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20 Years of Aquaculture Research and Development

An Anniversary Souvenir Volume
July 9, 1993





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Greetings

F O R E W O R D

We are proud to say that during the past 20 years, SEAFDEC/AQD has become established as a leading aquaculture center in Southeast Asia. This achievement could not have become possible without the able leadership of the past Department Chiefs, namely: Dean Domiciano K. Villaluz, Dean Rogelio O. Juliano, Dr. Alfredo C. Santiago, Jr., and Dr. Flor Lacanilao, and the Deputy Chiefs, namely: Mr. Tatsuo Kawachi, Dr. Noboru Hoshino, Mr. Kunio Katsutani, Dr. Yasuhiko Taki, and Mr. Satoru Fukumoto, and the full support of the entire staff — from the Division Heads to the Aides, the expatriate researchers, and the consultants. They have contributed in one way or another in making SEAFDEC/AQD what it is today.

The invaluable support of officials who served as SEAFDEC Council of Directors, SEAFDEC Secretary-General, or as Chiefs of the other SEAFDEC Departments made SEAFDEC/AQD's existence significant. We thank them for their confidence in SEAFDEC/AQD in spite of the intermittent political odds.


The continued technical and financial support of the Government of the Philippines, the Government of Japan, and the other collaborating countries and agencies enabled SEAFDEC/AQD to accomplish more. To them we extend our gratitude.

As we enter our third decade, let us look forward with more dedication in our respective tasks and with more determination to make SEAFDEC/AQD the great institution we hope it to be. Let us work together to gain further recognition, accomplish more, and attain sustainable aquaculture development in the region.

Let us continue our campaign for the generation of technologies that have the least ecological effects, give equitable benefits to society, and are sustainable. In implementing research and development projects, let us not forget the fisherfolk, the traditional users of our aquatic resources who are the most affected when the environment is sacrificed for the sake of progress.

In the next decade, SEAFDEC/AQD will implement a multidisciplinary approach to research and development, involving not only natural scientists but also social scientists and the fisherfolk, for better understanding and sustainable utilization of our aquatic resources. We therefore seek everybody's continued cooperation to enable us to attain our goals.

For past cooperation and unstinted support, we dedicate to all concerned this publication commemorating the 20th Anniversary of SEAFDEC/AQD.



EFREN ED. C. FLORES
Department Chief



SOLCHIRO SHIRAHATA
Deputy Department Chief







**MALACAÑANG
MANILA**

MESSAGE

As a region of many island nations, Southeast Asia boasts of a rich aqua and marine life that has been a bountiful source of vital benefits such as food, fuel, livelihood, medicine and other material needs. The life-sustaining capacity of these resources, however, must be managed, developed and enhanced if Southeast Asian nations and their peoples are to continue benefitting from them.

The Philippines in particular has over a million Filipino fisherfolk dependent on small-scale capture fishery for a living. Sadly, however, a survey of agricultural and fishery workers reports that sustenance fishers are among the country's poorest of the poor.

It is therefore with much interest and enthusiasm that I view the work of SEAFDEC/AQD in the Philippines. As one of the four key departments of a regional treaty organization that is mandated to develop the fishery potentials of the region, the SEAFDEC/AQD plays a significant role in assuring the proper and effective development of these resources by promoting and undertaking aquaculture research relevant and appropriate for the region. In addition to its research activities, the SEAFDEC/AQD continues to develop and train human resources for aquaculture development in the region and to disseminate and exchange information on aquaculture.

On the occasion of SEAFDEC/AQD's 20th anniversary, I reaffirm my confidence in SEAFDEC/AQD as a vital force not only in building goodwill and exchanging knowledge and expertise among Southeast Asian nations and peoples but more importantly, in securing a better life for our peoples through aquaculture research, training and information. I trust that through SEAFDEC/AQD, we shall soon see our fishery resources better managed, our fish stocks revitalized, and our fisherfolk and their families more prosperous and progressive.

Congratulations and best wishes to SEAFDEC/AQD.

MABUHAY KAYONG LAHAT!

FIDEL V. RAMOS

**EMBASSY OF JAPAN
MANILA**



M E S S A G E

It is indeed my pleasure to congratulate the Aquaculture Department of the Southeast Asian Fisheries Development Center on the occasion of their 20th anniversary.

Since its founding in July 1973, the SEAFDEC/AQD has established itself as the only regional institute in the field of aquaculture. The activities of this organization have been praised by various private, national and international research institutes including the United Nation's Food and Agriculture Organization (FAO). I would like to take this opportunity to express my regard for the efforts made over the past 20 years by the staff of the SEAFDEC/AQD with the close cooperation of the Philippine government.

As you are well aware, the Philippines is endowed with vast maritime resources which constitute the major source of protein for the Filipino people. The Philippines has a long tradition in aquaculture, i.e., milkfish and seaweed cultivation. In recent years, this country has successfully expanded this tradition to include shrimp cultivation. There is no doubt that the SEAFDEC/AQD has played a significant role in the success of these developments.

Since its inception, the Government of Japan has been cooperating with the SEAFDEC/AQD. Our cooperation, though, is not limited to financial assistance. We have made available our extensive research in the area of fisheries, dispatched experts, accepted trainees and provided training ships.

The past 20 years have experienced major changes in the fishing industry. The major goal of the industry has now become the proper management of maritime resources and its rational utilization in order to prevent depletion. International cooperation is the key to attaining this objective. In this regard, the SEAFDEC/AQD, as a regional organization, will undoubtedly play an increasingly significant role in the field of aquaculture.

In closing, allow me to wish the SEAFDEC/AQD continued success in its worthwhile endeavors.

A handwritten signature in black ink, appearing to read 'H. Arai', written in a cursive style.

HIROKAZU ARAI
Ambassador of Japan to the Philippines



Republic of the Philippines
DEPARTMENT OF AGRICULTURE
Office of the Secretary
Elliptical Road, Diliman, Quezon City

M E S S A G E

My warmest greetings to SEAFDEC/AQD on its 20th anniversary.

For the past 20 years, SEAFDEC/AQD has indeed proven its competence in leading the aquaculture industry to what it is today.

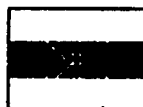
As the government agency mandated to oversee the development of the agricultural and fishery sectors, we at the Department of Agriculture are encouraged by the initiative and leadership of SEAFDEC/AQD.

We hope that your efforts will continuously complement and strengthen our programs which address the poverty of our artisanal fisherfolk, increase our food supply, and maintain ecological balance.

I wish you a more fruitful year ahead.



R. Sebastian
ROBERTO S. SEBASTIAN
Secretary



FISHERIES AGENCY
MINISTRY OF AGRICULTURE, FORESTRY AND FISHERIES, GOVERNMENT OF JAPAN

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MESSAGE

In behalf of the Government of Japan, I would like to express my heartfelt congratulations to the Aquaculture Department (AQD) in the Philippines on its 20th anniversary.

AQD was established in 1973, following the establishment of the Training Department in Thailand and the Marine Fisheries Research Department in Singapore. AQD has achieved successful results in the improvement and diffusion of fisheries techniques for fish and shellfish aquaculture (e.g., shrimps, milkfish), and has greatly contributed to increasing the aquaculture production and improving the nutritional standard in Southeast Asia.

I would like to express my deep appreciation to the SEAFDEC Secretary-Generals, the staff of AQD, and the authorities concerned in the Government of the Philippines for supporting the activities of AQD.

