and characteristics, fish schools distribution, surface area and volume of the water in the reservoir for further development of fish conservation area and management for sustainable exploitation in the future. In addition, TD also organized two training sessions for women’s groups in Myanmar, namely the Training on Fish Processing Product (27-28 April 2009), and Training on Basic Accounting System and Book Record for Fish Product Processing (21 August 2009).

In addition to the above programs, TD has also undertaken activities to promote the application of Set-net as fishing gear to enhance fishers’ cooperative activities and promote sustainable coastal fisheries management and resources enhancement since 2003. In 2009, the activities were implemented under the program on “Promotion of Set-net, an Eco-friendly Fishing Gear for Sustainable Coastal Fisheries Management”. The project team from TD took part in the Working Team of Set-net Project entitled “Empowerment of Coastal Fishing Community in South Sulawesi, through Technology Transfer of Community-based Set-net for Sustainable Fisheries” in Bone, Indonesia. Led by the Tokyo University of Marine Science and Technology (TUMSAT), the project aims to modify the Set-net in order to improve catch performance from the operations. In addition, a technical advisory trip was also conducted in Malaysia (both in the Andaman Sea and the Gulf of Thailand side) from 17 to 24 November 2009 to survey the existing stationary fishing gears and discuss problems with the gear operators.

3.3 Combating IUU Fishing

SEAFDEC has been supporting the implementation of the Code of Conduct for Responsible Fisheries, including the International Plan of Action to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated (IUU) Fishing which is a voluntary instrument endorsed by the FAO Council in 2001. In addition to the flag States requirements and coastal States measures needed to combat IUU fishing,

FAO has also moved forward in intensifying the measures that need to be undertaken by Port States to combat IUU fishing, and the development of the Legally-binding Instrument on Port State Measures which is already in its final stage. In 2009, SEAFDEC took part in the Second Resumed Session of the Technical Consultation to Draft a Legally-binding Instrument on Port State Measures to Prevent, Deter and Eliminate IUU Fishing from 4 to 8 May 2009 at the FAO Headquarters to keep track on the progress in the finalization of the Instrument.

Also with regards to combating IUU Fishing, EC has issued the EC Regulation establishing a Community system to prevent, deter and eliminate IUU fishing, requiring all fishing vessels and fishery products originating from third-countries (as well as from within the “territory of Member States”, Article 1.3) intending to land/transship their catch or trade their products with the EC countries to be inspected and to provide catch certificate or other related documents. As this Regulation would take into effect from 1 January 2010, and is envisaged to affect countries in the region exporting fish and fish products to the EU, SEAFDEC in 2009 has incorporated the issue on the EC Regulation for discussion during the RTC on International Fisheries-related Issues 2009, and continued to facilitate the exchange of information among countries on the progress and obstacles in the implementation of the Regulation.

In parallel with the global and international initiatives, SEAFDEC also facilitated cooperation in combating IUU fishing in the Southeast Asian region. However, the availability of reliable or aggregated information on the size and structure of small- and large-scale fisheries is among the prerequisites in ensuring effective fisheries management and combating IUU Fishing in the region. To pave the way towards obtaining better understanding on the size and structure of fishing vessels, SEAFDEC organized the Workshop on Fishing Vessel Record and Inventory from 27 to 29 July 2009 in Satun Province, Thailand. The Workshop discussed the existing systems for fishing vessel records and inventories (particularly on the legal aspects and institutional responsibilities) of the Member Countries, and the possibility of establishing the regional cooperation and harmonization of the systems among the countries in the region. In this regard, the Member Countries agreed in principle with the harmonization of Fishing Vessel Record and Inventory Forms, while the Forms would be finalized by SEAFDEC in close consultation with the Countries.



Participants of the Workshop on Fishing Vessel Record and Inventory

In 2009, SEAFDEC also continued its involvement in the “Regional Plan of Action (RPOA) to Promote Responsible Fishing Practices including Combating Illegal, Unreported and Unregulated (IUU) Fishing in the Region”¹ by sending representatives to participate and provide technical inputs during the Workshop on Capacity Building and MCS Curriculum Development from 12 to 14 August 2009 in Manado, Indonesia, and the Second RPOA Coordination Committee Meeting organized from 4 to 5 November 2009 in Lombok, Indonesia. In addition, SEAFDEC also participated in the

¹ adopted by Ministers responsible for fisheries from Australia, Brunei Darussalam, Indonesia, Malaysia, Papua New Guinea, the Philippines, Singapore, Thailand, East Timor and Vietnam in 2007

International Seminar on Building a Comprehensive Maritime Security and Possible Benefit to the Effort to Minimize Illegal Fishing in the Region (17-18 August 2009, Manado, Indonesia) which aimed to develop common perception and to generate commitment on the international and regional level to build a comprehensive maritime security framework and recognizing its possible benefit to the effort to minimize illegal fishing in the Southeast Asian region.

In addition to the above initiatives and activities, SEAFDEC since 2007 also supported the conduct of a regional study on eco-labeling as one of the trade-related measures that could provide incentives for fishers in the implementation of responsible fishing. On 30 January 2009, SEAFDEC in collaboration with the Department of Fisheries of Thailand organized a one-day Workshop on “Certification and Eco-labeling”, to provide information on the principles of product certification and developments of labels, particularly the eco-labels. In the perspective of the Southeast Asian region where most of the fisheries are small-scale, multi-species, multi-gear fisheries, fisheries certification may not be necessarily done for individual fishing boats but on the assessment/certification of the whole management system of fisheries in a defined area or community (cluster of communities).

3.5 *Fishery Statistics and Information*

Fishery statistics has been widely accepted as one of the important tools to provide basis for the formulation and implementation of national fisheries policies as well as management frameworks and actions. Since 2007, the SEAFDEC Secretariat has implemented a Program on “Improvement of Fishery Statistics and Information for Planning and Management of Fisheries in the ASEAN Region” with activities aiming at: i) streamlining the fishery statistics reporting from the Member Countries in Southeast Asia to SEAFDEC and FAO; ii) harmonizing the standards/norms, classification and definition of fishery statistics and information; and iii) supporting the development of Status and Trends of Fisheries and Aquaculture (STF) in Southeast Asia.

Under this Program, the new Regional Framework for Fishery Statistics of Southeast Asia was developed and agreed among the countries as regional minimum requirements for collection of fishery statistics at the national level. Based on the new Framework, the reporting of fishery statistics from the Southeast Asian Countries to SEAFDEC and FAO was also streamlined with the harmonized questionnaire, mechanism and process for reporting of fishery statistics (for statistics of 2008 and onwards).

In addition, in 2009, SEAFDEC has been supporting the Member Countries in the implementation of the FAO Strategies for Improving Information on Status and Trends of Fisheries (STF) and Aquaculture (STA) through the development of national STF and STA reports, starting with Philippines, Thailand and Indonesia as pilot countries. These pilot countries have gained better knowledge on fisheries to support development planning and management. In addition, throughout the process in the development of the STF and STA reports, the available sources of data and information in each country were also identified and fully utilized.

To also supplement the above initiative, another program on “Development of Regional Database for Fishery Management” was also implemented by TD. Under this program a regional database on fisheries resources in the South China Sea and the Andaman Sea was developed to accommodate the data collected from actual surveys, fish landing site, as well as other available information. In addition, this database is also envisaged to be further enhanced to facilitate the compilation of information collected through various SEAFDEC program frameworks, *e.g.* tagging program on economically important pelagic species, database for vessels registration/licensing program, as well as the analysis of data and information to support fisheries management of the region.

4. Conservation and Management of Aquatic Species under International Concerns

4.1 Sea Turtles

For the conservation and management of sea turtles, MFRDMD since 2004 has been conducting “the research on stock enhancement of sea turtles”, comprising of the studies on tagging and satellite telemetry, stock identification, and estimation on multiple paternities for regional sea turtle populations. From 20 to 21 October 2009, MFRDMD organized the Regional Core Expert Group Meeting to discuss the outcomes of the activities on sea turtles implemented in 2009 and plan the activities to be implemented in 2010 and onwards.

The sea turtle tagging and satellite telemetry study aims to estimate the migration routes, the interesting and foraging habitats, as well as other relevant biological information of sea turtles in the region. Conventional iniconel tag has been continually used in Brunei Darussalam, Indonesia, Malaysia, Myanmar, the Philippines, Thailand, and Vietnam. MFRDMD also conducted satellite telemetry studies where an olive ridley turtle were attached with PTT and released on 4 July 2009, from Meragang Beach, Muara, Brunei Darussalam, and on 17 December 2009, in Gayetyi Island, Bogalay Township, Myanmar.



Olive ridley turtle released with the PTT tag in Brunei Darussalam (left) and in Myanmar (right)

The study on multiple paternities of green turtles from Mak Kepit Beach, Terengganu, Malaysia was conducted by analyzing DNA microsatellite markers to estimate the level of multiple paternities and adult male stock sizes. Multiple paternities occurred in 4 clutches out of 9, and 12 males to fertilize the 9 clutches from different females, showing both polyandry and polygyny occurring in this sea turtle population.



Fishing trial on the use of circle hook in Kuching, Malaysia

Considering that serious illegal mass direct catch of sea turtles by foreign vessels has been occurring in some parts of the ASEAN region, MFRDMD also collected information on intended and incidental capture of sea turtles in the Member Countries to figure out the real situation for further actions to be taken in the future.

Moreover, TD also carried out studies on interaction between fisheries and sea turtles, including information collection on the sea turtle interaction from fishing activities and information dissemination to the Member Countries. A fishing trial and demonstration on the use of circle hook was conducted in Kuching, Malaysia from 29 September to 1 October 2009, while research on the response of sea turtles to different sound frequency was conducted. The preliminary results demonstrated the response of sea turtles to certain range of sound frequency. It is envisaged that this research would help in supporting the development of new materials/equipment to be attached with fishing gear in order to reduce the sea turtle interaction and mortality from fishing activities

4.2 Sharks

To address global concerns about the management of sharks, FAO has developed an International Plan of Action for the Conservation and Management of Sharks (IPOA-Sharks) in 1999 to ensure the conservation and management of sharks and their long-term sustainable use. In the Southeast Asian region, SEAFDEC has also supported its Member Countries in the conservation and management of sharks, *i.e.* conducting the Regional Study on Sharks Production, Utilization and Management in the ASEAN Region (2003-2004), and supporting the development of the National Plan of Action for Conservation and Management of Sharks or NPOA-Sharks. As of 2009, Brunei Darussalam, Malaysia, Myanmar, Indonesia and Thailand have developed their draft NPOA-sharks, while the other ASEAN countries are still under the process of formulation of their NPOA-Sharks. In 2009, SEAFDEC also conducted the Regional Synthesis on Shark and Ray Fisheries in Southeast Asia, and the outcome is expected to be available by early 2010.

4.3 Sea Cucumbers

Sea cucumber is one of the important commercially-exploited aquatic species of the Southeast Asian region. However, the status of sea cucumber fisheries is unknown, while there is inattention in the management of sea cucumber fisheries. In improving conservation and management of sea cucumbers in the region, from 2007-2008 SEAFDEC has supported the national experts of the Member Countries to undertake the study on sea cucumber fisheries, utilization and trade in Southeast Asian Region in order to obtain information on status, resources utilization, management and trade. The Report of the Regional Study on Sea Cucumber Fisheries, Utilization and Trade in Southeast Asia (2007-2008) was published in early 2009 and is envisaged to be used as reference material by the Member Countries in order to assess the possibility of developing the respective country's initiative or action plan and policy recommendations for the conservation and management of sea cucumbers.

4.4 Cetaceans

As cetacean species are among the important aquatic species under international concerns, SEAFDEC TD started the initiative of collecting information on cetacean species in both marine and freshwaters in Southeast Asia under the program on "Cetacean Research in Southeast Asian Waters: Cetacean Sighting Program" since 2008. The program was conducted in 2009 by making use of the existing research cruises of SEAFDEC and the Member Countries.

In 2009, observation programs were conducted onboard the M.V. SEAFDEC 2 and R.V. Chulabhorn (of Thailand) in August 2009. Moreover, the 1st Regional Workshop on Information Gathering and Cetacean Research in the Southeast Asian Waters was organized from 30-31 July 2009 at TD in order to review and discuss the issues related to existing whales/dolphins, and habitats of cetaceans in the Southeast Asian countries. Concluded from the Workshop were the information on whales and dolphins found and their hotspots in the Southeast Asian waters; the decline of Irrawaddy Dolphin

population in the Mekong River; the set of recommendations for future national programs/activities related to cetacean research; and establishment of the network of Cetacean specialists in Southeast Asia in order to enhance communication and collaboration in the future activities.



Observation activities on Cetaceans onboard the M.V. SEAFDEC 2 and R.V. Chulabhorn

4.5 Stock enhancement for species under international concerns

This program aims to develop ecologically sound strategies for stock enhancement including seed production and stock release techniques, monitoring and impact assessment (including socio-economics). The studies under this program cover the following species: seahorse (*Hippocampus comes*), abalone (*Haliotis asinina*), giant clam (*Tridacna gigas*), sandfish or sea cucumber (*Holothuria scabra*), angelwing clam (*Pholas orientalis*), and the humphead Maori or Napoleon wrasse (*Cheilinus undulatus*),

For *seahorse*, a high-value species but threatened with extinction, AQD continued refining the seed production techniques to improve production of hatchery bred juveniles. The use of UV-treated seawater for rearing newborn seahorses gave better survival and growth than when sand-filtered and chlorinated seawater are used. The use of copepods as replacement for brine shrimp as food for newborn seahorse was tested since brine shrimp is expensive and copepods are abundant in brackishwater ponds. However, depending on the source, the copepods sometimes harbor high bacterial load. Newborn seahorses fed with copepods treated with formalin bath had better survival than those stocks fed with un-treated copepods.

