

## **SEAFDEC IN SUPPORTING TO AQUACULTURE PROGRAMS IN SOUTHEAST ASIA COUNTRIES**

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### **I. BACKGROUND AND RATIONALE**

The Southeast Asian Fisheries Development Center (SEAFDEC) is an autonomous intergovernmental body established as a regional treaty organization in 1967 to promote sustainable fisheries development in Southeast Asia. SEAFDEC has a Secretariat as its administrative arm, and four technical departments including the Training Department (TD), which is in Thailand, the Marine Fisheries Research Department (MFRD) is in Singapore, the Aquaculture Department (AQD) is in the Philippines, and the Marine Fisheries Resource Development and Management Department (MFRDMD) in Malaysia.

SEAFDEC focuses on developing fisheries potential through training, research and information services to secure the food supply by rational utilization and sustainable development of the fisheries resources within the region. Its Member Countries are Brunei Darussalam, Cambodia, Indonesia, Japan, Lao PDR, Malaysia, Myanmar, the Philippines, Singapore, Thailand and Vietnam.

With concern of aquaculture in the region, AQD was established to develop aquaculture potentials of the region with four research stations covered marine, brackishwater, and freshwater areas. AQD has carried out research, technology verification, training and information programs on several aquaculture aspects, e.g., managing broodstock and improving seed quality, developing responsible aquaculture techniques, stock enhancement.

In 2001, the Ministers and their senior officials responsible for fisheries of the ASEAN-SEAFDEC Member Countries adopted the “*Resolution and Plan of Action on Sustainable Fisheries for Food Security for the ASEAN Region (RES & POA)*”, at the ASEAN-SEAFDEC Conference on Sustainable Fisheries for Food Security in the New Millennium: “Fish for the People”. The RES & POA are recognized as the common regional policy framework and guidelines in promoting and ensuring sustainable fisheries in the region. The Resolution in relation to aquaculture is cited as follows;

“Increase aquaculture production in a sustainable and environment-friendly manner by ensuring a stable supply of quality seeds and feeds, effectively controlling disease, promoting good farm management and transferring appropriate technology.” (No. 12)

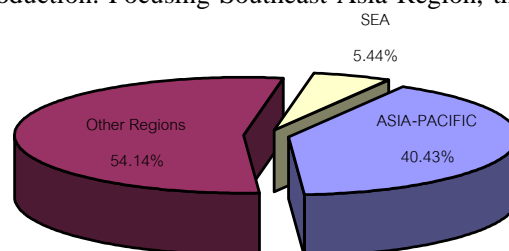
“Promote aquaculture for rural development, which is compatible with the rational use of land and water resources, to increase fish supplies and improve the livelihoods of rural people.” (No. 13)

## II. STATUS OF SOUTHEAST ASIA AQUACULTURE PRODUCTION

### 2.1 Reviewing the marine/coastal aquaculture production

In 2003, the world marine/coastal aquaculture production is 59,354,268 ton while Asia-Pacific produced 27,222,394 ton sharing 45.86% of world production. Focusing Southeast Asia Region, the production is 3,227,634 ton which sharing 5.44%.

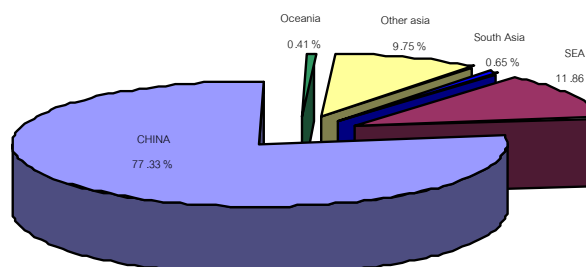
Area	Production	Percentage
World	59,354,26	-
Other regions	32,131,874	54.14%
Asia-Pacific	27,222,394	45.86%
Southeast Asia	3,227,634	5.44%



### 2.2 Marine/coastal aquaculture production in ASIA-PACIFIC region

For Asia-Pacific region, China (including Taiwan and Hong Kong) is the country shared the most of production. In 2003, China ranked first with 21,052,292 ton contributing 77.33% of the total regional production. Then, follow by Southeast Asian countries with 3,227,634 ton or 11.86% while Other Asia (Japan, Korea, Mongolia, Iran etc.) was placed third with a production of 2,655,083 ton or 9.75%. The South Asia covering India, Bangladesh Nepal, Sri Lanka, Maldives shared only 0.65% follow by Oceania 0.41%.