The role of fisheries, as an important industry to supply protein for the growing population in the world, is becoming more and more important. In particular, aquaculture is recognized as an indispensable component of fisheries due to its significant role to reinforce productivity of natural resources. Therefore, AQD is also expected to play a more important role not only in increasing fisheries production but also in further developing technology which makes good use of the reproductive power of natural resources and which harmonizes with the surrounding environment.

SEAFDEC, which also celebrated its 25th anniversary last year, now stands at the crossroads to expand its organization and activities as an international agency for regional cooperation, facing the new membership of Vietnam and Brunei Darussalam. SEAFDEC should now consider policy coordination with other international organizations and opening its door to non-member countries in the Asia-Pacific region. I greatly hope SEAFDEC would share its expertise accumulated over the past twenty-five years with the wide-ranging countries in the region in the light of promoting the South-South cooperation, and seek ways to share prosperity.

There are limited number of countries which depend on fisheries in the world. We should appeal to the world about the need for preservation and rational utilization of marine fishery resources through mutual cooperation. In this sense, it is indeed expected that SEAFDEC should send the message to the world about what fisheries ought to be in the future.

Finally, with my profound respect for the achievements of AQD during the past twenty years, I sincerely hope for the continued growth of AQD and the whole SEAFDEC.



Kazuo Shima

KAZUO SHIMA

Chairman, SEAFDEC Council of Directors
Deputy Director-General, Fisheries Agency (Japan)



Republic of the Philippines
DEPARTMENT OF AGRICULTURE
Office of the Secretary
Elliptical Road, Diliman, Quezon City

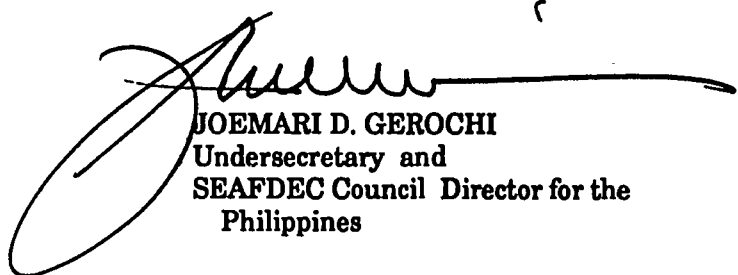
MESSAGE

I extend my warmest congratulations to the officers and staff of the Aquaculture Department as they celebrate their institution's 20th Anniversary.

It is a source of great pride that in the last two decades, the Aquaculture Department has developed modern and innovative aquaculture technologies that have helped transform this traditional occupation into a major industry, generating much business opportunities, food and livelihood, and export earnings not only for our country but also for the region.

As the past twenty years have witnessed, there have been many changes in the demography, trade patterns, and state of fishery resources and environment in the region. I then look forward to more intensive and expanded activities of the Department in aquaculture research and training. I am confident you shall prove equal to the challenge.

Again, congratulations!



JOEMARI D. GEROCHI
Undersecretary and
SEAFDEC Council Director for the
Philippines



**SOUTHEAST ASIAN FISHERIES DEVELOPMENT CENTER
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M E S S A G E

Becoming 20 years old is an important timemark for a person because in many countries, it is the legal beginning of an adult life. For an organization, the period of two decades is long enough for a thorough review of its work, performance, achievements, and perhaps shortcomings. It is also a time to recount and give recognition to work well done and for successful accomplishments.

As Secretary-General of this regional organization aiming to promote regional fishery development, I am very proud of the Aquaculture Department. The Department has made its name in the world's aquaculture circle as a forerunner in promoting new fish rearing techniques thereby helping to increase food resources, and of course good business. Its research work has been guided by the excellence and vision shown by the Department Chief, Division Heads, and the talented scientists who have largely been trained by or at the Department. Their work in development and extension has greatly benefitted SEAFDEC Member Countries, too.

Such accomplishments did not come easily, for without the understanding and continuing support of the donors and the SEAFDEC Member Countries, progress would have been much slower. I am most grateful to and thank the Government of Japan for its generous and uninterrupted financial and technical support to AQD since its establishment. I am also grateful to all other donor agencies and governments who have helped and collaborated in the field of common interest.

To AQD Chief Dr. Efren Ed. C. Flores, the Heads and the able staff of the Department, I can only say simply, thank you for your loyalty and hard work so that AQD may continue to enjoy the high status and favorable image it has today. May the 20th Anniversary be the beginning of AQD's fruitful decades to come. May this Anniversary be the occasion for all of us at SEAFDEC to spawn new hope for scientific innovations that enable man to generate an overflowing supply of food for the region.



Maitree Duangsa-wasdi

**MAITREE DUANGSAWASDI, PhD
Secretary-General and
Chief, Training Department**

**MARINE FISHERIES RESEARCH DEPARTMENT
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M E S S A G E

The Aquaculture Department celebrates its twentieth year with a truly impressive record of accomplishments. All staff members of the Marine Fisheries Research Department join me in sending our congratulations and to wish the AQD a truly happy 20th Anniversary celebration. The MFRD takes pride in its association with the AQD, and as a member of the Center, in sharing in some of its successes.

We note the many successes of the AQD, among which are the pioneering work in milkfish spawning and the completion of the life cycle of the tiger shrimp in its facilities. The consequent developments related to milkfish and algae culture in the Philippines have recently attracted worldwide attention. AQD has truly rendered a milestone service to the industry with these activities. These and many other interesting success stories are remembered on this occasion of AQD's 20th Anniversary.

We wish also to congratulate the staff of the AQD, who have equally successfully researched into the life cycles of warm water fish such as grouper, sea bass, and tilapia and of shellfish such as penaeid shrimp, oyster, and mussel, and are now preparing to research into other species important for the region. We hope that the industry will continue to benefit from the Department's findings.

As the AQD with the constant support of the Philippine Government carries on its excellent work, the MFRD joins in with all other well wishers to wish the Department even more success in its next 20 years, and to reaffirm our determination to cooperate in as many areas as possible.

Once again, congratulations and best wishes!



Hooi Kok Kuang
HOOI KOK KUANG
Department Chief

**MARINE FISHERY RESOURCES
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MESSAGE

I am honored to extend this congratulatory message on behalf of my colleagues of the Marine Fishery Resources Development and Management Department in this 20th Anniversary commemorative publication of the Aquaculture Department (AQD) of SEAFDEC. AQD has indeed strived to realize the vision of SEAFDEC in the research and development of aquaculture technologies in the region during the last 20 years since its formal establishment in 1973. The technological findings from the aquaculture research activities of AQD have contributed much towards the development of aquaculture in our region.

It is gratifying to note that the research programmes of AQD have responded well towards the needs of the aquaculture sector in this region as reflected by the evolution of its production oriented research activities in the early years to current ones which provides emphasis on sustainable aquaculture development through the use of environment-friendly technologies. AQD's strategy of developing environment-friendly aquaculture technologies with the participation of fisherfolk and traditional users of the aquatic resources as advocated by its current aquaculture research and development activities will certainly facilitate the acceptance, understanding and use of these new aquaculture technologies by the aquaculture sector.

In concluding, I would like to wish our colleagues in AQD further success in their future endeavours on the development of new aquaculture technologies that will contribute towards greater sustainable aquaculture development in the region.



A handwritten signature in black ink, appearing to read 'Lui Yeon Pong', written over a horizontal line.