With regards to activities on *abalone*, development of effective strategies for stock enhancement which include site assessment, site release, monitoring and recapture of released abalone was continued. Results showed that 3-3.5 cm abalone juveniles could be grown in pens in the Carbin Reef in Sagay Marine Reserve of central Philippines. The presence of natural food (epiphytic diatoms and seaweeds) and shelter such as corals and rocks could sustain the growth of the released animals. However, survival was affected by the presence of crabs, the main predator of abalone, at least in this particular release site. Regular monthly monitoring of the wild abalone population in Carbin Reef prior to any stock enhancement activity was also conducted. Preliminary release trial revealed the importance of the following elements prior to release of stocks: size at release of the stocks and conditioning of stocks (abalone) in the hatchery and in the wild prior to release to eliminate dependence on PVC as shelters. Recaptures of both wild and hatchery bred abalones suggest that there was minimal movement of the animals in the presence of favorable habitat and enough food. The growth rate shown by the hatchery-bred abalone also revealed that SEAFDEC hatchery-bred abalone grew and survived with the wild conspecifics in the natural environment and may be utilized for future large scale releases.

AQD also conducted studies to assess the bio-physical characteristics of the habitat, the socio-economic profile of the community and the abalone fishery in other potential release sites to determine the suitability of stock enhancement of abalone. Results highlighted the importance of gathering the socio-economic indicators for a potentially successful stock enhancement and validating

these with stakeholders prior to a full-scale stock release. Information dissemination to local community about the stock enhancement objectives and strategies was also found important to ensure cooperation.

The *sandfish or sea cucumber* is another species that has many traits suitable for aquaculture and stock enhancement. To develop and refine the seed production methods of sea cucumber, Vietnam (RIA3) and AQD collaborated on a project that would publish a manual on seed production methods and also conduct a training course for AQD hatchery staff. On the stock enhancement activity, stage 1 juveniles (<10 mm body length, <0.05 g) transported in low temperature inside oxygenated polyethylene bags with UV sterilized seawater gave high survival (up to 100%) 6 hours after the transport. Two separate month-long cage experiments revealed that juveniles released greater than 3 grams had highest survival in half buried-cages. Survey of sandfish production in Igang and eastern Guimaras in western Philippines also indicated substantial increase in 2009 compared to the 2008 level.

As for the *angelwing clam*, survey of sites for possible sources of broodstock and sites for release and development of technology for seed production in the hatchery was focused. Natural spawning occurred in 2009 with growth significantly higher in larvae fed with a mixture of two algal food than with only one type of algal food.

The *giant clam* (*Tridacna gigas*) has been identified as a primary species for restocking. Hence, a study was conducted to monitor the growth, survival and physico-chemical parameters in the 3 sites (Sagay Marine Reserve, Malalison Island in Antique, and Guimaras) stocked with *T. gigas*. The study found that higher survival at bigger size at release and growth rate is positively correlated with water temperature. Results of the study will be used as basis for selecting the size and site for future restocking activities on the giant clam.



Abalone (*Haliotis asinina*)



Sea cucumber (*Holothuria scabra*)



Local fisher with giant clam (*Tridacna gigas*)



Angelwing clam (*Pholas orientalis*)

Apart from the biophysical aspects of stock enhancement, *ex-ante* socio-economic analysis of stock enhancement was done in the Molocaboc village, a group of small islands within the Sagay Marine

Reserve. Results revealed low level of awareness on stock enhancement as a strategy for managing abalone and giant clam stocks among fishers and other stakeholders. The involvement of the people and taking into consideration their socio-economic concerns (sustainable food, catch, livelihood and income) are crucial in stock enhancement activity. The study also confirmed the importance of informing and engaging the fishers in stock enhancement and in managing released stocks.

Regarding the *humphead Maori* (Napoleon wrasse), AQD had renewed discussions with the Palawan Aquaculture Center for collaborative research on seed production of this species.



Giant clam nursery in Sagay Marine Reserve



Cage in Sagay Marine Reserve for experimental release of abalone juveniles



AQD holds local workshops to highlight the importance of engaging the fishers and the local community in stock enhancement and management of released stocks



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

5.1 Quality Assurance Systems for Small- and Medium-sized Fish Processing Establishments in ASEAN Member Countries

In the ASEAN region, traditional fish products represent significantly large portion of total fish utilization, and are major sources of animal protein for human consumption. As a result, these products are vitally important to food security, especially considering that most of them go to the marginalized and poorer segments of the population. However, many small- and medium-sized fish processing establishments (SMEs) in the ASEAN Member Countries are facing difficulties in the implementation of quality assurance systems due to economic and technical constraints. Large group of these establishments are Pre-Processing Establishments (PPEs), which produce semi-processed raw materials for the main processing establishments and Traditional Products Processing Establishments (TPEs).

The program on “Quality Assurance Systems for Small- and Medium-sized Fish Processing Establishments in ASEAN Member Countries” was therefore initiated by MFRD and implemented

from 2007 to 2009 to develop quality assurance systems for these SMEs that incorporate Good Manufacturing Practice (GMP) and Standard Sanitation Operating Procedures (SSOP) as the first step towards the implementation of Hazard Analysis and Critical Control Points (HACCP), and help these SMEs meet safety and quality assurance requirements. It is expected that under the program, Manuals on GMP/SSOP guidelines would be prepared and distributed to Member Countries to assist them in the conduct of their respective national training programs. This program is also in line with Measure No. 46 of the Roadmap for the Integration of the Fisheries Sector under the ASEAN Framework Agreement for the Integration of Priority Sectors.

In the year 2009, the participating countries continued to develop the GMP for their respective TPEs, namely: fermented shrimp paste (*belacan*) (Brunei Darussalam); salted boiled fish (*pindang*) (Indonesia); fermented fish (*prahok*) & dried fish (Lao PDR); fish cracker (*keropok lekor*) (Malaysia); fermented (pickled) fish & fish sauce (Myanmar); smoked milkfish & shrimp sauce (Philippines); fish balls and fish cakes (Singapore); fish sauce & dried fish (Thailand); and fish sauce & fermented tiny shrimp paste (Vietnam). The GMP drafts were submitted to MFRD for finalization and compilation.

To conclude the program activities, MFRD conducted the End-of-Activity (EOA) Workshop on GMP for TPEs from 6 to 7 October 2007 in Singapore. Presentations were made on the GMP developed by the ASEAN Member Countries for their selected TPEs, and the case studies on GMP implementation in the PPEs or TPEs in Member Countries. Discussions were also made to finalize the GMP drafts for further compilation as a handbook on GMP for TPEs.



Participants attending the EOA Workshop on GMP for TPEs from 6 to 7 October 2007

5.2 Chemical and Drug Residues in Fish and Fish Products in Southeast Asia

From 2004 to 2008, MFRD implemented the program on Chemical and Drug Residues in Fish and Fish Products in Southeast Asia to obtain an understanding of the levels of chemical contaminants in fish and fish products in Southeast Asia through the conduct of surveys, and transfer the technology on chemical contaminant testing in the region. At the end of the project, MFRD compiled the survey results from the participating Member Countries, namely Cambodia, Indonesia, Malaysia, Myanmar, Philippines, Singapore, Thailand and Vietnam, in the publication entitled “Technical Compilation of Heavy Metals, Pesticide Residues, Histamine and Drug Residues in Fish and Fish Products in Southeast Asia”. The Publication was disseminated to all Member Countries for information and reference in April 2009.

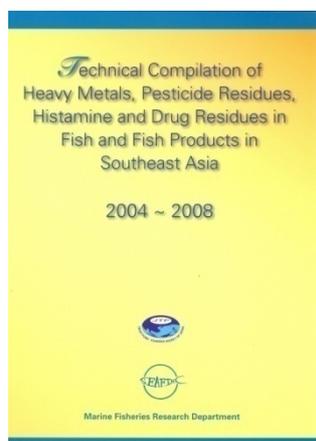
To follow-up this initiative, MFRD implements a follow-up program on Biotoxins Monitoring in Fish and Fish Products in Southeast Asia from 2009 to 2012.

Biotoxins are defined by the Codex Alimentarius Code of Practice for Fish and Fishery Products (CAC/RCP 52-2003) as 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. The substances are responsible for the toxicity of approximately 400 species of shellfish and fish that cause an increasing number of human intoxications around the world, *e.g.*

human poisoning or death after the consumption of contaminated marine shellfish or fish. In addition, the marine biotoxins could also result in the mass killings of fish and shellfish, and the death of marine animals and birds.

Monitoring seafood for toxicity is essential to manage the risks. However, there are several limitations in monitoring toxicity such as the variation in toxin contents between individual shellfish, different detection and even extraction methods for the various toxins requiring a decision which toxins would be tested, and the frequency of sampling to ensure that toxicity does not rise to dangerous levels in temporal or spatial gap between sampling times or locations. Furthermore, the growing harvest of non-traditional shellfishes (such as moon snails, whelks, barnacles, etc.) may also increase human health problems and management responsibilities.

The program on Biotoxins Monitoring in Fish and Fish Products in Southeast Asia was therefore implemented to increase the attention 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. The program is envisaged to come up with methodologies and technical capabilities of the ASEAN Member Countries in the analysis of biotoxins, and better understanding of the levels of biotoxin occurrences and incidences in fish and fishery products in the region.



“Technical Compilation of Heavy Metals, Pesticide Residues, Histamine and Drug Residues in Fish and Fish Products in Southeast Asia”



Participants at the 'Regional Technical Consultation on Chemical and Drug Residues in Fish and Fish Products in Southeast Asia (Biotoxins Monitoring in ASEAN)

In 2009, MFRD organized the Regional Technical Consultation Meeting on Biotoxins Monitoring in ASEAN from 26 to 28 August 2009 in Singapore. The RTC identified the training needs and capabilities available in each SEAFDEC member country, and agreed that the Regional Training Course on Biotoxins Analysis should be held by MFRD with resource persons from Japan, at the Veterinary Public Health Laboratory (VPHL) of AVA in the mid of 2010. The course would cover multi-component Diarrheic Shellfish Poisoning (DSP) and lipophilic toxins analysis using High Performance Liquid Chromatography Tandem Mass Spectrometry (LC-MS-MS) and PP2A kit, Paralytic Shellfish Poisoning (PSP) analysis using High Performance Liquid Chromatography (HPLC) and a commercially available ELISA method, and Tetrodotoxin (TTX) analysis using HPLC or LC-MS-MS as requested by the Member Countries. The RTC also discussed the survey of biotoxins in baby clam or green mussel in a sampling location in each individual country in 2011. In this regard, it was agreed that each member country would conduct a survey on baby clam or green mussel in one sampling location on a weekly basis in 2011, where the survey results would be compiled and published into a Technical Compilation of Biotoxins Monitoring in the ASEAN.

5.3 Others

During the year, MFRD also shared the information and expertise in the area of post-harvest technology and food safety for fish and fisheries products at various events organized at national, regional and international levels. In particular, MFRD involved in the SEAFDEC project funded by the ASEAN Foundation on Human Resource Development (HRD) on Poverty Alleviation and Food Security by Fisheries Intervention in the ASEAN Region, *i.e.* in the organization of the Regional Train-the-Trainer Workshop on Backyard Fishery Post-Harvest Technology (3-11 March 2009, Singapore), and the on-site HRD activities in the eight participating ASEAN member countries of Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, Philippines, Thailand and Vietnam.

From 22 to 24 March 2009, MFRD officers were invited to participate as resource speakers at the ASEAN Training Course on Post-Harvest Technology on Aquaculture in Nha Trang, Vietnam. The training course was organized by the International Cooperation Department (ICD) in collaboration with the Ministry of Agriculture and Rural Development of Vietnam (MARD) and the ASEAN Secretariat and was funded by Japan through the Ministry of Agriculture, Forestry and Fisheries (MAFF).



MFRD Officer presenting a lecture during the ASEAN Training Course on Post-Harvest Technology on Aquaculture

In addition, a Senior Officer from MFRD also participated in the 2009 National Forum on Contaminants in Fish held in Portland, Oregon, USA from 2 to 5 November 2009. This annual forum was organized by the Oregon Department of Human Science and Environmental Protection Agency (EPA), United States of America. The forum consisted of 44 study and research results presentations on regional issues in North-West USA such as sampling and analysis, risk assessment and toxicology as well as risk communication and management.

6. Sustainable Aquaculture Development

6.1 Integrated Mollusk Production

In 2009, the program continued to conduct studies covering the three culture phases of the donkey's ear abalone, *Haliotis asinina*: i) hatchery to produce seed stocks; ii) nursery to produce juveniles for grow-out; and iii) grow-out to culture abalone to marketable size.

An experiment was conducted to isolate and cultivate the diatom, *Cocconeis* sp. since there were reports that feeding larval abalone with this species of diatom results in better settlement, growth and survival of post larval abalone. Two strains of *Cocconeis* sp. were identified and some physiological requirements (light and nutrients) for mass production were determined. Results of the experiments showed that stocking smaller abalone juveniles (16 to 20 mm standard length) gave consistently high survival and growth when reared in nursery baskets and prefabricated plastic trays within 3 months. The growth of abalone juveniles stocked in plastic trays indicated increments of 2.8 to 3.0 mm standard length/month and 3.7 to 4 g body weight /month up to 90 days of culture.

To assess the nutritional requirement of abalone and develop diet that will replace seaweeds as feeds, AQD also conducted studies that will identify the lipid and essential fatty acid requirements of juvenile abalones. Addition of 18:2n-6 (linoleic acid) and 18:3n-3 (linolenic acid) and n-3 HUFA (mixture of 20:5n-3 and 22:6n-3) resulted in significant improvement of weight gains. Requirement of juvenile abalone for essential fatty acid is at 1.6% level of incorporation.

Experimental trials on hybridization of the Philippine native abalone species were done as part of the strategy to improve stocks and enhance its market potentials. In 2009, the study was able to produce two hybrid abalones (*H. asinina* female x *H. glabra* male; *H. asinina* female x *H. planata* male) which exhibit better growth, settlement and survival rates than the pure *H. asinina*.