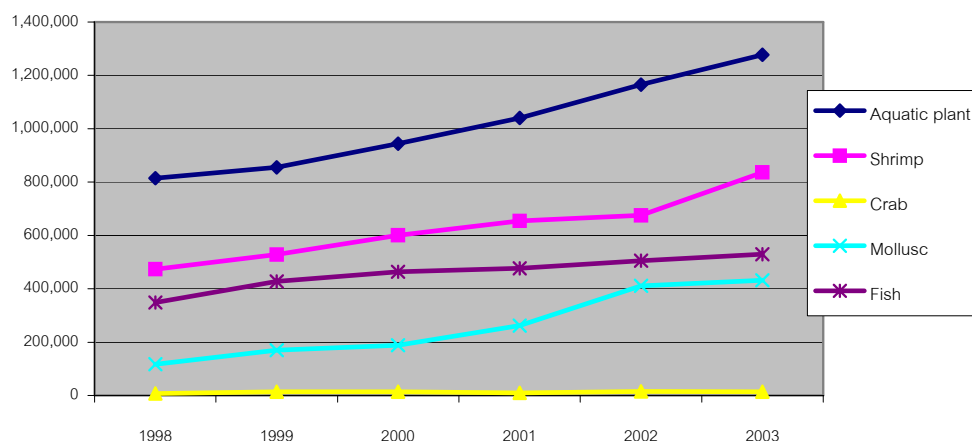
Sub-region	Production	Percentage
China	21,052,292	77.33%
Southeast Asia	3,227,634	11.86%
Other Asia	2,655,083	9.75%
South Asia	175,796	0.65%
Oceania	111,589	0.41%



### 2.3 Highlighted cultured marine species in Southeast Asian Region

During 1998-2003, aquatic plant ranked the first in terms of quantity and the production has been continuously increased, 56.83% comparing with 1998. The second group is shrimp and its trend is also has been increased. Comparing with the year 1998, shrimp production increased 76.69%.

The production of marine fish placed the third with slightly increasing trend, 52% comparing with 1998. The lowest production is crab, however, 6-year trend show the development of production with 76.69% increase.



Species	1998	1999	2000	2001	2002	2003	% Increase
Aquatic plant	814,546	855,179	943,391	1,040,631	1,165,458	1,277,460	56.83
Shrimp	473,252	528,039	600,704	654,352	675,009	836,183	76.69
Crab	7,259	13,828	14,088	10,294	15,479	13,945	92.11
Mollusc	117,281	170,117	188,101	261,633	410,740	432,295	90.16
Fish	348,232	427,706	464,275	477,428	505,473	529,285	51.99
<b>TOTAL</b>	<b>1,760,570</b>	<b>1,994,869</b>	<b>2,210,559</b>	<b>2,444,338</b>	<b>2,772,159</b>	<b>3,089,168</b>	

### III. SEAFDEC IN SUPPORTING TO AQUACULTURE PROGRAMS IN THE SOUTHEAST ASIAN REGION

#### 3.1) Plan of Action for Aquaculture Activities

Considering Aquaculture is one of the priority issues in the region, accordingly the senior official adopted the Plan of Action which includes Aquaculture Component to be used as a guideline to develop programs, projects and activities for the implementation of the Resolution as follow:

- 1.) Ensure that national policies and regulatory frameworks on aquaculture development are directed toward sustainability and avoidance of conflicts by incorporating consultations with stakeholder groups, implementing aquaculture zoning, considering social and environmental impact, and also regulating rights of access to, and use of, open water sites for mariculture.
- 2.) Ensure production of high quality seeds on a consistent and sustainable basis by providing government support for public and private hatchery development and research, developing domesticated broodstocks and fish reproductive technologies, and promoting responsible collection and use of wild broodstock and seed.
- 3.) Promote good farm management practices that reduce effluent pollution load and comply with relevant effluent standards through appropriate treatment.
- 4.) Reduce the risks of negative environmental impacts, loss of biodiversity, and disease transfer by regulating the introduction and transfer of aquatic organisms in accordance with the Regional Guidelines on the Responsible Movement of Live Aquatic Animals and Plants.
- 5.) Improve the efficient use of aquatic feeds by regulating the quality of manufactured feed and feed ingredients, providing guidelines on farm-level food conversion ratios and levels of aquaculture effluents, and supporting research into developing suitable alternative protein sources to reduce dependence on fish meal and other fish based products.
- 6.) Improve capabilities in the diagnosis and control of fish diseases within the Region by developing technology and techniques for disease identification, reliable field-side diagnostics and harmonized diagnostic procedures, and establishing regional and inter-regional referral systems, including designation of reference laboratories and timely access to disease control experts within the Region.
- 7.) Formulate guidelines for the use of chemicals in aquaculture, establish quality standards and take measures to reduce or eliminate the use of harmful chemicals.
- 8.) Build human resource capabilities for environment-friendly, healthy, wholesome and sustainable aquaculture through closer public and private sector collaboration in research and development, paying particular attention to the emerging need for skills in biotechnology, and effectively implementing aquaculture education and extension services.