LUI YEAN PONG
Department Chief



JAPAN INTERNATIONAL COOPERATION AGENCY

MESSAGE

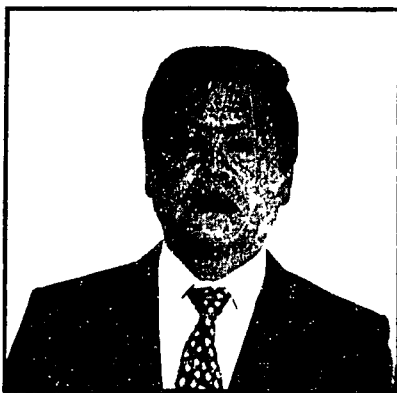
It is my pleasure to greet the Aquaculture Department of the Southeast Asian Fisheries Development Center (SEAFDEC) on the occasion of its 20th anniversary. This day is truly a milestone not only for the Aquaculture Department, but also for its relationship with the Japan International Cooperation Agency (JICA), for we have had a successfully continuing relationship based on cooperation in the form of expert assignment, training programs, and provision of technical equipment.

We at JICA are very glad to be part of this enduring relationship and, to assure the continuity of this dynamic partnership into the future, we wish to pursue new ideas that can further improve the level of cooperation in the field of aquatic resource development.

One of the possibilities of cooperation we are trying to explore is a regional training program at the Aquaculture Department of SEAFDEC. If this idea can be brought to fruition, it will be a good example of south-to-south cooperation, in lieu of the usual north-to-south technical cooperation programs.

As SEAFDEC enters its third decade, I sincerely hope that our respective organizations will pursue this harmonious relationship with renewed vigor.

Congratulations and mabuhay!



A handwritten signature in black ink, appearing to read 'M. Iijima', written in a cursive style.

MASATAKA IIJIMA
Resident Representative
JICA Philippines Office

JICA/ 12th Floor, Pacific Star Building, Sen. Gil J. Puyat Avenue Extension Corner Makati Avenue, Makati, Metro Manila, Philippines. P.O. Box 1026, MCPO, Makati, Metro Manila.
Tel.: 88-30-81



International Development Research Centre
Centre de recherches pour le développement international

MESSAGE

The International Development Research Centre (IDRC) of Canada wishes to congratulate the Aquaculture Department of the Southeast Asian Fisheries Development Center (SEAFDEC/AQD) for 20 years of aquaculture research and development. Through the years, IDRC has continued to be an active partner of SEAFDEC/AQD in pursuing aquaculture research and development efforts for the region. Among IDRC's most important collaborative projects with SEAFDEC/AQD was the milkfish research project (1975-1985) which resulted in major advances in milkfish culture. IDRC also assisted in the verification studies related to the spontaneous spawning of the milkfish in the various sites of the Philippines' National Bangus Breeding Program through SEAFDEC/AQD. IDRC also collaborated with SEAFDEC/AQD in the conduct of various training programs, seminars, workshops, and conferences. From 1984 to 1989, IDRC assisted SEAFDEC/AQD in its information dissemination activities through the Brackishwater Aquaculture Information System. Recently, IDRC's collaboration with SEAFDEC/AQD includes research projects in fish genetics, microbiology, seafarming, socio-economics, and mollusc culture.

As SEAFDEC/AQD enters its next decade, IDRC looks forward to a continuing mutually beneficial collaboration with SEAFDEC/AQD.

CONGRATULATIONS AND BEST WISHES!

ANDREW MCNAUGHTON
Senior Regional Program Officer
Environment and Natural Resources
Management

Regional Office for Southeast and East Asia/ Bureau Regional pour l'Asie du Sud-Est et de l'Est
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INTERNATIONAL FOUNDATION FOR SCIENCE
GREV TUREGATAN 19 • S-114 38 STOCKHOLM/SWEDEN

M E S S A G E

On behalf of IFS, I would like to congratulate SEAFDEC/AQD for the work it has done the past 20 years and express our best wishes for the future.

The International Foundation for Science (IFS) has a membership of 92 scientific academies and research councils in 79 countries, of which three-fourths are in developing countries. The Science Foundation of the Philippines became a Founding Member of IFS in 1972.

Since the IFS granting activities began in 1974, some 2,000 scientists in 93 developing countries have received research grants. With 107 scientists (45% are women) having received IFS grants, the Philippines is the country, after Nigeria, that has benefited more than any other.

Twelve of the grantees are located at SEAFDEC/AQD, and they studied various aspects of cultivating freshwater and saltwater fishes, and shellfish. The IFS grantees at SEAFDEC/AQD during the past 20 years are: Dr. Emmanuel Cruz, Dr. Felicitas Piedad-Pascual, Ms. Nipheronia Ogburn, Mr. Beato Pudadera, Ms. Isidra Tuburan, Dr. Enrique Avila, Mr. Luis Ma. Garcia, Ms. Gilda Lio-Po, Ms. Myrna Bautista, Dr. Relicardo Coloso, Dr. Arnil Emata, and Mr. Armando Fermin.

Research in the areas of Aquatic Resources is one of the areas supported within the IFS Granting Programme, together with Animal Production, Crop Science, Forestry/Agroforestry, Food Science, and Natural Products.

As SEAFDEC/AQD enters another decade of research and development, we at IFS look forward to more beneficial opportunities in the coming years.

BJORN LUNDGREN, PhD
Director



联合国
粮食及
农业组织

FOOD AND
AGRICULTURE
ORGANIZATION
OF THE
UNITED NATIONS

ORGANISATION
DES NATIONS
UNIES POUR
L'ALIMENTATION
ET L'AGRICULTURE

ORGANIZACION
DE LAS NACIONES
UNIDAS PARA
LA AGRICULTURA
Y LA ALIMENTACION

REGIONAL OFFICE FOR ASIA AND THE PACIFIC (RAPA)

Maliwan Mansion, Phra Atit Road,
Bangkok 10200, Thailand

M E S S A G E

It has been twenty years for you, AQD...
from inception to an institution that's full-grown.

You were like an early life of a child...
when "My Way" was sung as a lullaby.

You were sick and you cried,
'til the "Bridge Over Troubled Waters" was constructed...

Which later almost collapsed in flames
together with the yellow ribbons that were left unnoticed.

Do not shed tears and be mature,
for you are growing up and in bloom

The way we have always dreamed for you...
nearly twenty years ago.

Happy Birthday, AQD!



VERAVAT HONGSKUL
Regional Officer
(SEAFDEC Secretary-General, 1981-88)



For Fisheries Development
BAY OF BENGAL PROGRAMME



M E S S A G E

The Bay of Bengal Programme (BOBP) is a regional programme of the FAO. Its main component, the Small-scale Fisherfolk Communities in the Bay of Bengal, has as an ultimate goal, better life for the small-scale fisherfolk. BOBP seeks to achieve this goal by developing and demonstrating appropriate technologies in several areas of small-scale fisheries, such as fishing craft, gear, and aquaculture. BOBP also introduces new extension methodologies, provides development support, and runs an information service.

BOBP collaborates with SEAFDEC and SEAFDEC/AQD through exchange of information and technical consultation. BOBP hopes to continue this mutually beneficial collaboration in the years ahead.

On behalf of BOBP, allow me to congratulate SEAFDEC/AQD on its 20th anniversary.