Experiments were also conducted to further refine the hatchery and transport techniques for abalone larvae. Post-larvae transported at a density of 25,000 larvae/liter had the highest settlement rate (3.87%) when transported up to 9 hours compared to 50,000 larvae/liter loading density (3.33%). The survival rate of the second trial showed that higher loading density of 100,000 larvae/liter can be used for transporting larvae for 1 to 3 hours only. Regardless of loading density, mortality was almost 100% when transport time was extended up to 18 hours indicating that percent settlement was affected by transit time.

Concerning the large-scale production of abalone, it was reported that 226,160 juveniles were produced during the year. SEAFDEC/AQD started operating a low-cost abalone hatchery facility to showcase the abalone hatchery technology and to accelerate the adoption of the technology by middle class entrepreneurs.



Isolation and cultivation of diatom, *Cocconeis* sp. as feed for abalone larvae



Feeding abalone hybrid with seaweed (*Gracilaria* sp) during hybridization experiment



SEAFDEC/AQD's low-cost abalone hatchery facility showcasing the abalone hatchery technology

6.2 Mud Crab and Shrimp Domestication

The Program aims to develop a viable technology for the production of good quality seeds and captive broodstock of native species, particularly, *Penaeus monodon*, *Penaeus indicus* and *Penaeus merguensis* for shrimps and *Scylla* spp. for crabs that can be genetically selected for desired heritable characteristics. Concerning the studies on developing the specific pathogen free shrimp broodstocks, *P. monodon* broodstocks from the wild were examined to assess their genetic variation. Results of the microsatellite marker analysis showed that samples from Palawan population differed significantly from other sampled shrimp populations from the Philippines. Genetic variability of these samples was highest for the Davao stock and lowest for the Aklan stocks. Maturation of pond-reared *P. monodon* broodstock was enhanced through improvement of formulated diets and the use of marine annelid *Perinereis nuntia* as ingredient to shrimp diet. The results also suggested that annelid meal can be incorporated in the formulated diet of captive shrimp broodstock without significantly affecting the reproductive performance. No significant differences were detected in the survival and percentage of females that matured.

As part of the activity to domesticate the indigenous white shrimp *P. indicus* / *P. merguensis*, production run for *P. indicus* was conducted to assess the performance of wild broodstock from Tigbauan area.

AQD-formulated diets were developed and tested for their effectiveness to improve the maturation success of pond-reared broodstocks and growth of shrimp at various stages. In *P. indicus*, the use of AQD-formulated grow-out diets for stocks grown in ponds using environment-friendly schemes resulted in good growth. The study also showed that addition of siganids to shrimp stocks in ponds can improve feed utilization efficiency, resulting in better economic returns and less environmental pollution.



Penaeus indicus adults and juveniles



AQD-formulated feed for captive *P. monodon* broodstock



The biology of the seaworm, *Perinereis nuntia* and its potential as substitute for fish meal, shrimp meal and squid meal in shrimp and mud crab feeds were evaluated. Feeding tests were conducted to

assess the different levels of substitution (0% or control, 20, 40, 60, 80 and 100%) of animal protein sources with annelids in formulated diets for *P. indicus* juveniles and *S. serrata* crab instar.

Pro-active monitoring of the presence of shrimp diseases in hatcheries and grow-out farms has also been established. Shrimp samples with known viral infections based on analysis done at SEAFDEC were analyzed to confirm similarity of outcome. Results of diagnosis through PCR show similar results obtained at SEAFDEC and at the University of Arizona, OIE Reference Laboratory for Crustacean diseases. IHHNV DNA from *Penaeus monodon* and *P. vannamei* samples were examined and the results showed that there was a high degree of similarity of most infectious hypodermal and hematopoietic necrosis virus (IHHNV) isolates with the type IHHNV strain derived from Hawaii.

For mud crab, activities focused on the domestication and refinement of techniques for broodstock management, seed production, and culture during nursery and grow-out rearing in different production systems.

Wild stocks of *Scylla serrata* collected from various sites in the Philippines (Cagayan, Camarines Norte, Samar and Surigao) were examined for genetic diversity and reproductive performance. Results showed that the Camarines Norte stock had the highest mean expected heterozygosity (0.867), followed by Cagayan (0.830), Surigao (0.824) and Samar stocks (0.812). Analysis of the population structure indicated that *S. serrata* stocks from any of these four regions can be used for domestication and selective breeding programs.

As part of the activity to develop the seed production techniques of mud crab, wild broodstocks of the species *S. serrata*, *S. tranquebarica* and *S. olivacea* from Capiz, Iloilo and Samar were evaluated for their reproduction performance. The embryonic development of the three *Scylla* spp. was similar and could be divided into 10 developmental stages.

Since mud crabs are heavily dependent on trash fish, experiments were conducted to develop the AQD-formulated feeds and explore alternative protein sources. Survival and growth rates of crabs fed diet with 45% protein were better than those fed with 38% protein diet. The benefits of dietary tryptophan were also demonstrated in terms of improving the growth and survival of mud crab juveniles and in controlling their antagonistic behavior.



Genetic screening of *Scylla serrata* wild stocks for domestication



Preparation of AQD formulated feed supplemented with dietary tryptophan for mud crab

6.3 Marine Fishes

The Program aims to continually improve the technologies for the seed production and culture of marine fishes for sustainable aquaculture development in Southeast Asia. Marine fishes such as milkfish, grouper, sea bass, mangrove red snapper, rabbit fish, pompano, and hybrid red tilapia were among the species studied in the Program in 2009.

Broodstock Development

One of the strategies to extend the spawning season of sea bass in captivity was to evaluate the effects of temperature on reproductive performance. Generally, higher percentage of mature fish was observed in fish maintained at 29-31°C compared with those maintained at ambient temperature. Hatching rates were also better in eggs that were initially incubated in the heated tanks. Although the study has been completed under the Government of Japan Trust Fund IV, monitoring of broodstock performance will continue.

Previous studies showed that insulin-like growth factor II (IGF-II) mRNA expression could be used as a predictor for percent development during the early embryo stage in marine fishes. This information will be used to develop a non-invasive, simple, and rapid assay utilizing this expression as marker for egg quality in marine fishes.

Hatchery and Seed Production

Strategies have been taken to improve the seed production techniques for milkfish and siganids which include: i) feeding of the milkfish and rabbit fish broodstock fortified diet; ii) early introduction of SEAFDEC larval diet; and iii) enrichment of rotifers with SEAFDEC formulated enrichment media. In milkfish broodstock, the fortification of diet with vitamins and lipids improved the spawning frequency, egg production and fertilization rate. The early introduction of larval diet and emulsion to enrich rotifer also reduced the incidence of abnormal larvae. The advancing age and nutritional status of milkfish broodstock are factors that could affect their performance in captivity. Survival rates of siganid fry were also improved.

The interventions used to improve the seed production techniques for high value marine fish (sea bass, red snapper, grouper and pompano) are as follows: i) the supplementation of grouper and red snapper broodstock diets with vitamins and arachidonic acid (ARA) in capsule form; ii) the use of larval diet at early stage; and iii) the use of locally produced enrichment media for rotifer.

In 2009, significant progress was again made in development of AQD formulated feed for various growth phases of the marine fishes. The mysids (*Mesopodopsis orientalis*) which are found as potential live food substitute for *Artemia* in grouper larval culture have been produced in a laboratory scale and will be evaluated for their nutritional content and fitness for marine fish larval feeding. The use of PUFA-rich thraustochytrids as enrichment diet for live foods (rotifer and *Artemia*) in the larviculture of sea bass was also assessed. The enriched rotifer and *Artemia* nauplii could be used as natural food for sea bass larvae to increase the levels of DHA in the larvae.

Nursery

Studies to evaluate the effectiveness of AQD formulated diets in the nursery rearing of marine fishes (grouper, mangrove red snapper, and sea bass) were continued. Tryptophan (L-trp) supplementation significantly increased growth and survival in marine fish juveniles. Supplementation of formulated diets with ginger only or L-trp + ginger enhanced the immune response of sea bass juveniles. However, in trials done on grouper in 2009, no significant differences in growth and survival were observed among the different diet treatments.

Grow-out and Other Studies

The effect of alternative feeding regimes on growth of milkfish in tanks provided with flow-through water was determined. Growth of fish subjected to 2-week alternate starvation and re-feeding cycle was comparable with that of the control group that was fed daily, suggesting that compensatory growth mechanisms might be at work. Growth of fish subjected to a 4-week starvation and re-feeding cycle was lower than that of the control. The effect of different feeding regimes on growth of milkfish in a simulated marine cage environment was also determined. Results generally reflected the result of

the tank experiment. Prolonging the starvation period to 3 weeks did not enhance the compensatory growth response.

Evaluation of SEAFDEC formulated diet in brackishwater pond culture of various marine fishes (mangrove red snapper, grouper, sea bass, and rabbit fish) showed that fish fed SEAFDEC diet had consistently comparable if not better growth and survival than those fed the commercial diet. In rabbit fish, results suggested that more plant protein sources could be included in the diet without adversely affecting growth and survival. In another experiment, the effectiveness of AQD formulated diet was evaluated on sea bass grown in floating net cages in Lake Vito (Dingle, Iloilo) and in grouper cultured in marine floating cages.

Efforts were continued to improve the nutritional value of locally available feed resources for practical aquatic feeds by fermentation using milkfish gut bacteria and/or selected fungi. Comparison of the sequences of the PCR products with known sequences in Gene Bank confirmed the identification of *Bacillus cereus*. However, the *Lactobacillus* sp PCR product of the 16S rRNA did not align well with known *Lactobacillus* gene sequences in Gene Bank suggesting that another strategy needs to be implemented to confirm the species of *Lactobacillus* isolate.

Another important focus of the Marine Fish Program was developing formulated diet based on plant protein sources and less on the more expensive fish meal. In milkfish, the use of soy products as alternatives to fish meal is being explored. Growth data suggested that the optimum protein and fat levels in the practical diets containing fishmeal and soy bean meal are 34.7 and 9.8%, respectively. In grouper diets, white cowpea meal was tried to partially replace fish meal. White cowpea meal (20%) in grouper diet was comparable with fishmeal-based diet based on the growth performance, FCR, survival and flesh quality evaluation.



Integrated broodstock and marine fish hatchery at AQD's Tigbauan Main Station

6.4 Small-Holder Freshwater Aquaculture

The Program aims to generate, verify and disseminate science-based technology for breeding, hatchery and farming of selected freshwater aquaculture commodities (giant freshwater prawn, Asiatic carps, tilapia and *Clariid* catfishes) for rural development and improved livelihood in the Southeast Asian region.

Giant Freshwater Prawn

In 2009, the requirements for the domestication and stock evaluation of the indigenous giant freshwater prawn species *Macrobrachium rosenbergii rosenbergii* (proposed to be called as *Macrobrachium wallacei*) were investigated. Native freshwater prawns collected from Zarraga, Iloilo, Philippines were assessed for their breeding performance, larval rearing/seed production and culture requirements for the successful domestication of this endemic species. A shorter egg incubation

period of 22-25 days was observed at 0 and 12 ppt. Successful larval production was observed when berried females were held in 0 and 6 ppt salinity and larvae subsequently reared in 12 ppt. However, even under these conditions only 1% of the hatched larvae metamorphosed to post-larvae.

In another experiment, native prawn larvae were reared in tanks at 12 ppt salinity using the green water culture system. Although the survival of the larvae in the hatchery is poor, the last run of the larval rearing in green water showed some improvement. Results generally indicate that like the *M. rosenbergii dacqueti* which took close to two decades to domesticate, it may also take a while for the native species to be propagated and farmed successfully for commercial aquaculture. Nevertheless, even if domestication may take years, culture of *M. rosenbergii rosenbergii* could provide a viable alternative to the *M. rosenbergii dacqueti* if not primarily for aquaculture, but for stock conservation.



Macrobrachium rosenbergii rosenbergii (proposed new name: *M. wallacei*) is the focus of research at AQD's project on freshwater prawn



Hapa net cages at AQD's Binangonan Freshwater Station for grow-out rearing of freshwater prawn

Seed production methods for the commercial *Macrobrachium rosenbergii dacqueti* have been refined to suit Philippine conditions. Larval rearing runs were conducted and produced a total of 97,202 post larvae.

Bighead Carp

The optimum stocking densities for rearing bighead carp *Aristichthys nobilis* fry under different climatic conditions (cold and warm months) in hapa net cages in Laguna de Bay, Philippines were determined. Results showed that the ideal stocking density for rearing bighead carp fry during the nursery phase is 200 fry/m² for the cool months and 300 fry/m² during warm climate. A study was also continued to evaluate the economic feasibility of producing advanced sizes (100-300 g) of bighead carp fingerlings in a lake-based fish pen.

Nile and Red Tilapia

To promote tilapia *Oreochromis* spp. farming among fish farmers near Laguna Lake, the technology for a modular system of intensive tilapia culture in lake-based net cages was verified. Results indicate that size at stocking and strain differences apparently have an effect on the final growth of tilapia. Strain differences on the other hand, revealed better growth for the SEAFDEC selected strain compared to the commercial farmed strain from Laguna. Red tilapia meanwhile showed slower growth, as the initial stocking size used was noted to be less than 20 grams.

Another verification study on tilapia cage farming was conducted in freshwater reservoir in Iloilo, Philippines. Since tilapia has been promoted as a culture commodity even in brackishwater ponds in the Visayas and Mindanao, a tilapia hatchery was established in the SEAFDEC/AQD main station in Tigbauan, Iloilo to support the demand for Nile and red tilapia fingerlings in the aforementioned

regions. Recently, production of sex reversed Nile tilapia fingerlings using a methyltestosterone-lined formulated diet was also conducted.