9.) Promote aquaculture as an integrated rural development activity within multiple-use of land and water resources available through inter-agency coordination in policy formulation, project planning and implementation, stakeholder consultation, extension services and technology transfer.

### **3.2) Implementation of SAFDEC Program**

Along line with the RES & POA, SEAFDEC launched various regional programs to support the Member Countries. The programs and their activities in relation to marine and coastal aquaculture are summarized as follow:

#### **Promotion of Mangrove-friendly Aquaculture in Southeast Asian Countries: Mangrove-Friendly Shrimp Culture Project (2000-2005)**

Shrimp culture has been identified as one of major courses in the destruction of mangrove forest and effluents from intensive shrimp culture resulted in negative impact on the mangrove ecosystem. Thus, the Program was initiated with the aims to develop sustainable culture technology packages on shrimp farming that are friendly to mangroves and the environment, and to disseminate such packages to the region through actual demonstration and training.

As part of the Program, the verification and refinement of intensive shrimp culture techniques were conducted in Thailand and Philippines whereas the similar activities for semi-intensive culture were run in Vietnam and Myanmar. In Thailand, it is covered study the physical and biological technology for water recycling which the resulted indicated that an integration of bivalves, tricking filter and seaweeds is recommended for effluent treatment. The reason is that bivalves could improve the effluent water's suspended matter while seaweeds have the potential ability to absorb dissolved nutrients. The series of study also demonstrated the seawater irrigation facility to ensure the proper release of water from shrimp pond to the sea as well as plantation for enhancing food web in water recycling shrimp farms. It served as basis for the estimation of suitable density of mangrove trees and suitable species of weeds preventing erosion of pond dike.

The environment-friendly schemes verified in the Philippines sites are capable of achieving high productivity and return of investment. The activity in Vietnam aimed to develop a model for semi-intensive culture and demonstrate system that can effectively increase production. In Myanmar, the project aimed to promoting the most appropriate culture system that could avoid occurrence of viruses and disease in shrimp.

SEAFDEC also conducted the researches to studies the nutrients dynamics, environmental impacts and waste inputs resulting from an integrated closed recirculating intensive farming system. Under the theme of nutrient research, the study to assess the capacity of mangrove forests to process aquaculture pond effluents was conducted. The results confirmed the efficacy of fish as bio-manipulator in a green water system to control potentially pathogenic luminous bacteria in shrimp culture.

A lot of trainings under the scope of mangrove-friendly shrimp aquaculture were conducted both in regional and national levels. The on-site trainings were conducted in Vietnam, Myanmar and Cambodia. The information as the outcome of the meetings/consultations was published as well as the manuals and publications of project achievements were disseminated to the public.

#### **Development of Fish Disease Inspection Methodologies for Artificially-bred Seeds (2000-2005) Development of Fish Disease Surveillance System (2005-2008)**

Antibiotic and other chemicals are often used to control fish disease; however, some of these are harmful to human health and could give rise to resistant pathogens in cultured organisms. Therefore, the aquaculture products must be safe for human consumption and a monitoring system for the presence of chemical residues in such product need to be developed. The Program was developed with the aimed to enhance disease diagnosis and health management of cultured animal, to promote the

healthy and wholesome trading of aquaculture products, and to develop a fish disease surveillance network in the region.

SEAFDEC succeeded in conducting the research to establish and standardize diagnostic techniques for a) white spot syndrome virus (WSSV) using PCR to tiger shrimp, b) cell lines for detection of disease viruses focusing on viral nervous necrosis (VNN) of marine fish; and c) two of serious pathogens infected in tiger shrimp – monodon baculovirus (MBV) and hepatopancreatic parvovirus (HPV). Biology and pathogenesis of disease agents was also studied to screen economically important fish for the presence of parasites and to determine diagnosis and pathology of infection. Some parasites were detected and identified from grouper, snapper, milkfish, and rabbit fish.