L O ENGVALL
Programme Director

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MESSAGE

*The Intergovernmental Organization of the
NETWORK OF AQUACULTURE CENTRES IN ASIA-PACIFIC (NACA)
extends its best wishes for continuing success to the
AQUACULTURE DEPARTMENT OF SEAFDEC*

We take this occasion to record NACA's gratitude to the Department for the outstanding contribution that it had given to the Network, as the Regional Lead Centre in the Philippines (RLCP) under the NACA Project, and to the sustained collaboration that it currently extends to the NACA Organization.

As NACA's RLCP, the Aquaculture Department implemented among others the Senior Aquaculturists Course from 1980-81 through 1987-88, in collaboration with the University of the Philippines in the Visayas. This one-year course graduated 187 senior personnel mostly from the Asia-Pacific Region. On behalf of the alumni of this course — many of whom are occupying highly responsible posts in government, private enterprise as well as in regional and international agencies or projects — NACA congratulates the Department and its leadership and staff for continuing to carry on a highly relevant manpower development programme for aquaculture personnel at all levels and intensifying its research and development activities for the overall benefit of the peoples of the region.

We also would like to record our appreciation to the Government of the Philippines for its continued participation in NACA activities. This has further enhanced the technological resources available to more countries in the region through the regional activities coordinated by NACA which are mainly based on Technical Cooperation among Developing Countries.

Operating along the same principle of regional cooperation, NACA and SEAFDEC have shown that this approach is an efficient and economical way to expand the development of both regional and national aquaculture — a significant and timely consideration in view of the increasing interdependence of countries in the development and management of aquatic resources, and the need to further cement regional solidarity and foster self-reliance.

Finally, with the "can do" outlook of the current leadership of the Government of the Philippines, NACA believes that the Aquaculture Department will achieve greater productivity to continue to provide more benefit to the people.

BANCHONG TIENSONGRUSMEE
NACA Coordinator



Coastal Resource Research Network



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M E S S A G E

The Coastal Resource Research Network wishes to congratulate the Southeast Asian Fisheries Development Center Aquaculture Department for 20 years of service to the research and development of aquaculture in the ASEAN region.

SEAFDEC continues to be an important player in the development and extension of technologies to face the needs of aquaculture in the 1990's. Current problems demand innovative and multidisciplinary approaches which are being met by SEAFDEC. The Second Mollusc Culture Network Meeting and Workshop on Participatory Research Methods for Coastal Resource Development was held in Iloilo City in October 1992 with the assistance of the friendly and helpful staff of SEAFDEC/AQD.

We look forward to continuing our association with SEAFDEC/AQD. Best wishes!

GARY NEWKIRK
Network Coordinator

BECKY FIELD
Network Administrator



MESSAGE

We are pleased to extend our best wishes to the Aquaculture Department of SEAFDEC on its 20th anniversary.

Since 1976, the Laboratory of Aquaculture and the Artemia Reference Center of the University of Ghent, Belgium has collaborated with your Institute. We are looking forward to continue this fruitful collaboration with the new project on larviculture sponsored by the Belgian Administration for Development Cooperation. Furthermore, we look forward to have more SEAFDEC students for postgraduate studies at our university.

On behalf of all staff, researchers, and technicians of the ARC, congratulations!

DR. PATRICK LAVENS
Research Coordinator

PROF. DR. PATRICK SORGELOOS
Director

Artemia Reference Center
State University of Ghent
Rozier 44, B - 9000 Ghent, Belgium



M E S S A G E

On behalf of all the staff at The Oceanic Institute, we congratulate SEAFDEC on its 20th anniversary. We are pleased with your success and wish you the best for the next twenty years.

The start of the new decade for The Oceanic Institute was paralleled by the beginning of many new and far-reaching projects for our organization. Our research programs have brought to light new developments which lead us closer to our goal of supporting the growth of commercial aquaculture both domestically and abroad.

The Oceanic Institute, now entering its 33rd year of research, is well on its way to completing the new facilities that will comprise the Center for Applied Aquaculture. Through this expansion we become one of the world's largest aquaculture research organization with an applied focus and a commercial orientation. The design and operation of the center will make it an exceptional facility to assist in the expansion of commercial aquaculture.

During this past year, we have had the pleasure of seeing professionalism and growth in numerous companies and organizations in the aquaculture industry. As we approach the year 2000, the business of aquaculture will begin to realize its potential in terms of new trade, increased production, and improvements in technical efficiency. By targeting all aspects of commercial aquaculture research and development, from conception to applied training, The Oceanic Institute plays a major role in an evolving aquaculture industry.

We are looking forward to another year of excitement, change and opportunities, and would like to express our appreciation for all who have contributed to our successful efforts in the past.



W.C. ROWLAND
President



INTERNATIONAL CENTER FOR LIVING AQUATIC RESOURCES MANAGEMENT
MC P.O BOX 1501, MAKATI, METRO MANILA 1299, PHILIPPINES

MESSAGE

*Congratulations to SEAFDEC/AQD
on its 20th Anniversary from all of us at ICLARM*

SEAFDEC and ICLARM have a Memorandum of Agreement under which the AQD is a member of the Asian Fisheries Social Science Research Network, coordinated by ICLARM and funded by IDRC. ICLARM greatly benefits also from an information exchange agreement with SEAFDEC/AQD.

We hope to continue such cooperation and increase it as opportunities arise in the future.

Mabuhay!

A handwritten signature in black ink, appearing to read 'Basilio M. Rodriguez, Jr.' with a stylized flourish at the end.

BASILIO M. RODRIGUEZ, JR.
Officer-in-Charge

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Tips TECHNOLOGICAL
INFORMATION
PROMOTION SYSTEM



M E S S A G E

We congratulate the Aquaculture Department of the Southeast Asian Fisheries Development Center on the occasion of its 20th anniversary.

Through your research breakthroughs, training programs and technology transfer activities, you have, without doubt, contributed laudably to aquaculture development in the country as well as in the region.

For the past six years, the Technological Information Promotion System (TIPS) has been SEAFDEC/AQD's partner in disseminating relevant technology information in the fisheries sector through the TIPS Bulletins which are circulated in developing countries of Asia, Africa, and Latin America. Information flows have in fact been enhanced through the exchange of similar data for countries outside of Southeast Asia.

As both our organizations pursue development, TIPS commits itself to closer partnership with SEAFDEC/AQD in the years ahead.

INTERNATIONAL
OPERATIONS CENTRE

Rome, Italy

ASIAN REGIONAL
CENTRE

Metro Manila, The Philippines

LATIN AMERICAN
REGIONAL CENTRE

Caracas, Venezuela

DONORS

Italy, European
Economic Community,
The Netherlands, Austria

NATIONAL BUREAUX

Argentina, Brazil,
Chile, China,
Colombia, Costa Rica,
Cuba, Egypt, India,
Mexico, Pakistan,
Peru, The Philippines,
Saudi Arabia, Uruguay,
Venezuela, Zimbabwe

A handwritten signature in black ink, reading 'Ernesto Maipid, Jr.'.

ERNESTO E. MAIPID, JR.
National Bureau Director



Tips is an international network for information sharing on trade and technology.

**WESTERN PACIFIC FISHERIES
CONSULTATIVE COMMITTEE**

Suite 316 PASDA Mansions
77 Panay Avenue, Quezon City
Metro Manila, Philippines
Telephone: 99-99-23

Fax: (632) 741-0928 Telex: 66485 PINTR PN



M E S S A G E

Our members from the ASEAN and the Pacific Island Nations (PINs) join me in sending you warm felicitations on the occasion of the 20th anniversary of your Department.