As part of the Aquaculture and Water Quality component of the ACIAR-funded project on Integrated Fisheries Resources Management, technology demonstration runs for appropriate feeding management strategies in tilapia cage culture in Lakes Buhi and Bato were completed.



Red tilapias grown in lake based net cage



A boatload of silver perch (*Leiopotherapon plumbeus*) in Candaba, Pampanga

Clariid Catfish

A study on cage farming of Asian catfish *Clarias macrocephalus* (Gunther) in Laguna de Bay, Philippines has been pursued. Prior to the cage trials, nursery rearing of native catfish fry in tanks showed that fry stocked at 100/m² grew to an average weight of 21.07 g after 3 months of rearing.

Indigenous Freshwater Species

A study on the reproductive biology of silver perch *Leiopotherapon plumbeus* from selected freshwater habitats in Luzon started in 2009. Histological examination of silver perch ovaries initially revealed three major stages of ovarian maturation stages: primary growth, vitellogenesis, and final oocyte maturation.

Prior to lake-based cage farming trials, a preliminary study on the growth of climbing perch *Anabas testudineus* in tanks using different farm-based feeds was conducted. After four months of rearing, results showed no significant differences in growth of climbing perch reared in tanks using various farm-based diets and commercial diet. For the Manila catfish *Arius* spp., exploratory studies were conducted to monitor the growth in lake-based cages. Feeding trials to determine the ideal feed ration in Manila catfish first feeding larvae showed that highest growth was attained when fed daily at 15% of fish biomass.

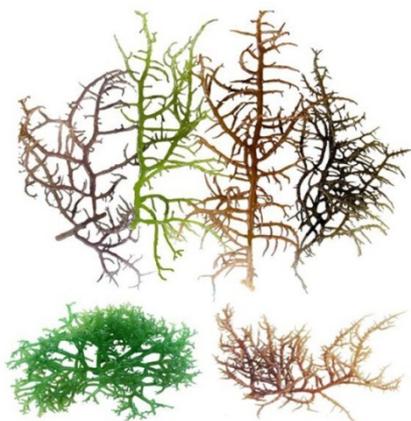
6.5 Seaweed Strain Improvement

SEAFDEC/AQD's Program on Seaweed focuses on mass propagation of regenerants from tissue culture and natural sporulation, land-sea-based nursery and out-planting to mitigate the problems of cultivar shortage and deterioration of cultivar quality. In 2009, the Program implemented the following three studies: i) Propagation of *Kappaphycus* plantlets from callus-like structures through tissue culture which from 2008 focused on the establishment of land-sea-based seaweed nursery of *Kappaphycus* plantlets from tissue culture; ii) Seed production of *Kappaphycus*: Protoplast isolation and sporulation which focused on the refinement and optimization of protocols for mass production of *Kappaphycus* plantlets from spores and monitoring performance of the "new" plants in the nursery and grow-out; and iii) Effect of Acadian Marine Plant Extract Powder (AMPEP) from *Ascospheillum nodosum* on occurrence of *Neosiphonia* infestation in *Kappaphycus* which looked at the potential use of AMPEP in reducing the incidence and severity of epiphytism in *Kappaphycus*.

For the tissue culture study, the optimum AMPEP concentrations for mass production of *Kappaphycus* varieties using tissue culture were determined. The lesser the AMPEP concentration needed for shoot formation, the better it is for mass production. It was also observed that a difference in growth pattern occurred when young plants of different varieties from the laboratory were allowed to grow on improvised vertical lines than on the commonly used horizontal lines in the 3-tonne tanks. Vertical planting produced rounder and bigger sections but with very stubby shoot growth. Abrupt elongation of these shoots took place only when the young plants were transported and grown at the sea-based nursery in Zamboanga City.

A sea-based nursery cage was constructed in Panyam, Zamboanga City. The clear waters and sufficient water flow in the area were found advantageous for the out-planted tissue culture plantlets resulting in abrupt increase in shoot length and overall body mass after transfer to the sea-based nursery. A total of 808 young plants were transported to 3 different locations – Panyam in Zamboanga City, Bongao in Tawi-Tawi and BFAR, Sorsogon in a span of 10 months.

For the study on mass production of *Kappaphycus* through sporulation, several experiments were conducted to determine the optimum conditions for sporeling production in the laboratory. There is no significant difference on the growth of Ks1-CP (sporeling) at 25°C and 35°C.



Seaweeds (*Kappaphycus* sp)



Tissue culture of seaweed (*Kappaphycus*) in a temperature gradient incubator facility at AQD

Experiments were conducted to monitor the growth performance of germlings from spores in outdoor nursery tanks, in cages and in the grow-out. Studies that would assess the growth performance and carrageenan characteristics of different *Kappaphycus* strains as well as new plants produced from spores. Highest growth rate was observed in vanguard (grown in Cabalagnan) having the highest weight gain of 20.28% per day.

The study on the effect of AMPEP on the occurrence of epiphytes, was carried out at the Igang Marine Station. Results showed that growth rates decrease with increasing distance of the plants from the water surface. Plants that were pre-treated with AMPEP show relatively faster growth rates compared to control plants. Prevalence of *Neosiphonia* infection decreased with distance from the water surface. Moreover, *Neosiphonia* infection was relatively lower in plants that were pre-treated with AMPEP compared to control plants.

Another study conducted focused on examining whether dipping in AMPEP will enhance recovery of plants that have been previously infected with *Neosiphonia*. Plants dipped in AMPEP 2x during the 45-day culture period showed the best recovery from *Neosiphonia* infection. However, results did not show clear trends.

6.6 Aquatic Ecology

The Program aims to assess the impact of aquaculture on the environment and develop bioremediation measures to mitigate such impacts. Studies in 2009 focused on: i) assessment of the impacts of mariculture activities in Humaron Cove, Guimaras; ii) development of sediment quality assessment techniques; iii) biodiversity assessment in relation to farm management practices; and iv) determination of ammonium uptake of *Gracilariopsis bailinae* and its impact on the co-culture of abalone, *H. asinina*, and *G. bailinae* in a recirculation system.

The impacts of mariculture activities in Humaron Cove, Guimaras were assessed through monthly monitoring of water quality in the study sites. The total suspended solid (TSS) measurements did not only increase but were found much higher than the critical value set by the Philippines' Department of Environment and Natural Resources at <100 mg/L. The consistent high values of TSS suggest that waste products from uneaten feeds or faecal matters from mariculture were not totally flushed out by the system.

For the study that will lead to development of detailed sediment quality techniques, sediment quality of Igang Marine Station was assessed. Sampling points (3 fish cages and 3 non-cages) established in 2008 were consistently monitored in 2009 to determine the recovery of sediments from the impacts of mariculture. Color of sediment improved from black to brown in 2009 on cage areas, suggesting that sediment in Igang Marine Station is progressively recovering from the impacts of mariculture activities.



Monitoring of sediment quality in AQD's Igang Mariculture Park; Sediment quality is progressively improving from 2008 to 2009, indicating gradual recovery from the impact of mariculture



Sample of by-catch or non-crop species collected from brackishwater pond

Another initiative of the program is the assessment of biodiversity of brackishwater ponds and the adjoining mangroves and shores in relation to natural seeding and farm management practices. Six ponds used by various technology verification projects at Dumangas Brackishwater Station were totally drained and the by-catch (non-crop) species were obtained for identification and enumeration. The volume and number of species of fishes, crustaceans and mollusks collected as 'by-catch' varied

from pond to pond. The marine animals in mangrove patches adjacent to ponds were also sampled and studied. Mollusks and crustaceans were abundant and of high diversity.

Experiments were continued to assess the ammonium uptake of *Gracilariopsis bailinae* and its impact on the co-culture of abalone, *H. asinina*, and *G. bailinae* in a recirculation system. Ammonium removal was 48%. Specific growth rates were 1.4 to 1.8% day⁻¹ for *Gracilaria* receiving 1 ppm NH₄ and 1.4-1.7% day⁻¹ for *Gracilaria* without treatment. Wet weight to dry weight ratios ranged from 8.2 to 9.9. Agar yields were 3.58% for *Gracilaria* receiving 1 ppm NH₄, 3.49% for *Gracilaria* without treatment, and 9.25% for initial *Gracilaria* sample. Crude protein greatly improved for *Gracilaria* receiving 1 ppm NH₄ (16.68%) compared to *Gracilaria* without treatment (13.46%).

6.7 Other R&D Activities

Institutional Capacity Development on Sustainable Aquaculture (ICDSA)

During 2009, the ICDSA focused its efforts on four projects: i) Enhancing the promotion of mud crab technology in Northern Samar; ii) Enhancing Promotion of Grouper Culture in Misamis Occidental; iii) Pilot Project on Milkfish Cage Culture for Fisher-folk in Guimaras Affected by Oil Spill; and iv) Freshwater aquaculture in Dumarao, Capiz.

Significant efforts were made in building the capacity of the rural communities through on-site training and demonstration on viable aquaculture technologies. During 2009, over 400 individuals were trained on culture techniques of mud crab, grouper, milkfish and tilapia.

The nursery and grow-out techniques disseminated to partner NGOs, fisher-folk organizations and other targeted beneficiaries in all the project sites were proven financially and technically viable. When done and managed properly, it was found that a family could earn a substantial income. For example, in Northern Samar, a family earned an additional income of about PhP14,318 (USD 311) in 6 months in a 200 m² pond. In Misamis Occidental where the grouper cage culture technology was disseminated in Panaon and Sinacaban (Gata Dacu Multi Purpose Cooperative), the multi-species hatchery at Misamis Occidental Aquamarine Park is now operational and has produced close to 10,000 fingerlings that were stocked in cages. In Capiz, the municipality of Dumarao has pursued tilapia culture as an additional livelihood.



Mud crabs (*S. serrata*) harvested after 100 days of rearing using different practical diets for grow-out



Mud crab technology demonstration farm in Northern Samar: Crab nursery in Pambujan



A fisher-folk collecting crabs from the wild using bamboo trap



Fisher-folk in Guimaras harvest milkfish from a marine cage



Guimaras fisher-folk and their wives learn to prepare marinated deboned milkfish

ABOT AquaNegosyo

The ABOT AquaNegosyo (Agree-Build-Operate-Transfer Aqua-business) project provided technical assistance to six clients during 2009. Technical assistance rendered were initial assessment of farm site, assessment of existing culture system, transport and stocking of fish, and monitoring of culture system and stocks. These entailed 19 man-trips to farms in the Provinces of Bataan, Batangas, Cebu, Pangasinan, Quezon, and Sorsogon; and about 59 man-days of direct technical assistance. Three of these clients had signed formal agreements with AQD to avail of aquaculture business packages for multi-species pond grow out in Cebu, Quezon, and Sorsogon, respectively. The rest of the clients are in various stages of planning and other preparatory activities.

The project responded to queries of at least 100 more clients through email, phone or in person consultation. Queries ranged from technological and procedural concerns to marketing and financial aspects.

6.8 Development of Technologies and Human Capacity Building for Sustainable Aquaculture

This program aims to address regionally relevant technologies for sustainable aquaculture in the areas of broodstock development, genetic improvement, seed production, and culture systems of priority species for aquaculture, through research and human capacity building.

As part of the activity to facilitate successful adoption of aquaculture technologies developed by AQD, evaluation of the socio-economic impact of adoption of mud crab culture on fisher-folk communities in Samar was continued. Respondents welcomed the introduction of mud crab nursery technology, based on the following reasons: i) accessibility of seed stocks; ii) illegal transport of seeds is minimized; and ii) improved income of the community. However, there were also constraints and difficulties in the adoption of technology, as experienced by the small-scale farmers. Hence, interventions are needed to motivate fisher-folk in the uptake of sustainable aquaculture.

To facilitate the transfer the viable aquaculture technologies in the Member Countries of SEAFDEC, AQD conducted the following three international courses during the year: i) Marine Fish Hatchery (19 May – 24 June 2009); ii) abalone hatchery and grow-out (3-23 July 2009) and; iii) seaweed farming (16-23 November 2009). Moreover, with support of GOJ-TF, the following extension manuals were also published: i) seed production and grow-out of mud crab in Vietnam; and ii) Philippine freshwater prawn. In Cambodia, the economic study on the rice-fish culture system revealed that the system is a technology which can improve the income of rural farmers and that further support is needed in terms of building their capacity through training and publication. In Myanmar, successful mud crab farming demonstration has encouraged and provided appropriate technology for the Government.



Participants of International Marine Fish Training during their practical session on induced spawning



Rice-fish aquaculture system in rural community of Cambodia

In addition to the above initiatives, SEAFDEC also implemented the project on “Promotion of Sustainable Freshwater Aquaculture for Rural Communities” since 2007 to assist the Southeast Asian countries in developing rural freshwater aquaculture and promote appropriate aquaculture systems that could be applied in remote rural areas in Southeast Asia. A Regional Training on “Community-based Aquaculture for Remote Rural Areas of Southeast Asia” was annually conducted, and the Handbook for Community-based Aquaculture for Rural Development in Southeast Asia was developed and used as reference materials in the provision of training. In 2009, the Third Joint Regional Training on Community-based Freshwater Aquaculture for Remote Rural Areas of Southeast Asia was conducted in Vientiane, Lao PDR from 7 to 17 July 2009. The Workshop on Contribution of Fisheries to Food Security was also organized as part of the event. The Workshop discussed and identified the priority issues and constraints in achieving food security and livelihoods through fisheries and aquaculture intervention at the local level, as well as the possible approaches, strategies and activities to tackle with the issues.

6.9 Establishment of disease surveillance system of aquatic animals

The main objective of the program is to develop a surveillance system for diseases of aquatic animals in Southeast Asia through establishment of resources and facilities for fish health diagnosis and human capacity building.