After studies on the diagnosis method and parasites, the results contributed to establishment of disease prevention and control method. The research studies on Luminous vibriosis, major bacterial disease of tiger shrimp, with intention to develop husbandry techniques such as the use of live bacteria (probiotic) and green water culture system, as alternatives for chemotherapy to control vibriosis. SEAFDEC established the evaluation methods for residual chemical in aquaculture products. The activity addressed the development and standardization of detection methods of residual chemical, especially pesticides and antibiotics, in aquaculture products. The usage of antibiotics in shrimp culture was also monitored.

The hands-on trainings on the important viral disease of shrimp and marine fish were conducted in collaboration with Office International des Epizooties (OIE). Various meetings and symposiums were organized under the Program to share the most current experience and knowledge on the fish disease issues.

As the next-step of fish disease works of SEAFDEC, the Program on **Development of Fish Disease Surveillance System** was developed and contributed from the experiences of the former program. Its objective is to develop a surveillance system for diseases of aquatic animal in Southeast Asia. Highlighted activities are follows;

- a) Research and development on the refinement of diagnostic methods and development of new prevention methods for aquatic animal disease;
- b) Surveillance for important viral disease of fish and shrimp and ‘*Mobile Clinics*’ to identify causative agents of serious or unknown infectious disease; and
- c) E-learning and hands-on training

In 2005, as part of research and development, surveys and collection of white shrimp sample have been conducted to monitor virus in Indonesia and the Philippines. The first sampling of rock oyster was taken in Thailand to be focused on notifiable OIE parasitic disease as well as the presence of macro-parasite. For disease diagnosis activities, they were implemented in Myanmar, Cambodia, and Vietnam for sample collection of tiger shrimp. The samples from Myanmar were positive for MBV and HPV while negative for others.

### **Regionalization of the Code of Conduct for Responsible Fisheries: Aquaculture Development**

After the adoption of the Code of Conduct for Responsible Fisheries (CCRF) in 1995, the need to regionalize the Code was to examine, clarify and elaborate the generic articles of the global CCRF by establishing a set of guidelines considering regional specificities including fishery structure, ecosystems, cultural, social and economic factors as well as issue of importance in Southeast Asia. Further, the regionalization process shall also facilitate the implementation of the CCRF at national level where it is matters most.

In aspect of aquaculture development, the Program successfully implemented in terms of formulation and dissemination of ‘*Regional Guidelines for Responsible Fisheries in Southeast Asia: Responsible Aquaculture*’. It was based on Article 9 of the CCRF, which aims to forestall or mitigate the negative effects of aquaculture, both human and ecosystem. The regional necessary requirement to promote the

implementation of responsible aquaculture was accommodated in the Guidelines. Due to the fact that aquaculture farms in the region are generally small, the Guidelines also provide the specific guidance for efficient use of inputs (fry, broodstock, feed, etc.) to improve production and facilitate responsible practices.

In this particular, the Guidelines elaboration was made on the following thematic areas;

- Responsible development of aquaculture, including culture-based fisheries, in areas under national jurisdiction;
- Responsible development of aquaculture, including culture-based fisheries, within transboundary aquatic ecosystems;
- Use of aquatic genetic resources for purposes of aquaculture including culture-based fisheries; and
- Responsible aquaculture at the production level.

**Integrated Regional Aquaculture Program (IRAP):  
Aquaculture for Rural Development and Supply of Good Quality Seeds (2000-2005)**

In response to the need for promotion of sustainable aquaculture in the region, the Program was initiated to assure a supply of quality seed stocks of various aquatic commodities, and to assure aquaculture development will benefit the rural populace through consultations, demonstration, and dissemination of specific aquaculture technologies.

*Aquaculture for Rural Development* expected to come up with appropriate responsible aquaculture technologies that will help alleviate poverty and ensure food security for people in the rural areas. The other called *Supply of Good Quality Seeds* focusing on appropriate responsible seed production technologies in support of the aquaculture and stock enhancement program in the region. These two components of IRAP were implemented together with the linkage of each other. The activities under IRAP covered pilot demonstration, research, training, and information dissemination. The beneficial countries expressed their interests in specific aquatic species for the implementation. Although most priority activities identified by ASEAN countries given to freshwater; however, marine species were selected as interest of Malaysia, Myanmar, Thailand and Vietnam.