Please accept our congratulations for two decades of achievement and meaningful contributions to aquaculture research and development and training and extension for the benefit of SEAFDEC Member Countries and the rest of Southeast Asia as well.

We would also like to take this opportunity to thank you and your staff for the full cooperation and assistance you have generously extended to us since our establishment in December 1988. In particular, we wish to cite the support and cooperation you have kindly provided us in connection with the Study Tour of major ASEAN fisheries education and training institutes that we organized for PIN fisheries officials in October/November 1992.

We wish you continued success in your undertakings and look forward to a long and mutually beneficial working relationship with your institution.

All the best!

A handwritten signature in black ink, appearing to read 'Elvira A. Baluyut', with a long, sweeping flourish extending to the right.

ELVIRA A. BALUYUT
Director

Suez Canal University

Ismailia Egypt
FAX: 20 64/325308
Tel: 20 64/327059

MESSAGE

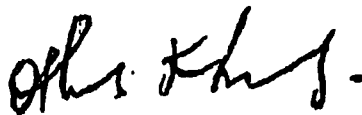
Suez Canal University and its Fish Research Centre would like to congratulate you and the staff of SEAFDEC/AQD for the achievements in the last 20 years which have good, sound, and clear effects all over the world.

It was a pleasure for us to cooperate with your Center a few years ago.

Suez Canal University gave the development of aquaculture high priority since 1977 (the start of the University) because our location is near Suez Canal, Mediterranean Sea, Red Sea, and the Nile River as well as other fresh, brackish, and marine bodies of water. The University put up a Fish Research Centre which concentrates on applied scientific research. The projects were on grass carp and its role in the control of aquatic weeds, tilapia production, and development of fish feed that utilizes local ingredients and by-products. The University also succeeded in producing *Artemia*, a very important feed used in hatcheries. Catfish, freshwater prawns, and algae production were also studied.

Our training programme is a priority and SEAFDEC took part in it.

Once again, we congratulate you and we hope for more progress and cooperation in the development of aquaculture.



DR. AHMED KHODAIR
President



REPUBLIC OF THE PHILIPPINES

Bureau of Agricultural Research

DEPARTMENT OF AGRICULTURE

3rd Flr., ATI BLDG., ELLIPTICAL RD.,
DILIMAN, QUEZON CITY

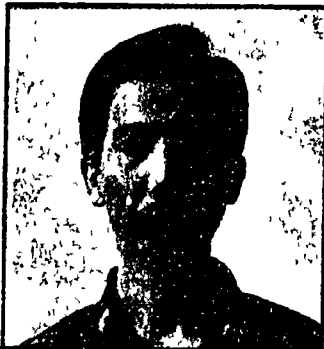
MESSAGE

Greetings to the management and staff of the Southeast Asian Fisheries Development Center - Aquaculture Department (SEAFDEC/AQD) on the celebration of its 20th Anniversary. Through the years, SEAFDEC/AQD has been one of the active partners of the Bureau of Agricultural Research in the Department of Agriculture in the pursuit and management of fisheries and aquaculture research and development in our country.

We greatly appreciate and recognize the significant involvement of SEAFDEC/AQD in the various activities of DA-BAR. The partnership has been highlighted when the Department became a member of the Fisheries Research Network of the Fisheries Sector Program (FSP). Presently, collaborative undertakings in the implementation of FSP-Research and Extension Component are through the National Fisheries Research Program, the Manpower Development Program for Fisheries and linkages in the information system.

For the past two decades, SEAFDEC/AQD has satisfactorily performed its role not only in the region but most importantly to national development. As we approach the onset of the 20th century, we challenge the staff of SEAFDEC/AQD to continuously uphold its leadership in the generation and promotion of environment-friendly aquaculture technologies that are relevant to the sustainable development of the fisheries sector.

With warmest regards and best wishes.



William D. Dar
WILLIAM D. DAR
Director



Republic of the Philippines
Department of Agriculture

Bureau of Fisheries and Aquatic Resources

860 Quezon Ave., Quezon City, Metro Manila 3008
Tel. Nos. 96-54-98 or 96-54-28

M E S S A G E

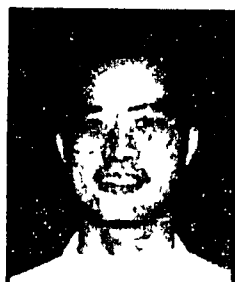
We wish to congratulate SEAFDEC/AQD on its 20th anniversary and we join the ASEAN countries in giving recognition to the contributions of SEAFDEC/AQD to the advancement of research and technology in fish culture and to the benefits of these efforts to aquaculture development.


From the beginning, SEAFDEC/AQD chose the perilous path of centering their research on species claimed to breed only in the wild. The successful results of these research are SEAFDEC/AQD's vindication that new frontiers can be opened up only with courage and commitment.

From the very beginning also, SEAFDEC/AQD chose to use research in transforming the people in the aquaculture industry by involving them in SEAFDEC/AQD's goals, sharing with them research breakthroughs, and translating these breakthroughs into technologies that industry people can understand. It was not by chance that the growth of the Philippine aquaculture industry coincided with the twenty years existence of SEAFDEC/AQD.

We want to look at these first 20 years as just the beginning of SEAFDEC/AQD's exploration of new frontiers in aquaculture research and that SEAFDEC/AQD shall infuse into these ventures the same vigor and courage that it had always shown.

Our best wishes for the coming years of fruitful endeavors.




GUILLERMO L. MORALES
Director



U.P. IN THE VISAYAS
ILOILO CITY 5000 PHILIPPINES

OFFICE OF THE CHANCELLOR
Tel. No. 7-92-48 & 7-06-71
Fax No. (33) 7-92-48

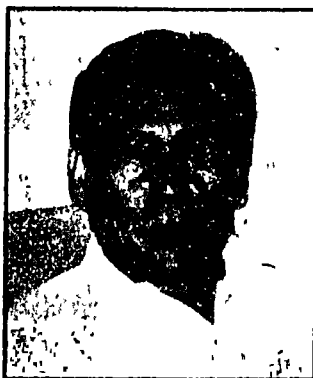
MESSAGE

There is no question that SEAFDEC/AQD played a role in developing the aquaculture industry in the region especially through its research and training activities in the shrimp industry. However, the uncontrolled spread of shrimp farming has resulted in massive environmental deterioration. Many negative effects have been reported in the Philippines, and the coastal folk bear the social costs of large-scale aquaculture development, including loss of traditional livelihood for the fishing community, ejection from their residence site, and degradation of natural coastal resources. Add to this the social conflict resulting from resource use, that is, the fish culturists as against subsistence fishermen. This example only shows that while aquaculture offers economic benefits, these are outweighed by the harmful environmental and social effects.

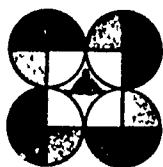
It will be timely for SEAFDEC/AQD on its 20th anniversary to review its objectives and consider the development of technology that is environment friendly and which provides equitable social benefits. Sustainability should characterize every culture system that is developed, and ecological effects of this made integral part of training and extension work.

On behalf of the University of the Philippines in the Visayas, I would like to congratulate SEAFDEC/AQD on its 20th anniversary and hope that SEAFDEC/AQD continues to contribute to the development of appropriate technologies.

It is our desire to continue the mutually beneficial collaboration with SEAFDEC/AQD.