Research and Development (R&D) on refinement of diagnostic methods and development of new prevention methods for aquatic animal diseases

As part of the management strategy to maintain virus-free stocks of the economically important fish, research was conducted to control the vertical transmission of the virus through egg disinfection, determine the susceptibility of the different economically-important fish to viral nervous necrosis, (VNN) and to enhance fish immunity through DNA vaccination. Three vaccination studies pertaining to the efficacy of the formalin-inactivated vaccine against VNN in sea bass, grouper and pompano were accomplished.

Research was also continued to develop immunoprophylactic methods of disease prevention of shrimps. The study indicates the potential of recombinant VP28 vaccine to replace formalin-killed vaccine for field trials. With regard to epidemiology of the white spot syndrome virus (WSSV) in different shrimp (*P. monodon*) culture techniques in the Philippines, results revealed that rainy days, high rainfall and low atmospheric temperature are hazard factors in the development of WSSV in cultured shrimp. Sharing of water source with other farms and feeding live mollusks were also identified as WSSV risk factors. Protective factors were feeding with natural food, high mangrove to pond area ratio, green water shrimp culture technique and ploughing of pond bottom during pond preparation.

With regard to pilot testing of the "indigenous probiotic" in grow-out shrimp ponds, tank experiments showed that a combination of bacterial isolates (SEAFDEC indigenous probiotic) sourced from the green water culture when applied to the culture of *P. monodon* juveniles can effectively prevent luminous vibriosis and produce shrimp with higher biomass and higher survival.

In another experiment, the major pathogenic agents causing hemorrhagic and white spot disease of cultured freshwater catfish *Pangasianodon hypophthalmus* from Vietnam and Cambodia were compared. Results showed that bacterial isolation of diseased fishes from An Giang, Can Tho Provinces (Vietnam) and Kandal Province (Cambodia) were not different. The herbal extract of *Phyllanthus amarus* and *Psidium guajava* and the antibiotics Cephalexin, Cefaclor, amoxicillin and Ampicillin were effective with the anaerobic bacteria, *Clostridium* spp. On the other hand, the herbal extract of *Allium sativum* and the antibiotics Bactrim, Tetracycline and Doxycycline were effective with aerobic bacteria, *Aeromonas* spp., *Edwardsiella* spp.

A study was also conducted to determine the withdrawal periods of oxytetracycline and oxolinic acid when used as antibacterial agents for shrimp farming. Tank feeding experiment was conducted in black tiger shrimps *P. monodon* using AQD formulated feed. Concentration-time curves of oxytetracycline and oxolinic acid were plotted logarithmically and the time calculated to zero residual concentrations were 13.54 days and 16.36 days for oxytetracycline and oxolinic acid, respectively.



DNA vaccine injected intramuscularly to grouper



Test for PCR and cell culture to confirm the presence of virus in fish

Surveillance for important viral diseases of fish and shrimps in the region, and mobile clinics

Surveillance of major diseases affecting shrimps and freshwater prawns, as well as other crustacean species that are cultured in close proximity to them or used as sources of natural food, was conducted. Diseases that were included were white spot syndrome virus (WSSV), infectious hypodermal and hematopoietic necrosis virus (IHHNV) and significant diseases associated with *P. vannamei* such as Taura syndrome virus (TSV) and infectious myonecrosis virus (IMNV) using methods prescribed by OIE. White tail disease of *M. rosenbergii* was also included in the study. *P. monodon*, *P. indicus*, *P. merguensis*, *P. vannamei* and the freshwater prawn, *M. rosenbergii* samples were tested for viral diseases using polymerase chain reaction. Samples analyzed were negative for TSV and IMNV; thus, these diseases are still presumed exotic to the country. Positive samples were obtained for IHHNV

and WSSV. There is a need to develop in-country specific pathogen-free (SPF) or at least high health domesticated shrimp stocks to minimize the need for repeated importation. Keeping broodstock free of viruses will be a significant factor in breeding programs, especially for some diseases that can be vertically transmitted. Disease mapping is an effective strategy to view possible disease hotspots.

In Thailand, surveys of giant freshwater prawn viral disease, MrNV and SSV were continued. Two of the seven female brooders specimens from Suphanburi Province were MrNV RT-PCR positive. The other 15 post-larvae from the same province were negative. As for samples obtained in grow-out farms, one of the 12 samples from Suphanburi gave MrNV positive, while negative in the other 15 specimens in Chachaengsao and Suphanburi Provinces.

Following the introduction of the Pacific white shrimp, *Leptopenaeus vannamei*, incidences of disease outbreak have occurred in Indonesia. Hence, a survey was carried out in the 10 provinces to assess the potential risk of pathogen distribution. Both the pathogen TSV and IMNV have spread rapidly and pose serious risk to cover all shrimp areas in the country. TSV was found in all the surveyed provinces and it is more likely to be endemic in locations where the *vannamei* shrimp is being cultured. The IMNV was found in East and West Java, Banten, Bali, Lombok and Lampung, and has also been reported in North Sumatera and West Kalimantan.

The trans-boundary movement of live ornamental and food fishes among countries has resulted in the introduction of pathogens and the succession of disease outbreaks. In this connection, active surveillance of emerging viruses among susceptible carp cultured in the least developed Southeast Asian countries was conducted. A total of 545 carp samples consisting of koi, common carp, grass carp, silver carp collected from Cambodia, Philippines and Myanmar were assayed for the presence of KHV, SVCV and GCRV by cell culture, PCR/RT-PCR and infection bioassay. All samples showed negative results reconfirming the consistent specific virus-free status of Cambodia, Lao PDR, Myanmar, Philippines and Vietnam. The study also provided mobile clinic services during the sampling visits to all participating countries except Vietnam. A study was also conducted to screen commercially important bivalves and gastropods for their associated parasite fauna.



Fish health team with the external reviewers during the 2009 AQD's Annual Progress Meeting of Government of Japan Trust Fund Programs

7. Fisheries for Food Security and Poverty Alleviation

Fisheries is among the very important sectors contributing to food security and enhancing the well being of the people in the Southeast Asian region. The importance of fisheries to food security and being the important source of protein food is particularly prominent for people in the rural areas especially those involved in small-scale, subsistence fisheries. In enhancing the contribution from fisheries to food security and poverty alleviation, SEAFDEC Secretariat continued to implement two programs, namely "Promotion of "One Village, One Fisheries Products (FOVOP)" System to Improve the Livelihood for the Fisheries Communities in ASEAN Region" and "Human Resource Development (HRD) for Poverty Alleviation and Food Security by Fisheries Intervention in the ASEAN Region".



Regional Train-the-Trainer Workshop on Backyard Fishery Post-Harvest Technology

For the program on “Promotion of “One Village, One Fisheries Products (FOVOP)” System to Improve the Livelihood for the Fisheries Communities in ASEAN Region”, based on the Regional Strategy for the Promotion of FOVOP and the HRD materials as adopted at the regional level in 2008, a series of national HRD Workshop on the Promotion of FOVOP were conducted in 2009 by the participating pilot countries, namely: Cambodia (19-20 May 2009, and 19-20 September 2009), Indonesia (15-19 June 2009), Lao PDR (23-27 March 2009 and 4-8 May 2009), Myanmar (3-8 August 2009), and Philippines (24-28 August 2009), with the participation of government officials at national and local levels as well as the representatives from the women’s groups/communities. In addition, the HRD Workshop in Vietnam and the Regional Technical Consultation on the Promotion of FOVOP in ASEAN Region are being planned for early 2010.

For the program on “Human Resource Development (HRD) for Poverty Alleviation and Food Security by Fisheries Intervention in the ASEAN Region”, in 2008, Training of the Trainers were conducted by AQD and TD on Rural Aquaculture, and on Responsible Fishing Technology, respectively. In 2009, the Training of the Trainers were continued for the topics on Local/Indigenous Institutions and Co-management (by TD on 12-21 January 2009 in Samutprakarn, Thailand), Inland Fisheries Development (by MFRDMD on 16-24 February 2009 in Kuala Terengganu, Malaysia), and Backyard Fishery Post harvest Technology (by MFRD on 3-11 March 2009 in Singapore). Following the training of the trainers, a series of on-site activities were also planned and conducted under each thematic areas, *i.e.* i) Local Indigenous Institutions and Co-management (Philippines, Thailand, Cambodia, Lao PDR, Vietnam, Indonesia and Malaysia); ii) Responsible Fishing Technologies (Philippines, Thailand, Lao DR, Vietnam and Myanmar); iii) Backyard Fishery Post-harvest Technology (Thailand, Philippines, Lao PDR, Myanmar, Indonesia, Cambodia and Malaysia); iv) Rural Aquaculture (Philippines, Lao PDR, Vietnam, Indonesia, Malaysia, Cambodia and Myanmar); and v) Inland Fisheries Development (Thailand, Cambodia, Vietnam, Indonesia, Malaysia and Myanmar).

As food security was regarded as one of the high priority issues of ASEAN, the 14th ASEAN Summit in 2009 endorsed the ASEAN Integrated Food Security (AIFS) Framework and its Strategic Plan of Action (SPA) which requires the implementation of activities during 2009-2013. To discuss the future collaboration in the implementation of activities under the AIFS Framework, the ASEAN-FAO Conference on Food Security was organized from 27 to 28 May 2009 in Bangkok, Thailand, with the representatives from SEAFDEC participating and delivering a statement highlighting the important roles and contributions from fisheries to food security of the region. During this Conference, SEAFDEC also proposed potential areas of activities to support the implementation of AIFS from fisheries sector on: i) Strengthening Food Security Arrangements; ii) Promoting Sustainable Food Production; and iii) Identifying and Addressing Emerging Issues Related to Food Security (*e.g.* adaptive measures to mitigate impacts from climate change to food security), which were supported by the special SOM-30th AMAF Meeting in August 2009, and the Preparatory SOM-31st AMAF Meeting in November 2009.

SEAFDEC is also planning to organized the ASEAN-SEAFDEC Conference on Sustainable Fisheries for Food Security Towards 2020, to follow up the progress made by the ASEAN Member Countries in the implementation of the Resolution and Plan of Action adopted during the ASEAN-SEAFDEC Conference on Sustainable Fisheries for Food Security in the New Millennium: “Fish for the People” in 2001, discuss the priority issues on fisheries and food security, and develop the Decade Resolution and Plan of Action on Sustainable Fisheries for Food Security in the ASEAN Region (Towards 2020), which will be used as policy principle in achieving sustainable fisheries for food security in the coming decade. The conduct of this Conference was supported by the SEAFDEC Council during its 41st Meeting in 2009, and ASEAN starting from the 17th Meeting of the ASWGFi, the Special SOM-30th AMAF, and the SOM-31st AMAF; and is tentatively scheduled from 13 to 17 June 2011 in Bangkok, Thailand, to be hosted by the Department of Fisheries of Thailand.

8. Addressing Emerging International Fisheries-related Issues

8.1 *International Fisheries-related Issues*

Since 1998, SEAFDEC has implemented programs to monitor and review the potential international fish trade-related issues, as well as other environment-related issues which may impede the sustainable development of fisheries of the region. In 2009, SEAFDEC organized the Regional Technical Consultation on International Fisheries-related Issues from 10 to 12 February 2009, in Bangkok, Thailand. The priority issues identified and discussed at the RTC included: the EC Regulation to Prevent, Deter, and Eliminate Illegal, Unreported, and Unregulated (IUU) Fishing; the FAO Legally-binding Instrument on Port State Measures for Combating IUU Fishing; Small-scale Fisheries; Refinement of the Required Adaptive Measures and Proposed Activities to Mitigate the Impacts of Climate Change; Aquaculture Certification; Fisheries Subsidies, and the Implementation of the United Nations General Assembly (UNGA) Resolution 61/105 (Paragraph 83-87). The RTC also discussed and agreed on the regional coordinated positions in corresponding to the individual issue to be appropriately reflected at the relevant regional/international fora in order to safeguard the interest of the countries in the region.

In addition, during the year, SEAFDEC representatives also participated in the international meetings that discussed issues relevant to fisheries of the region in order to provide regional inputs based on the regional technical consultation outcomes and regional common/coordinated positions. These included: i) the FAO-COFI Meeting (2-6 March 2009, FAO/Rome) where SEAFDEC has supported the intervention of Member Countries to reflect the regional coordinated positions; ii) the Second Meeting of Regional Fisheries Bodies Secretariat Network (9-11 March 2009) where SEAFDEC was selected as the vice chair of the Network; and iii) the Second Resumed Session of the FAO Technical Consultation on Legally Binding of the Port State Measures (4-8 May 2009, FAO/Rome) in order to update the development status and negotiation process.

8.2 *Climate Change and Fisheries*

SEAFDEC have during 2009 been active in addressing issues related to climate change and adaptation by: i) seeking regional responses on steps forwards such as during the Regional Technical Consultation on International Fisheries Related Issues, 10-12 February 2009 in Bangkok, Thailand; ii) providing awareness on the importance and cross-cutting nature at sub-regional level in terms of mitigation and adaption is something that has to be incorporated in routine planning and capacity building through the two sub-regional events, namely the Second Gulf of Thailand Meeting, 24-26 February 2009 and the First Andaman Sea Meeting, 20-22 October 2009; and iii) further developing the information based on climate change and its impacts on fisheries and important habitats through active participation in relevant regional events. Such events have been organized by AIT (January 2009), MRC (February 2009), World Ocean Congress, Manado (May 2009), ASEAN (at various occasions), WWF (July 2009), IWMI/SENSA (December 2009). SEAFDEC had successfully incorporated climate change as integral and cross-cutting part in its activities such as the Project on “Activities Related to Climate Change and Adaptation in Southeast Asia with a Special Focus on the

Andaman Sea, 2009-2011”. Finally, as mentioned earlier, SEAFDEC had been active in the development of an ASEAN Fisheries Management Mechanism. SEAFDEC facilitated and supported the process to develop a work plan for the ASEAN Fisheries Consultative Forum (AFCF). As endorsed by the SOM-AMAF end of October 2009, one of the “key cluster” activity areas for the AFCF is “Adaptation and Mitigation of Impacts of Climate Change” with the Philippines as a lead country for that cluster.