Grouper, seabass and mud crab were selected species to be conducted for both activities in Myanmar aiming at utilizing the coastal and marine resources for aquaculture in order to alleviate the social economy of the rural communities. Vietnam considered milkfish and siganids as priority for both activities aiming at promoting the adoption of their culture technologies in coastal areas. Malaysia focused on production of disease-free grouper with the aims at producing such groupers seeds by improving broodstock management while Thailand interested in cage culture of abalone and babylonia shell were identified as interest in the view of aquaculture for rural development. The latter activity aimed to study the growth, survival rate, and FCR of the cultured species in order to assess the possibility of extending the techniques to fishers in coastal areas.

**Broodstock Management and Seed Quality Improvement of Cultured Species; and  
Development of Responsible and Sustainable Aquaculture Techniques**

The Program on *Broodstock Management and Seed Quality Improvement of Cultured Species* address problem areas related to broodstock management, genetic improvement, and improvement of hatchery production technologies of major cultured species. The other called *Development of Responsible and Sustainable Aquaculture Techniques* aims to develop sustainable aquaculture technologies with minimum impact on the ecosystems by promoting efficient aquaculture systems and designs for maximum sustainable productivity. With concern on the linkage of these two programs in working out problem areas of specific commodities, the studies implemented in term of species groups covering abalone, mud crab, shrimp, and marine fish.

### **1) Integrated Abalone Production**

This consists of four components; a) seed production to study the enhancement of natural flora conducive for settlement and microbial communities; b) intermediate culture to assess the economic viability of land-based nursery in tanks as well as the technical and economic viability of open-water nursery in cages; c) grow-out culture in bottom-set and suspended cages; and d) stock enhancement to evaluate the result of SEAFDEC stock enhancement trials conducted earlier.

### **2) Mud Crab Seed Production**

The Program has the following objectives: a) to refine broodstock management and hatchery-nursery techniques; b) to develop production of mud crab juveniles from hatchery-produced megalopae as a new industry; c) to determine populations and fisheries to quantify growth, migration and mortality rates of *Scylla* species; and d) to develop mangrove pond aqua-silviculture production systems and trials of stock enhancement through release of hatchery-reared juveniles into mangrove habitats.

### **3) Shrimp Domestication**

The Program aims to produce broodstock of native shrimp species, *Penaeus monodon*, *P. indicus*, and *P. merguensis*, genetically selected for desired heritable traits. Specifically, it is expected to come up with the a) technology development to produce viable *P. monodon*, *P. indicus* and *P. merguensis* broodstock in captivity and determine its economic viability; b) evaluation of the commercial viability of *P. indicus* and *P. merguensis* hatchery and; c) technology development for production of known live feed for shrimp broodstock such as the brine shrimp and marine polychaetes.

### **4) Marine Fish Seed Production**

This aims a) to develop, refine and package marine fish seed production technologies; b) to test the economic feasibility of marine fish seed production; c) to develop and improve broodstock diets of marine fish; and d) to develop test kits for egg/larval quality and VNN diagnostics. The activities in relation to marine and coastal aquaculture includes;

- Pathogenesis and control of sub-clinical infection of VNN in broodstock of grouper.
- Insulin-like growth factor II as molecular markers for egg quality in finfish and mud crab
- Reproductive and larval performance of rabbitfish

### **Research and Development of Stock Enhancement for Species under International Concerns: Stock Enhancement for Threatened Species of International Concern (2005-2009)**

Heightened public interest in environment protection and resource conservation has become an important factor in fisheries development. To address the environmental concerns particularly threatened or endangered species, SEAFDEC undertaken the Program with the aims to develop ecologically sound strategies for stock enhancement including hatchery production and release of genetically diverse and disease-free juveniles. It is also expected that stock enhancement technologies and social strategies will be transfer to the countries in the region.

The Program initially focus on depleted species for which hatchery technologies have already been developed. The activities included: a) Regional Workshop to review the status of stock enhancement in Southeast Asia, identify threatened species, and assess the existing technologies for such species; b) Research on strategies for sea ranching and stock enhancement; c) Verification of developed and established technologies; and c) Training and information dissemination on stock enhancement.