FLOR LACANILAO, PhD
Chancellor
(AQD Chief, 1981-82, 1986-92)



Republic of the Philippines
Department of Science and Technology

**PHILIPPINE COUNCIL FOR AQUATIC AND MARINE
RESEARCH AND DEVELOPMENT**

Los Baños, Laguna, Philippines
Tel. No. EC015 to 19 (loc. 277)

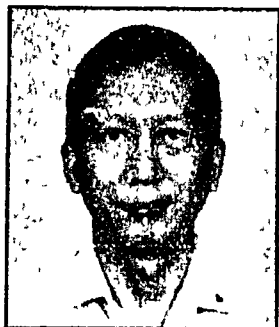
M E S S A G E


It is with pleasure and a deep sense of pride to greet the Aquaculture Department of the Southeast Asian Fisheries Development Center on its 20th Anniversary.

The SEAFDEC/AQD has stood as a symbol of what the Filipino talent can achieve given the proper support and encouragement by government and industry. Scientists of the Department have contributed much to the development of technologies particularly for the mass propagation of milkfish and penaeid fry in hatcheries. Scientific papers published by the research staff of the Department have also gained wide recognition and approval.

The PCAMRD directorate and staff wish to express their appreciation and gratitude to the SEAFDEC/AQD for its excellent contributions as a cooperating station for aquaculture research and development of the National Aquatic Resources Research and Development System.

May SEAFDEC/AQD continue to be productive and fishfarmer-oriented in the years to come.




RAFAEL D. GUERRERO III
Executive Director



Congressman OSCAR G. GARIN

Iloilo - First District

M E S S A G E

I consider it a privilege to congratulate the Aquaculture Department officials and personnel on the occasion of the 20th Anniversary of its founding.

The interest provided by SEAFDEC/AQD to countryside development has been greatly felt within the areas of the 1st Congressional District of Iloilo in terms of employment, technology transfer, and skills development among the local population. Indeed, SEAFDEC/AQD is partly an instrument which further developed and modernized marine culture in this part of the country. In addition, it has made its facilities and expertise available to accredited agencies through its community assistance program.

Through its 20 years of existence, SEAFDEC/AQD has illustrated the government's commitment to the goal of socio-economic sufficiency. It has contributed major development programs and projects in marine and aquaculture industry thus helping achieve higher levels of productivity, and ultimately giving benefits to a greater number of residents within the area. I hope that it would continue to provide brighter perspective of development for this particular industry.

Once again, congratulations and may we look forward together towards achieving our mutual concern for the interest of public welfare.




OSCAR G. GARIN
Congressman

Manila Address: Congress Tel No. 922-2619 Residence Tel. No. 96-11-48
Provincial Address: Iloilo City Tel 70033 71335 Guimbal, Iloilo PLDT Toll Station No. 1934

Republika ng Pilipinas
Panlalawigan ng Iloilo
TANGGAPAN NG GOBERNADOR
Lungsod ng Iloilo



IN REPLY, PLEASE ADDRESS
THE GOVERNOR FAX: 7-42-30
PROVINCE OF ILOILO 7-17-39
PROVINCIAL CAPITOL 7-22-40
ILOILO CITY 7-21-46

MESSAGE

Breakthrough in research and development of our fishery resources has gained impetus by the putting up of the Southeast Asian Fisheries Development Center/Aquaculture Department (SEAFDEC/AQD) here in Tigbauan, Iloilo about 20 years ago. Today, SEAFDEC/AQD in celebrating its 20th Anniversary has proven accomplishments which have a major impact here in the Philippines as well as in Asia.

Important studies accomplished in the Center like the spawning of "sabalo" and the tiger shrimp in captivity has a worldwide implication. Other aquaculture studies and development made SEAFDEC/AQD a source of pride for Iloilo. These pioneering efforts resulted into better productivity and more relevant conservation measures of our marine resources.

The 20th Anniversary Celebration reflects another milestone in the Center's history and the coming of the years will usher a more prosperous "blue revolution" in the Philippines.

My best wishes to all the officers and staff of SEAFDEC/AQD on the Center's anniversary.




ARTHUR D. DEFENSOR
Governor



Republic of the Philippines
Municipality of Tigbauan, Iloilo
Office of the Mayor

MESSAGE

I sincerely convey my warm personal greetings to the management and staff of the Aquaculture Department, Southeast Asian Fisheries Development Center (SEAFDEC/AQD) on its 20th year anniversary.

It is my hope that the success of the AQD would not only mean accomplishment of its programs but more meaningfully, success in its social responsibilities.

This challenge is not only for the management but for each and every one of the employees.

In view of this, I am extending my continued support to the Department's effort in promoting fisheries development not only in the Philippines but also in Southeast Asia.

Mabuhay kayong lahat!



CELSO T. LEDESMA
Municipal Mayor

Republic of the Philippines
Province of Iloilo
Municipality of Tigbauan
BARANGAY BUYU-AN

OFFICE OF THE BARANGAY CAPTAIN

M E S S A G E

Sa mga opisyal kag tanan nga empleyado sang SEAFDEC/AQD, guinatamyaw ko kamo sing malipayon nga ika-20 ka tuig nga pagsukat sining Julyo 9, 1993.

Ini nga institusyon nakahatag gid sing daku nga pagligwat sang pangabuhi sang pumuluyo sa sini nga Barangay, ilabi na sa mga kwalipikado sa ila tagsa ka patag sang pagtrabaho. Madamo man ang nag-ayohan sa ila pagpangabuhi sa mga natun-an nila nga teknolohiya sa pagpabu-ad sang lukon nga amo ang una nga ginhatagan sang SEAFDEC/AQD sang pagtamod sa na-una nga mga tinuig. Sang una nga ginsuguran ang pagpatindog sini nga institusyon, madamo man nga sablag ang nasumalang ilabi na ang mga tag-iya sang duta nga amo ang guinpahamtangan sini. Apang sa kooperasyon sang mga opisyal sang barangay kag sa banwa, natuman gid man kag karon tayoyon na ang operasyon sang SEAFDEC/AQD. Gani sa sining anibersaryo sa ika 20 ka tuig, guinapanginbulahan ko si Dr. Efren Ed. C. Flores nga sa iya pagpongko bilang Hepe sang SEAFDEC/AQD, gintaga-an niya sing pagtamod ang amon barangay kon sa diin diri nahamtang ang pinakamayor nga opisina sang SEAFDEC/AQD.

Sa inyo tanan, malipayon gid nga pagsilebrar sang ika-20 ka tuig nga anibersaryo.



Virgilio T. Perando
VIRGILIO T. PERANDO
Barangay Captain



What AQD should be and do: Visions of AQD Chiefs



Dean Domiciano K. Villaluz (1973-79)

Nature could not go on replenishing resources if we do not help in the process of replenishment... The forestry, agriculture, and fishery sectors should work together and be more concerned with the environment.

We should develop technologies simple enough for the small people to use and small enough so that their application would not require heavy instruments and scarce resources. These technologies should not outstrip the capability of a small community and of nature to provide the resources.



Dean Rogelio O. Juliano (1979-80)

Among other things, there is a need to put more emphasis on applied and practical research as applicable technologies are what the aquaculture industry in the region needs most ... the consolidation of the commodity-oriented research programs into aquaculture systems-oriented R & D research areas was necessary in order to give primary consideration to the environment and the production systems deriving from such environment.

As SEAFDEC/AQD has been involved in aquaculture development through research, training, and extension services in the region, its efforts will continue to be harnessed to help out the region feed its malnourished with animal protein and to help in the nation building.