9. Human Capacity Development in Fisheries

In order to enhance human capacity development in supporting the development of the fisheries sector, throughout the year SEAFDEC Secretariat as well as the technical departments organized a number of activities for the Member Countries, *e.g.* consultative meetings, workshops, training courses, etc., both at the national and regional levels. It is envisaged that these activities would help enhancing human capacity under the wide scope of fisheries in order to ensure sustainable development of fisheries and the contribution from fisheries to food security, national economy, as well as the well being of people for the generations to come.

The number of participants from the SEAFDEC Member Countries to the activities of SEAFDEC During the year could be summarized as follows:

	Country										
	Brunei Darussalam	Cambodia	Indonesia	Japan	Lao PDR	Malaysia	Myanmar	Philippines	Singapore	Thailand	Vietnam
Consultation meeting, seminar and workshop at the regional/sub-regional levels	18	22	40	26	14	44	21	24	12	80	34
Consultation meeting, seminar and workshop at the national/local levels	0	0	0	0	40	0	126	105	0	135	0
Regional training course	4	16	8	4	34	11	9	23	3	24	9
National, On-site training courses	0	92	108	0	150	87	93	570	0	343	31
Total	22	130	153	30	238	142	249	722	15	582	74

Specifically for TD, in addition to the training courses organized under the specific subjects and disciplines, since 2008 the Department has also provided a wide range of tailor-made training courses and study tour programs in the field of fisheries and other relevance aspects at the national and international levels. In 2009, more than 15 tailor-made courses were organized for university students, governmental officers, etc., of Member- and Non-member Countries.

For AQD, training at the national, regional and community levels has also been a continuing activity. In overall, 40 training sessions were conducted in 2009, of which thirty five percent of these sessions were conducted on-site at the Member Countries and/or at the stakeholders’ facilities; the other courses were conducted at AQD’s four stations. In terms of the number of trainees, a total of 612 national and foreign participants were trained representing various stakeholder groups (government officers, fish farmers, fisher-folk, fishery school teachers, students and private sector practitioners). AQD also delivered activities through its Fish World, *i.e.*: i) visitor services: briefing, guided tour of facilities; ii) live animal exhibits in aquaculture, fisheries, and biodiversity (collection, identification, cataloguing); iii) rescue and rehabilitation of endangered marine animals; iv) R&D workshops and internships for secondary science teachers and students; v) Aquaculture Week 2009 competitions among elementary and high schools students, and vi) research and workshop on *tangab* (filter net) fishery in Iloilo Strait and BFAR, fishers, and other stakeholders.



SEAFDEC/AQD joins exhibition at fisher-folks day held in Roxas City, Capiz



Local students participate in aquarium quiz during aquaculture week held at AQD's Fish World (Museum)

10. Enhancing SEAFDEC Visibility

Since its establishment, SEAFDEC has undertaken various activities and regularly developed information materials to support sustainable development of fisheries in Southeast Asia. Since 2007, the common policy framework used for the formulation and implementation of SEAFDEC information-related activities is the “Information Strategies for Enhancing SEAFDEC Visibility and Communication”. The Information Strategies envisions that: “SEAFDEC shall be a sustained and unified Centre of Excellence for Tropical Fisheries Information, accessible to all committed to sustainable fisheries development and food security, working for the benefit of its Member Countries, in close collaboration with the ASEAN and fishery-related organizations regionally and globally.



Audiences' visit to the SEAFDEC/TD exhibition booth

From 12 to 14 October 2009, SEAFDEC organized the Tenth SEAFDEC Information Staff Exchange Program (ISEP) Meeting in Ayutthaya Province, Thailand. The Meeting reviewed the implementation of the Information Strategies by SEAFDEC Secretariat and Departments during the past year, and discussed ways and means to improve the future information-related activities to enhance the activities and visibility of SEAFDEC.

In summary, the activities implemented in 2009 that contributed to enhancing the visibility of SEAFDEC include:

- i) Production and dissemination of information materials, *e.g.* SEAFDEC publications, and articles published in other scientific journals/proceedings, etc.
- ii) Establishment and administration of SEAFDEC and Departmental websites
- iii) HRD activities that contributed to the information-related activities
- iv) Provision of information services, *e.g.* library services, on-line information services, etc.
- v) Arrangements of exhibition and promotional events to publicize SEAFDEC activities
- vi) Enhancement of internal communications and information sharing among SEAFDEC staff
- vii) Strengthening cooperation and networking with other organizations
- viii) Raising SEAFDEC image at international, regional and national levels through the organization of meetings, trainings, the active participation at external events, the development of Press

Statements for SEAFDEC regional events, and the development of common/ coordinated position of the region reflected at the international fora.

The Tenth ISEP Meeting also reviewed the Information Strategies, and agreed on the adjustment of the Information Strategies to be reported to the SEAFDEC Council during its 42nd Meeting in 2010.

RECOMMENDATIONS FROM THE REGIONAL ADVISORY COMMITTEE FOR FISHERIES MANAGEMENT IN SOUTHEAST ASIA (RAC)



The Regional Advisory Committee for Fisheries Management in Southeast Asia (RAC) was established in 2008 as a subsidiary body of the SEAFDEC Council to assist the SEAFDEC Member Countries in achieving the sustainable utilization of fisheries resources and provide technical/scientific advice to the SEAFDEC Council. In 2009, the Second Meeting of RAC was organized from 2 to 4 September in Bangkok, Thailand to review and discuss priority issues relevant to fisheries management of the Southeast Asian region, of which the important recommendations were made as follows:

Enhancing Sustainability of Fishery Resources and Stocks

- i) Considering the deterioration of fishery resources/stocks in Southeast Asian waters, regional collaborative management efforts to enhance the inland and marine fisheries resources and stocks are required.
- ii) Goals and roadmap for the enhancement of resources/stocks should be developed by SEAFDEC in consultation with the Member Countries and other relevant regional/international organizations. This should also be incorporated into the national/regional policy framework, and taken into consideration in the further development of activities at the national and regional levels.
- iii) Required actions (immediate and long-term) on fisheries resources enhancement should be further identified and elaborated on, and to be incorporated into the national/regional program of the Member Countries, SEAFDEC and other relevant organizations. The activities, covering both inland and marine fisheries, could be tentatively classified into clusters, as follows:
 - o Conservation and restoration of marine and freshwater habitats (*e.g.* mangrove forests, inundated forests, tidal flats, artificial reefs, sea grass and seaweed beds, etc.), including establishment of fisheries *refugia* and other forms of marine and inland protected areas, to enhance fishery resources/stocks (*also consider the experience of other organizations, e.g. United Nations Environment Programme/Global Environment Facility/South China Sea (UNEP/GEF/SCS), Mekong River Commission (MRC), etc., in the implementation of relevant activities*);
 - o Stock enhancement of heavily-exploited and economically-important species (*also consider the key elements for successful stock enhancement program based on the experience of SEAFDEC/AQD in the implementation of relevant programs*);

- Assessing the impacts of habitat restoration and stock enhancement activities on the environment, fishery resources, and socio-economic conditions of fishers;
 - Improvement and implementation of effective fisheries management, *e.g.* management of fishing capacity (freezing of capacity), enforcement of regulations (*e.g.* zoning, gear restriction, seasonal restriction), promotion of rights-based fisheries, etc.;
 - Promotion of responsible fishing operations, and reduction of the impacts from fishing operations to fishery resources and eco-systems (*also consider the Draft Plan of Action for the Reduction of the Impacts of Fishing on Coastal and Marine Waters in Southeast Asia*).;
 - Maximizing the use of existing data and information (available in Member Countries, SEAFDEC and other organizations) to visualize the overall pictures of the ecosystem as well as the status and trends of fishery resources/stocks to support policy planning and management for sustainable fisheries; and
 - Enhancing the involvement of local governments and stakeholders' participation and public awareness, as well as integration of socio-economic aspects in the resources and stock enhancement activities.
- iv) Considering that there are several clusters of activities that are envisaged to contribute to the sustainability of the fishery resources/stocks, a holistic approach should be considered in the formulation and implementation of activities.
- v) Technical Working Groups (TWGs) could be established or technical consultations could be organized, as and when necessary, to further discuss and elaborate on the relevant issues and follow-up on the recommendations made by RAC. The establishment of TWGs or the conduct of the consultations could be done either under RAC or within the existing SEAFDEC Program Frameworks.
- vi) SEAFDEC, as the RAC Secretariat, should explore and enhance its collaboration with other relevant international/regional organizations, *e.g.* UNEP/GEF/South China Sea Project, Coral Triangle Initiatives (CTI), FAO, MRC, etc., in the TWG and consultation activities in order to mobilize their experiences and obtain their views that could be incorporated in the RAC policy recommendations for the enhancement of resources/stocks, as well as to heighten the possibility that the recommendations are incorporated into the policy framework and/or activities of other relevant organizations.

Improving Data and Information Collection on Fishing Vessel Record and Catch Documentation Scheme

- i) The SEAFDEC Member Countries should continue their attempts in assessing the current level of fishing capacity through vessel registration and/or fishing licensing system of commercial fisheries and small-scale/coastal fisheries (or gear registration in the case of inland fisheries). Vessel registration record of the respective countries should also be regionally harmonized to ensure reliable and comparable statistics and information, which are useful for policy planning and management of fisheries (*also consider the Vessel Record and Inventory Survey Forms for large-scale and coastal fishing vessels developed by SEAFDEC*).
- ii) To improve the catch documentation scheme and fishing logbook system by the Member Countries, the following issues should be considered:
- establishment of guidelines for the implementation of the catch documentation in the region;
 - making the catch documentation scheme applicable to commercial and small-scale fisheries;
 - sharing experiences on the best practices on the development of the fishing logbook system;
 - exploring new devices for better tracking such as electronic tagging;
 - linking the fishing logbook system with the vessel registration and/or licensing system as appropriate; and
 - enhancing capacity building.

- iii) The Logbook System should be used by the SEAFDEC Member Countries, starting from commercial large-scale fishing vessels and later on to be expanded to small-scale vessels, to improve their respective catch documentation schemes. Information to be recorded in the Logbook should be simple enough for the fishers to complete and suitable to support management for sustainable fisheries, particularly the catch by fishing areas.
- iv) SEAFDEC (as RAC Secretariat) should continue to monitor the issue and compile the information on the status of the implementation of SEAFDEC Member Countries in response to the EU requirements, the problems/difficulties faced by the countries as well as appropriate solutions from the regional perspective. The issues and relevant information should be reported to the SEAFDEC Council for consideration and recommendation particularly on the technical support required from SEAFDEC.

COOPERATION WITH DONORS AND PARTNER ORGANIZATIONS IN 2009

1. Collaborative Activities between SEAFDEC and Other Organizations

ASEAN Foundation

SEAFDEC started the close collaboration with the ASEAN Foundation in 2000 during the preparation for the ASEAN-SEAFDEC Conference on Sustainable Fisheries for Food Security in the New Millennium: “Fish for the People” (2001). In 2009, collaboration between SEAFDEC and the ASEAN Foundation was enhanced through the implementation of the programs on: i) Promotion of “One Village, One Fisheries Products (FOVOP)” System to Improve the Livelihood for the Fisheries Communities in ASEAN Region (2007-2009); and ii) Human Resource Development (HRD) on Poverty Alleviation and Food Security by Fisheries Intervention in the ASEAN Region (2008-2010), which are financially supported by the ASEAN Foundation with SEAFDEC as an executing agency. In addition, SEAFDEC also plans to organize the ASEAN-SEAFDEC Conference on Sustainable Fisheries for Food Security Towards 2020 (tentatively scheduled in June 2011) with partial funding support from the ASEAN Foundation. The Conference is envisaged to come up with the Decade Resolution and Plan of Action on Sustainable Fisheries for Food Security in the ASEAN Region (Towards 2020), which will be used as policy principle in achieving sustainable fisheries for food security in the coming decade.

Association of the Southeast Asian Nations

SEAFDEC has been collaborating with ASEAN since 1998 under the ASEAN-SEAFDEC Fisheries Consultative Group Mechanism (FCG) framework. In 2007, the collaboration between the two organizations was formalized with the establishment of the ASEAN-SEAFDEC Strategic Partnership (ASSP). In 2009, 22 programs under the ASSP/FCG mechanism were implemented by SEAFDEC, and are envisaged to contribute to sustainable development of fisheries of the ASEAN-SEAFDEC Member Countries.

In addition to the technical programs, the areas of cooperation between ASEAN and SEAFDEC also covered: the cooperation in the Implementation of the ASEAN Roadmap for Integration of the Fisheries Sector; the establishment of ASEAN Fisheries Consultative Forum (AFCF); the ASEAN Shrimp Alliance (ASA); and the establishment of the ASSP Portal Website. SEAFDEC also participated in the 17th Meeting of ASEAN Sectoral Working Group on Fisheries (3-5 June 2009 in Vietnam), the special SOM-30th AMAF Meeting (13-15 August 2009 in Vietnam) and the Preparatory SOM-31st AMAF Meeting (7-8 November 2009 in Brunei Darussalam), where the progress of the ASEAN-SEAFDEC collaborative programs as well as other areas of cooperation were reported and discussed.