In 2005, the consultation was organized and the two of identified species, which have potential to implement are abalone and seahorse. As part of research and development, seed production of abalone and its marking has been conducted in AQD. The assessment of potential site for stock enhancement for abalone and seahorse has been implemented.

### **3.3) Collaboration with other organizations**

#### **1) Research Institutes and University in Philippines**

The collaborative program on *Aquaculture Biotechnology* implemented under cooperation with National Fisheries Research and Development Institute (NFRDI), Mindanao State University (MSU), University of the Philippines in the Visayas (UPV), and the University of Eastern Philippines (UEP). It aims to develop a) methods for enhancing growth and reproduction in commercially important aquaculture species; b) superior stocks for aquaculture; and c) rapid diagnostic techniques for fish diseases. The program implemented in form of training course to transfer the knowledge and skill in specific issues in relation to the aquaculture biotechnology.

#### **2) Private Sector and Concerned Government Agencies in Philippines**

With collaboration from above agencies, the program on *Technology Verification and Dissemination Program* was developed aiming at fast track the commercialization of environment-friendly aquaculture technologies on economically important culture species, i.e. shrimp, crabs and groupers. This is done through demonstration and hands-on training on technical and economic viability and sustainability of the technologies in the Philippines and also in other member countries. The program intensifies technology transfer activities for sustainable aquaculture to improve fish production, generate employment, livelihood and export revenues.

#### **3) WorldFish Center and Bureau of Fisheries and Aquatic Resource of the Philippines**

With supports from both mentioned agencies, the program on *Dissemination and Adoption of Milkfish Aquaculture Technology in the Philippines* has been implemented to analyze the production, market and policy structures of the milkfish industry in the Philippines in order to identify the constraints and opportunities for the future growth of the industry with emphasis on the adoption and impact of technological development. Case studies in hatchery and grow-out production systems and documented for transfer or replication in other parts of the Philippines.

#### **4) ASEAN (ASEAN Foundation through ASEAN-Japan Solidarity Fund)**

The collaborative program with ASEAN, presently, focuses on human resource development (HRD) aspect. The Program on *HRD for Sustainable Development Fisheries in Brunei Darussalam-Indonesia-Malaysia-Philippines East ASEAN Growth Area (BIMP-EAGA) Region* implemented in the beginning stage in March 2005. SEAFDEC launched this project which covered the area of HRD in aquaculture. A series of in-situ Participatory Workshops shall be conducted in the identified localities of the BIMP-EAGA region. Target participants are front-line fisheries or agriculture officers assigned to promote and assist in aquaculture development at the local level. In December 2005, SEAFDEC has successfully implemented the Participatory Workshop for Responsible Aquaculture for Fisheries Officers from the Sabah, Malaysia. The topics covered included Responsible Aquaculture Development, Mangrove-friendly Shrimp Culture, and Marine Fish Culture in Cages, Mangrove Crab Culture, Seaweed Culture and Mollusc Culture.

Another Program on *HRD on Poverty Alleviation and Food Security by Fisheries Intervention in the ASEAN Region* is planned to implement in the year 2006. The objective of this project is to enhance human capacity of both relevant fisheries government agencies and selected rural fishery communities so as to alleviate the identified poverty status through fisheries intervention covering the areas of rural aquaculture. A special focus will also be given to the areas for the rural poor and communities affected by the tsunami disaster in ASEAN region. The envisaged activities will be to further identify the specific requirements of the HRD issues in each respective site. Various simple technologies to develop the rural small sized aquaculture will be trained to the participants for their better understanding of the issues.



### **3.4) Future operations:**

In order to support the Member Countries, SEAFDEC shall effectively continue the implementation to be in line with regional priority issues and needs, particular on the scope of rural development and sustainable aquaculture development contributing to poverty alleviation. The programs also be operated in terms of research and development, transferring knowledge and technology, as well as training and disseminating the information. The future programs are included:

Regional priorities cover.

- Development of Fish Disease Surveillance System;
- Promotion of Sustainable Aquaculture for Rural Communities;
- Research and Development of Stock Enhancement for Species under International Concerns;
- Broodstock Management and Seed Quality Improvement of Cultured Species
- Development of Responsible and Sustainable Aquaculture Techniques
- Research and Analysis of Chemical Residuals and Contamination in Fish, Fish Products and the Environment such as Fishing Ground and Aquaculture Field

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