Mr. Kunio Katsutani (Sept.-Dec. 1980)

The support and assistance we extended to SEAFDEC/AQD should be continued so that it will be great in every way most particularly in research for the benefit of the aquaculture industry ... Let SEAFDEC/AQD continue to take its place among the leading institutions in the region and to contribute towards the development of aquaculture in the region.



Dr. Alfredo C. Santiago, Jr. (1983-86)

We are committed to support the fish farmer. The technologies that we have thus far transferred to the fish farmers constitute but a small segment of what research has yet to unravel. Meanwhile, the hungry and the poor can not wait very long. We are racing against time. For this reason, we have launched a production-oriented research to be nearer our goal of providing food for the poor.

We should continue to watch the dynamism of the aquaculture industry by constantly keeping in touch with the fish farmers. Our basic purpose is for the aquaculture industry to benefit more from the results of our research and development.



Dr. Flor Lacanilao (1981-82, 1986-92)

With the establishment of a new government regime in the country, an environment more conducive was created not only for socioeconomic development but also for scientific research such as that mandated upon SEAFDEC/AQD to pursue. Our accomplishments may be modest in scale, but we believe we have not failed to meet the normal quantity and quality of work expected by its numerous beneficiaries in Southeast Asia.

As SEAFDEC/AQD continues to play an active role in developing the aquaculture industry in the region, it should put more emphasis on the development of technology that is environmentally friendly and which provides equitable social benefits. It should also address the complex socioeconomic, environmental, and even political problems facing aquaculture or resulting from its growth.



Dr. Efren Ed. C. Flores (1992-present)

The mandate of academic institutions is basic research, or that which pursues knowledge for knowledge's sake. SEAFDEC/AQD is a research and development institution that caters to the fisheries industry in the region, and hence should pursue applied research.

The technologies developed by SEAFDEC/AQD must take into consideration sustainable development of the region's aquatic resources. In doing so, a multidisciplinary approach is necessary. The natural scientists working with the social scientists and the fisherfolk open many venues for investigation of a central problem viewed from different perspectives. The participation of fisherfolk in particular allows them access and understanding of the technologies developed, they who are the traditional users of our aquatic resources and who are most affected when the environment is sacrificed for the sake of progress.

SEAFDEC/AQD must help make aquaculture sustainable.

20 Years of Research and Development

Establishment

The establishment of the Aquaculture Department (AQD) of the Southeast Asian Fisheries Development Center (SEAFDEC) was based on the proposal submitted by the Philippine Government for the implementation of an aquaculture project in the Philippines. The proposal was approved by the SEAFDEC Council of Directors during its fourth meeting held in Manila, 18-22 January 1971.

The initial implementation of the aquaculture project was entrusted to the Mindanao State University (MSU) following a conference on 5 September 1972 among officials of the Philippine Government, headed by Arturo Tanco, Jr. of the Department of Agriculture and Natural Resources, and officials of the Government of Japan led by Ambassador Toshio Urabe. The MSU Board of Regents adopted the development of AQD as a special project and allocated initial funding for its implementation.

The team of Japanese experts headed by Dr. Katsuzo Kuronuma, sent to the Philippines in 1971 and 1972 to undertake feasibility studies on potential project sites, recommended that the Aquaculture Department be located in Iloilo. Thus, the Aquaculture Department was formally established at Tigbauan, Iloilo during the Sixth Meeting of the SEAFDEC Council in Kuala Lumpur 3-7 July 1973. The Dean of MSU College of Fisheries, Dean Domiciano K. Villaluz, upon nomination by the Philippine Government, was appointed Department Chief.



Officials of SEAFDEC/AQD and the Department of Agriculture and Natural Resources reported to Philippine President Marcos (far right) the progress in the construction of AQD. Pres. Marcos visited AQD in 1974 (inset).

President Ferdinand E. Marcos issued Presidential Decree No. 292 on 13 September 1973, formally recognizing the international status of AQD and providing it with tax exemption and immigration privileges and other immunities generally granted to international and treaty organizations based in the Philippines.

Organization

The Aquaculture Department (AQD) is one of the four Departments of SEAFDEC. The other three are the Training Department in Thailand for marine fisheries training, the Marine Fisheries Research Department in Singapore for fishery post-harvest technology, both established in 1967, and the Marine Fishery Resources Development and Management Department established in Malaysia in 1992.

SEAFDEC/AQD was formally inaugurated in April 1975. Its proposed activities for the coming year are deliberated during the Program Committee Meeting and approved during the Council Meeting (right).





Mr. Tatsuo Kawachi



Dr. Noboru Hoshino



Mr. Kunio Katsutani



Dr. Yasuhiko Taki



**Mr. Satoru
Fukumoto**



Mr. Soichiro Shirahata

The Council of Directors representing the Member Countries is the policy-making body of SEAFDEC. The chief administrator is the Secretary-General whose office, the Secretariat, is located in Bangkok, Thailand. Each Department is headed by a Department Chief provided by the host government and a Deputy Department Chief provided by the Government of Japan.

Department Chiefs of AQD

1. Dean Domiciano K. Villaluz, July 1973 - June 1979
2. Dean Rogelio O. Juliano, July 1979 - 31 Aug 1980
3. Mr. Kunio Katsutani*, 1 Sept 1980 - 31 Dec 1980
4. Dr. Flor Lacanilao, 1 Jan 1981 - 31 Dec 1982
5. Dr. Alfredo C. Santiago, Jr., 1 Jan 1983 - 8 Apr 1986
6. Dr. Flor Lacanilao, 9 Apr 1986 - 8 Apr 1992
7. Dr. Efren Ed. C. Flores, 9 Apr 1992 - present

* Acting Department Chief

SEAFDEC/AQD Deputy Department Chiefs

1. Mr. Tatsuo Kawachi, Oct 1975 - Dec 1977
2. Dr. Noboru Hoshino, Dec 1977 - Apr 1980
3. Mr. Kunio Katsutani, Apr 1980 - June 1983

4. Dr. Yasuhiko Taki, June 1983 - June 1985
5. Mr. Satoru Fukumoto, June 1986 - June 1991
6. Mr. Soichiro Shirahata, July 1991 - present

Each Department has a Plan of Operation and Program of Work approved by the SEAFDEC Council of Directors every three years.