Food and Agriculture Organization of the United Nations (FAO)

In 2009, SEAFDEC participated and provided technical inputs during the fisheries-related meetings organized by FAO, namely the Regional Workshop on Best Practices for Supporting and Improving Livelihoods of Small-scale Fisheries and Aquaculture Households (13-15 October 2009 in Manila, Philippines), the 28th Session of the Committee on Fisheries (COFI) (2-6 March 2009 in Rome, Italy), the 29th FAO Regional Conference for Asia and the Pacific (26-31 March 2009, in Bangkok, Thailand), the Second Resumed Session of the Technical Consultation to Draft a Legally-Binding Instrument on Port State Measures to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing (4-8 May 2009 in Rome, Italy), the Regional Workshop on Practical Implementation of Ecosystem Approach to Fisheries and Aquaculture in the APFIC Region (18-22 May 2009 in Colombo, Sri Lanka), the ASEAN-FAO Regional Conference on Food Security (27-28 May 2009 in Bangkok, Thailand), the FAO-EC Regional Conference on Rural Development and Agricultural and Food Quality Linked to Geographical Origin in Asia: Lessons and Perspectives (11

June 2009 in Bangkok, Thailand), the Third Resumed Session of the Technical Consultation to Draft a Legally-binding Instrument on Port State Measurements to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing (24-28 August 2009 in Rome, Italy), the Inception Workshop for Bay of Bengal Large Marine Ecosystem (BOBLME) (3-5 November 2009 in Bangkok, Thailand), and the FAO Workshop on Methods for Aquaculture Policy Development (9-11 December 2009 in Bangkok, Thailand).

The representatives from FAO also took part and provided inputs during the SEAFDEC meetings, namely: the Workshop on Certification and Eco-labeling (30 January 2009 in Bangkok, Thailand), the 41st Meeting of the SEAFDEC Council (7-10 April 2009 in Fukuoka, Japan), the Workshop on Fishing Vessel Record and Inventory (27-29 July 2009 in Satun Province, Thailand), The First Meeting of Andaman Sea Sub-region (20-22 October 2009 in Phuket), the Second Meeting of SEAFDEC Regional Advisory Committee for Fisheries Management in Southeast Asia (RAC) (2-4 September 2009 in Bangkok, Thailand), the 32nd Meeting of SEAFDEC Program Committee (16-18 November 2009 in Kota Kinabalu, Malaysia). In addition, FAO also agreed to be a partner in the organization of the ASEAN-SEAFDEC Conference on Sustainable Fisheries for Food Security Towards 2020, and has been actively involved in the preparatory process of the Conference.

During the year, SEAFDEC Training Department also collaborated with FAO in the organization of several regional workshops related to sustainable fishery in the region, such as the Regional Workshop on the Reduction of the Impacts of Fishing in Coastal and Marine Environment in the Southeast Asian Water (12-15 January 2009), the 1st Workshop on the Assessment of Fishery Stock Status in the South and Southeast Asia (16-19 June 2009), the 2nd Workshop on the Assessment of Fish Stock Status in the South and Southeast Asian Countries (5-9 October 2009), and the FAO/GEF Inception Workshop on By-catch Management and Reduction of Discards in Trawl Fisheries (3-6 November 2009).

Coordinating Working Parties on Fishery Statistics (CWP)

Activities undertaken by SEAFDEC in 2009 which contributed to the collaborative work with the Coordinating Working Parties on Fishery Statistics (CWP) are Harmonization of Standards/Norms, Classification and Definitions of Fishery Statistics and Information in the Region; and the Streamlined Reporting of Fishery Statistics from the Member Countries to SEAFDEC and FAO under the SEAFDEC program on Improvement of Statistics and Information for Planning and Management of Fisheries in the ASEAN Region. These activities were discussed and concluded with future directions and way forward for future collaboration with CWP at the Regional Technical Consultation on Fishery Information and Statistic in Southeast Asia (19-21 January 2010, Bangkok, Thailand). SEAFDEC representative also participated in the Expert Workshop for Draft for CWP Handbook on Standards of Aquaculture Statistics and Regional Workshop on Capacity Building Need for Improving Aquaculture Statistics and Data Collection in Asia (10-18 November 2009, Vietnam). The Workshop provided recommendation on the minimum data requirements to support effective management and sustainable development of fisheries, possible data sources, data collection procedures/problems, as well as required capacity building for collection of data/information.

Fisheries Resources Monitoring System (FIRMS)

Under the collaboration between SEAFDEC and FIRMS established in 2004, SEAFDEC has provided information to the Fisheries Inventory of FIRMS based on the One-year Study on Shark Production, Utilization and Management in the ASEAN Region (2003-2004). Based on the information provided, eight Fisheries Fact Sheets were developed as follows: i) Shark Fisheries in Brunei Darussalam; ii) Shark Fisheries in Cambodia; iii) Shark Fisheries in Indonesia; iv) Shark Fisheries in Malaysia; v) Shark Fisheries in Myanmar; vi) Shark Fisheries in the Philippines; vii) Shark Fisheries in Thailand; and viii) Shark Fisheries in Vietnam. In early 2010, these Fact Sheets were verified and published to be accessible by public. SEAFDEC plans to continue providing information as input to the Fisheries Inventory of FIRMS based on the available information of SEAFDEC. For 2010, it is planned that

SEAFDEC would provide the information on sea cucumber fisheries collected from Brunei Darussalam, Cambodia, Indonesia, Malaysia, Myanmar, Philippines, Thailand and Vietnam through a one-year regional data collection framework (2007-2008). The information include: Status of sea cucumber fisheries, dominant sea cucumber species, sea cucumbers production, utilization and trade (import and export), and recommendation for conservation and management of sea cucumber resources in the respective country in the region.

National Fisheries University of Japan (NFU)

The Arrangement of Cooperation between SEAFDEC and the NFU has been ongoing since 2005 and renewed in November 2009. Under the SEAFDEC-NFU collaborative framework, two SEAFDEC/TD researchers joined the research and training cruise using the training ship T/S KOYO MARU of National Fisheries University (NFU) of Japan in the central part of Vietnam from 5 to 17 November 2009. Moreover, the signing ceremony of the arrangement for academic and educational cooperation between SEAFDEC and the NFU was arranged on 27 November 2009.

Swedish International Development Cooperation Agency

The collaboration between SEAFDEC and the Swedish International Development Cooperation Agency (Sida) in 2009 was mainly under the program on “Support the Implementation of the Code of Conduct for Responsible Fisheries”. The program comprises components on supporting the establishment of regional fisheries management body/mechanism in Southeast Asia; improving the capacity for the management of fisheries and important coastal fisheries (*refugia*); and understanding on the size and structure of large-scale (or industrial) fisheries and capacity strengthening to monitor and record active fishing efforts in coastal fisheries. The program also supported the activities under the ASEAN Fisheries Consultative Forum (AFCF) particularly the organization of the Preparatory Meeting of the AFCF from 26 to 27 May 2009 in Bangkok, Thailand, as well as SEAFDEC’s involvement in the “Regional Plan of Action (RPOA) to Promote Responsible Fishing Practices including Combating IUU Fishing”.

As the program on “Support the implementation of the Code of Conduct for Responsible Fisheries” would be completed in 2009, SEAFDEC is planning to implement the new program of activities related to climate change and adaptation in Southeast Asia with special focus on the Andaman Sea (originally entitled “Support to Tsunami Rehabilitation of Affected Countries in the ASEAN Region”) starting from 2009 to 2011. The program aimed at ensuring the long-term sustainability of fisheries, reducing vulnerability to impacts of climate change and improving livelihoods of fisher-folk in the ASEAN region, and around the Andaman Sea. The Program comprises components on: i) Integration of fisheries and habitat management; ii) Monitoring, Record and Control large-scale and small-scale (coastal) fishing; iii) Local knowledge, cross cutting issues and safety at sea; and iv) Policy dialogue and promotion of regional cooperation on fisheries management.

Vocational Education Commission of Thailand

The Training Department collaborated with the Vocational Education Commission of Thailand for the conduct of the four-month Training Course on Fishing Vessel Operation from 6 October 2009 to 26 February 2010 for Tinsulanonda Fisheries College, Songkhla Province. The training course aimed to provide skills to students and share to them some experiences which they can use for their work in the future. The training course consisted of six subjects, namely: Ship Construction and Stability; Marine Communication; Laws and Regulations of Navigation; Navigation Technology Practices; Marine Machinery Technology and Practices; and Fishing Gears Technology and Practices. Moreover, as part of their practical training, the students had hands-on experience and practice onboard the M.V. SEAFDEC and M.V. Plalung including study tours in relevant areas.

Japan Society for the Promotion of Science (JSPS)

During the year, two TD staff received scholarships from the Japan Society for the Promotion of Science (JSPS) under the JSPS-NRCT program to attend the training course on purse seine at Tateyama Bay, Japan from 7 to 16 July 2009; and from 14 to 15 December 2009, TD staff were also invited to attend and made a presentation at the JSPS-NRCT Seminar 2009 in Thailand. Moreover, on 18 December 2009, TD convened the SEAFDEC-JSPS Technical Meeting on Responsible Fishing Technologies and Practices to review the progress of the collaborative activities conducted by TD which have been technically supported by various institutions in Japan under the JSPS as well as to further promote the collaboration between SEAFDEC and JSPS on responsible fishing technologies and practices.

2. Collaborative Arrangements between SEAFDEC and Other Organizations

Australian Centre for International Agricultural Research (ACIAR)

On 29 April 2009, AQD entered into a Contract of Agreement with the Australian Centre for International Agricultural Research (ACIAR) for nine-month collaboration on the 'Community Agricultural Technology Program (CATP)'. The collaboration involved research and delivery of CATP to accelerate adoption, within Philippine farming communities, of technical innovations based on results from selected past and current ACIAR funded projects. The duration of the collaboration was from 29 April 2009 to 31 December 2009. Specifically, AQD was involved both in the management of the program and the dispersal of research and development funds to existing research and development sub-projects until completion of the program at the end of 2009.

Evonik Degussa GmbH (EVONIK) Germany

On 7 March 2009, AQD entered into agreement for collaboration with Evonik Degussa GmbH (EVONIK) on the project 'Amino Acid Supplementation in Common Carp Feeds Containing Fish Meal Partially Replaced with Plant-Based Protein'. EVONIK is a manufacturer of amino acids, vitamins and other feed additives and through extensive research and development, it has considerable know-how and expertise in the field of nutrition. Cooperation was from 16 March 2009 to 16 September 2009. Under this Agreement, AQD provided the technical expertise and carried out the research work related to the amino acid supplementation in common carp feeds, in cooperation with EVONIK.

Fisheries Research Agency (FRA) of Japan

On 16 February 2009, the Fisheries Research Agency (FRA) and SEAFDEC extended the "Arrangement for Scientific and Technical Cooperation between FRA and SEAFDEC" which was established since January 2004 with an initial period set for 5 years. The objectives and scope of the cooperation are remained as set forth in the original Arrangement on: i) the development of scientific and technical cooperation in various fields that are of interest to the two organizations, ii) the development of scientific exchange program (exchange of scientist), and iii) other matters, which require detailed discussions between SEAFDEC and FRA. The extension of this Arrangement would be effective for five years from the date of signature and is subject to revision and extension by mutual consent. During the signing ceremony in 2009, the areas of potential collaboration between the FRA and SEAFDEC were elaborated, *e.g.* on sustainable utilization of fisheries resources; promotion of coastal fisheries and aquaculture; safe and reliable supply of fishery products; and safety at sea and energy saving technologies.

Food and Agriculture Organization of the United Nations (FAO)

In 2009, TD signed two Letters of Agreement to collaborate with the Food and Agriculture Organization (FAO). For the first Agreement, FAO provided financial contribution to TD to assist in

the preparation and organization, as well as provision of hosting facilities for the workshop on “Assessment of Fishery Stock Status in South and Southeast Asia”. Two Workshops were conducted in Thailand, on 16-19 June 2009 and 5-9 October 2009, respectively.

For the second Agreement, financial contribution was provided to TD to prepare three dimensional illustrations of fishing gears from materials, *e.g.* illustrations, photographs, line drawings, sketches, etc., and provide the unprotected electronic and hard copy of the illustrations to FAO for further usage.

National Fisheries University (NFU) of Japan

On 27 November 2009, SEAFDEC and the National Fisheries University (NFU) of Japan extended the “Arrangement for Academic and Educational Cooperation between SEAFDEC and NFU”, which was established since May 2005 with an initial period set for 5 years. The forms of cooperation remain as set forth in the original Arrangement, *i.e.*: i) Collaboration of faculty, staff members and training ship for research, symposia and other academic pursuits; ii) exchange of staff and students for education, training and research; and iii) exchange of data, documentation and research materials in fields of annual interest. It was further agreed that, the detail of implementation of activities and financial arrangements would be discussed in a case-by-case basis, and the cooperation in specific programs or project pursuant to the above areas of cooperation would be covered by separate contract between SEAFDEC and NFU. The extension of the Arrangement between SEAFDEC and NFU would be effective for five years starting from 17 May 2010, and is subject to revision and extension by mutual consent.

National Agriculture Training Council (NATC)

On 23 November 2009, TD established technical and training collaboration with the National Agriculture Training Council (NATC) which is the government agency under the Ministry of Agriculture and Agro-Based Industry of Malaysia. Possible areas of collaboration elaborated during the discussion between TD and NATC were the technical and training collaboration in the field of fisheries and human resources development activities for NATC, specifically in developing “Train the Trainers” program for NATC trainers and instructors in the areas of: i) fishing gear technology; ii) navigation; iii) marine engineering; iv) post-harvest technology; v) food technology; and vi) aquaculture, on cost-recovery basis. In addition, other relevant areas were also outlined, *i.e.* audio-visual and media development, fisheries management, fishery resources enhancement, fishery extension methodology, oceanography and fisheries information system and database development, simulator systems in capture fisheries. The details on the technical and training collaboration as well as relevant programs would be further discussed between TD and NATC to enhance the implementation of activities under this collaborative agreement.

Novus International Incorporated, USA

On 31 August 2009, AQD signed an agreement with Novus International Incorporated, which is a private company based in USA, to conduct grouper larval research on “Growth, Survival and Nutritional Composition of Grouper Fry Fed Formulated Diet”. At present fry production of grouper is still low and inconsistent. Larval rearing of grouper relies heavily on the natural food like rotifers, brine shrimps and mysids. The use of formulated larval diet could solve the problem and provide a diet that can supply proper nutrition needed by larvae for metamorphosis and survival. Cooperation period is from September 2009 to September 2010.

United Soybean Board, USA

The United Soybean Board (USA) and AQD forged a one-year agreement to implement a study entitled “Use of Soybean Meal and Soy Protein Concentrate as Alternatives to Fish Meal in Practical Feeds for Milkfish”. The study, covering the period from 1 January to 31 December 2009, aimed to

refine optimal soy diet for milkfish and to conduct pilot feeding trial in sea cages with optimal soy diet. It was expected that the project would support the strong R&D and extension activities of AQD and would also promote sustainable milkfish aquaculture in the Philippines as well as in other countries in the region.

WorldFish Center

In 2009, AQD entered into its collaboration with the WorldFish Center for the “Culture of Sandfish (*Holothuria scabra*) in Asia-Pacific”. The collaboration, covering the period from 2 December 2009 to 30 November 2011, focuses on Research on pond-based farming of sandfish in both Vietnam and the Philippines. The activities/areas of cooperation include: i) Enhancement of capacity for efficient production of larval sandfish by facilitating technology transfer and skill development among project partners; ii) Development of alternative modalities for farming of sandfish in ponds under a range of environmental and structural settings; iii) Enhancement of community benefit from sea cucumber culture and sea ranching through understanding markets and maximizing product value; and iv) Extending of developed technologies and systems to industry through training and support for model enterprises.

SEAFDEC PROGRAMS IN THE YEAR 2010

In the Year 2010, SEAFDEC would continue to implement activities on the development of fisheries and aquaculture technologies to support sustainable development of the fisheries sector with particular priority on responsible fisheries in line with the Code of Conduct for Responsible Fisheries; the contribution from fisheries to food security; and poverty alleviation and livelihood. In this connection, emphasis would also be given to the linkages between fisheries and the environment, as well as the introduction/provision of fisheries-related technologies that are applicable for small-scale fishers and rural communities. In addition, SEAFDEC would continue to discuss: the global emerging issues and situation including the requirements for food safety and the region's compliance with the regulations imposed by major importing countries to ensure sustainability of fisheries; the environmental-related issues and requirements for conservation and management of marine species, and adaptation of impacts from climate change; and the global economic situation which would impact all production sectors of the world including the fisheries sector of the Southeast Asian region.

The SEAFDEC programs of activities proposed for 2010 were scrutinized during the 32nd Meeting of SEAFDEC Program Committee and were further proposed to the 42nd Meeting of the SEAFDEC Council, for consideration and endorsement. The programs include:

Departmental Programs

1. Center-wide Information Network (Secretariat)
2. Information and Communications 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)
9. Aquatic Ecology (AQD)

ASEAN-SEAFDEC FCG/ASSP Programs

1. Assistance for Capacity Building in the Region to Address International Trade-related Issues (Secretariat)
2. Activities Related to Climate Change and Adaptation in Southeast Asia with Special Focus on the Andaman Sea (Secretariat)
3. Improvement of Statistics and Information for Planning and Management of Fisheries in the ASEAN Region (Secretariat)
4. Promotion of "One Village, One Fisheries Products (FOVOP)" System to Improve the Livelihood for the Fisheries Communities in ASEAN Region (Secretariat)
5. Human Resource Development (HRD) for Poverty Alleviation and Food Security by Fisheries Intervention in the ASEAN Region (Secretariat)
6. Information Collection of Highly Migratory Species in Southeast Asia Waters (Secretariat)
7. ASEAN-SEAFDEC Conference on Sustainable Development of Fisheries and Food Security Towards 2020 (Secretariat)
8. Sustainable Utilization of Potential Fisheries Resources and Reduction of Post-harvest Losses (TD)
9. Fisheries Resource Survey and Operational Plan for M.V. SEAFDEC 2 (TD)
10. Responsible Fishing Technologies and Practices (Fishing in Harmony with Nature) (TD)
11. Deep Sea Fisheries Resources Exploration in the Southeast Asia (TD)
12. Development of Regional Database for Fishery Management (TD)
13. Promotion of Rights-based Fisheries and Co-management Towards Institutional Building and Participatory Mechanism for Coastal Fisheries Management (TD)

14. Rehabilitation of Fisheries Resources and Habitat/Fishing Grounds through Resources Enhancement (TD)
15. Chemical and Drug Residues in Fish and Fish Products in Southeast Asia (Biotoxin Monitoring) (MFRD)
16. Traceability Systems for Aquaculture Products in South Asian Region (MFRD)
17. Promotion of Sustainable and Region-oriented Aquaculture (AQD)
18. Resource Enhancement of International Threatened and Over-exploited Species in Southeast Asia through Stock Release (AQD)
19. Accelerating Awareness and Capacity-building in Fish Health Management in Southeast Asia (AQD)
20. Food Safety of Aquaculture Products in Southeast Asia (AQD)
21. Tagging Program for Economically Important Pelagic Species in the South China Sea and Andaman Sea (MFRDMD)
22. Research and Management of Sea Turtles in Foraging Habitat in the Southeast Asia Waters (MFRDMD)

Non-funded ASEAN-SEAFDEC FCG/ASSP Programs

1. The Use of Indicators for Sustainable Development and Management of Capture Fisheries in the ASEAN Region (MFRDMD)
2. Development of Integrated Inland Fisheries Management in ASEAN Countries (MFRDMD)
3. Utilization of Freshwater Fish in ASEAN Member Countries (MFRD)
4. Capacity Improvement of Fisheries Community for Fisheries Management and Alleviation of Poverty (TD)

Other Programs

1. Cetacean Research in Southeast Asian Waters: Cetacean Sighting Program (TD)
2. Promotion of Inland Small-scale Fisheries Management through Rights-based Fisheries and Co-management Towards Institutional Building and Participatory Approaches (TD)

SEAFDEC VISIBILITY

In order to enhance SEAFDEC visibility, the SEAFDEC Council endorsed “the Information Strategy for Enhancing SEAFDEC Visibility and Communication” in 2006. Under the Information Strategy, it is envisioned that “SEAFDEC shall be a sustained and unified Center of Excellence for Tropical Fisheries Information, accessible to all committed to sustainable fisheries development and food security, working for benefit of its Member Countries, in close collaboration with the ASEAN and fishery related organizations regionally and globally”. Eight Strategies were identified, and in 2009, the activities implemented in-line with each Strategy could be summarized as follows:

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

- Production of SEAFDEC Information Materials:
 - 36 titles/issues of promotional materials (with 36,477 copies produced and 28,978 copies distributed);
 - 55 titles of technical materials (with 19,511 copies produced and 5,029 copies distributed); and
 - 18 papers/articles published in scientific journal/proceedings.
- Establishment and administration of SEAFDEC Websites (SEAFDEC Integrated Homepage and Departmental websites) with a total of 68,181 unique visitors, 25 links from other websites, and 19,848 annual download.

Strategy 2: Capacity development of information staff at all levels

- Provision of HRD activities for SEAFDEC information-related staffs based on requirement, and during the annual ISEP Meeting
- Obtaining library materials in SEAFDEC Secretariat and departmental libraries which also help enhancing the capacity of SEAFDEC staff. A total of 3,312 issues of Newsletter and serial publications, 385 titles of books, reports and technical publications, and 195 audio-visual materials were added up in the libraries during the year.

Strategy 3: Enhance the accessibility of SEAFDEC information to target groups

- Provision of library services, and on-line information services
- Establishment of networking with a total of 289 libraries within and outside the region
- Distribution of a total of 62 copies of publications to target group
- Provision of a total of 325 downloadable materials in the Websites
- Arrangement of exhibition: A total of 11 exhibitions were conducted to display the activities of SEAFDEC, with the total number of visitors of 31,380 persons to the booth.
- Visitors to SEAFDEC: 5,527 visitors directly visited SEAFDEC Secretariat and Departments.

Strategy 4: Strengthen cooperation and networking with other organizations

- Establishment of collaborative agreement/implementation of collaborative activities with 26 fisheries-related organizations at national, regional and international levels
- Receiving a total of USD 2,445,413 from non-regular sources for the implementation of programs/activities
- Establishment of Regional Fisheries Policy Network (RFPN) (members stationed at the Secretariat and virtual members) to enhance coordination between SEAFDEC and Member Countries on technical/policy matters

Strategy 5: Enhance internal communication and information sharing

- Establishment of e-mail and e-group communication systems (all Departments)
- Production of regular internal Newsletter (TD and AQD)

Strategy 6: Raising SEAFDEC image at international, regional and national levels

- Organization of events:
 - Regional/International meetings, seminar, workshop (26 meetings with 816 participants);
 - National/local meeting, seminar, workshop, consultation, etc. (9 meetings with 443 participants);
 - International/regional training course (17 courses with 232 trainees);
 - National, On-site training courses (58 course with 1,550 trainees);
 - Study tour (14 program with 153 trainees);
 - Internship (25 persons); and
 - On-the-Job training (1 colleges with 128 students).
- Participation to events organized by other organizations
 - Meeting at regional/international level (43 meetings, with 73 participants from SEAFDEC); and
 - Meeting at national/local level (25 meetings with 37 participants from SEAFDEC).
- Sending mission to visit member countries (1 missions, with 2 staffs)
- Production of Press Statements (13); while the appearance in press was also monitored (75)
- Preparation of common/coordinated position of the region reflected at the international fora (1)
- Conduct of questionnaire evaluation on SEAFDEC image at international, regional and national levels

Strategy 7: Sustainability of financial support for information and communication activities

- Selling of technical publications and souvenir items under a cost recovery basis
- Regularly reviewing the mailing list of SEAFDEC publications
- Digitizing publications and making them available for download from the websites

Strategy 8: Regular monitoring and evaluation of information activities

- Organization of the Tenth SEAFDEC Information Staff Exchange Program (ISEP) Meeting to monitor the implementation of information activities and visibility of SEAFDEC

SEAFDEC INCOME AND EXPENDITURE IN 2009

Southeast Asian Fisheries Development Center Un-Audited Abridged Consolidated Financial Statements

	<u>2009</u> US\$ (Un-audited)	<u>2008</u> US\$ (Audited)
INCOME		
Contributions from :-		
Member governments	7,194,564	5,971,967
Other sources	<u>1,367,904</u>	<u>1,042,544</u>
Total Income	<u>8,562,468</u>	<u>7,014,511</u>
EXPENDITURE		
Operating and Capital Expenditure		
Research	734,352	864,792
Training	527,086	579,300
Information	702,783	727,505
Collaborative	130,635	152,115
Others	243,068	36,111
Administrative	<u>6,460,272</u>	<u>4,691,314</u>
Total Expenditure	<u>8,798,196</u>	<u>7,051,137</u>
SURPLUS (DEFICIT), For the year	(235,728)	(36,626)
FUND BALANCE, Beginning of year	4,630,583 ^{1/}	4,845,140
FUND ADJUSTMENT	<u>0</u>	<u>0</u>
FUND BALANCE, End of year	<u>4,394,855</u>	<u>4,808,514</u> ^{1/}
REPRESENTED BY :		
Cash at Bank	4,545,865	4,604,354
Receivables	86,799	159,280
Advances and Deposits	512,863	257,377
Supplies Inventory	62,700	41,888
Fuel oil for vessels	115,470	43,307
Prepayments	<u>20,913</u>	<u>16,435</u>
Total Current assets	5,344,610	5,122,641
Termination indemnity fund	1,611,244	1,526,464
Other assets-Net	<u>14,504</u>	<u>117,668</u>
Total Assets	<u>6,970,358</u>	<u>6,766,773</u>
Less : Liabilities		
Accrued payable	964,259	330,082
Fund held in trust	0	101,713
Provision for termination indemnity	<u>1,611,244</u>	<u>1,526,464</u>
Total Liabilities	<u>2,575,503</u>	<u>1,958,259</u>
NET ASSETS	<u>4,394,855</u>	<u>4,808,514</u>

Remark:

^{1/} Fund balance at the end of 2008 also include the fund balance of MFRD (US\$ 366,957). However, starting from 2009, MFRD no longer submit the financial report to SEAFDEC. The difference in the figure of fund balance at the end of 2008 and at the beginning of 2009 is therefore as a result of unreported figure of MFRD, and the difference of US\$189,026 as a result of change of rate in US\$ translation.

**Un-audited contribution received by SEAFDEC from Member Countries
and other sources of funds for the year 2009 (In US\$)**

Sources	Secretariat	TD	MFRD	AQD	MFRDMD	Total	
						In US\$	%
Brunei	7,000					7,000	0.1
Cambodia	6,000					6,000	0.1
Indonesia	26,000					26,000	0.3
Japan	280,000					280,000	3.3
Lao P.D.R.	4,000					4,000	0.1
Malaysia	10,000				1,367,516	1,377,516	16.0
Myanmar	10,000					10,000	0.1
Philippines	15,000			3,231,018		3,246,018	37.9
Singapore	8,000					8,000	0.1
Thailand	20,000	2,196,030				2,216,030	25.8
Vietnam	14,000					14,000	0.2
Sub-total	400,000	2,196,030		3,231,018	1,367,516	7,194,564	84.0
Other Sources ^{1/}	85,758	371,214		910,932		1,367,904	16.0
Total	485,758	2,567,244		4,141,950	1,367,516	8,562,468	100

Remark:

^{1/} Other sources of contribution include: bank interest; gain/loss of exchange rate; contribution from donors directly to Departments and miscellaneous incomes

Other sources of contribution received by SEAFDEC in the year 2009 (In US\$)

	Amount in US\$ ^{1/}
Fisheries Agency-Japan(TF-II)	753,186
Fisheries Agency-Japan (TF-IV)	710,389
Swedish International Development Cooperation Agency (Sida)	387,330
Total	1,850,905

Remark:

^{1/} The figure includes the other sources of contributions which are not reported in the SEAFDEC Financial Statement.