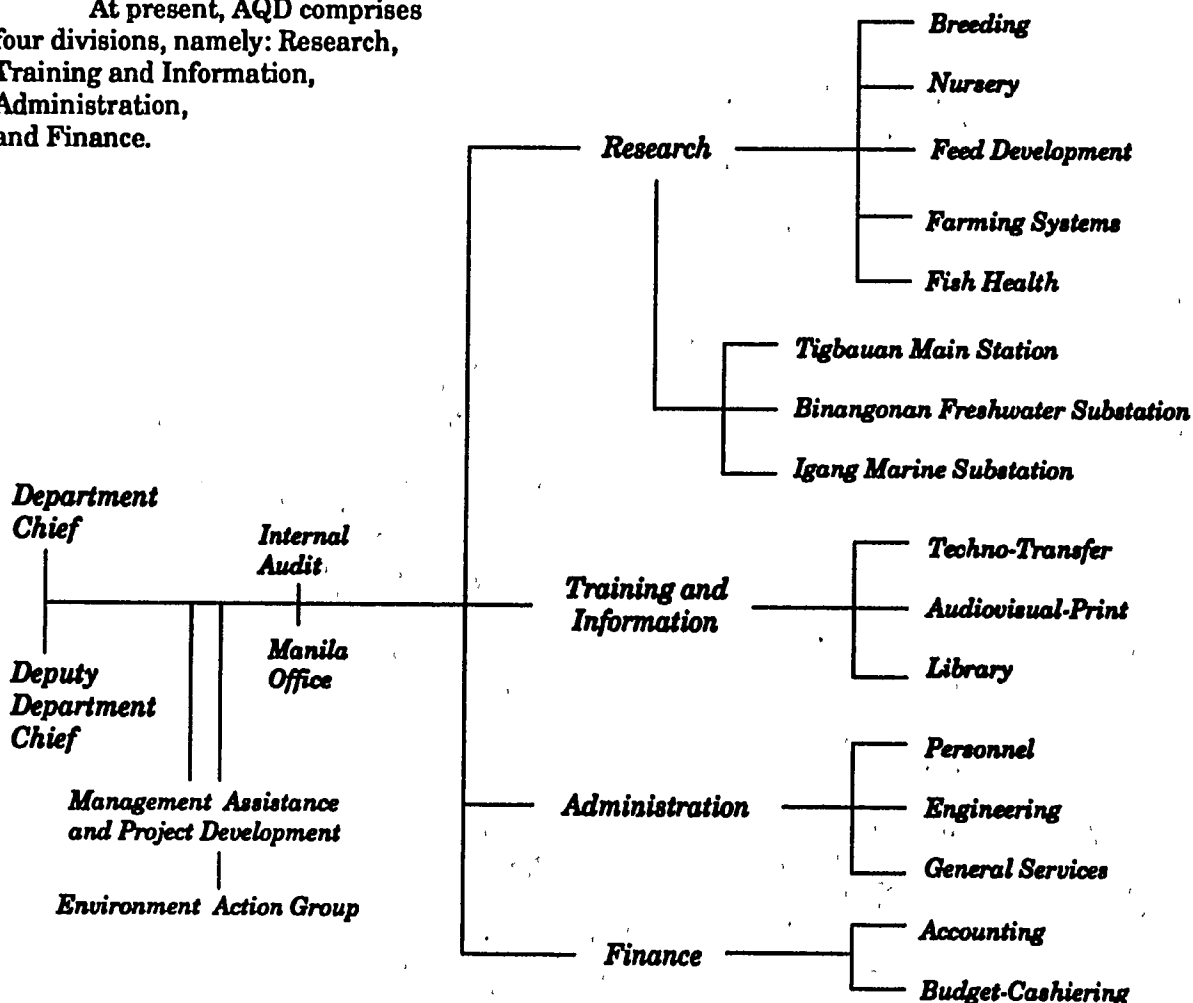
Under its Plan of Operation and Program of Work, as approved by the SEAFDEC Council, AQD shall have the following functions:

- To promote and undertake aquaculture research that is relevant and appropriate for the region
- To develop human resources for aquaculture
- To disseminate and exchange information on aquaculture

In support of SEAFDEC/AQD, the Philippine Government created on 14 October 1982 the National Board on SEAFDEC/AQD Programs, Budget and Operations. The Board served as an internal mechanism to ensure close coordination between the host government and SEAFDEC/AQD. On 13 January 1987, the Board was replaced by PTAC or the Philippine Technical and Administrative Committee for SEAFDEC. The Committee is tasked to monitor and assess the performance of AQD's research and development programs in accordance with the policies and standards established by the SEAFDEC Council and the Philippine Department of Agriculture.

Organizational structure

At present, AQD comprises four divisions, namely: Research, Training and Information, Administration, and Finance.



Most of the research on economically important food fishes in the region are conducted at the Tigbauan Main Station. Starting late 1980s, the research priorities of the Department have been based on the recommendations arising from the Seminar-Workshop on Aquaculture Development in Southeast Asia or ADSEA. ADSEA is held every three years, the first in 1987, the second in 1991, and the third is scheduled in 1994.



Stations and project sites

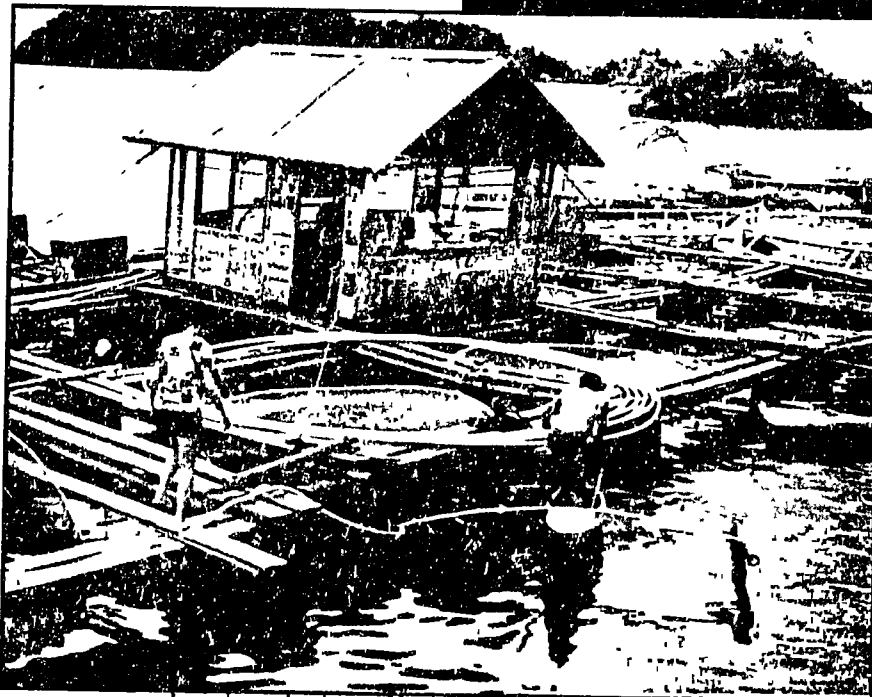
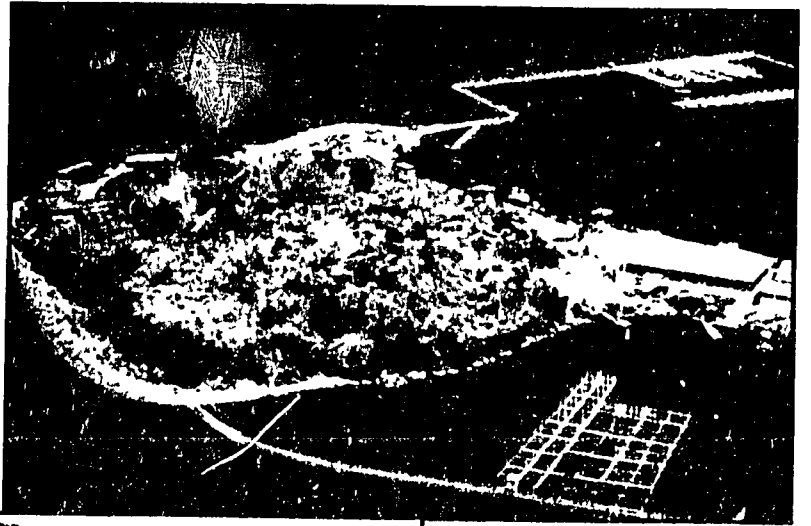
Research was mostly conducted at the Tigbauan Main Station, where the hatcheries and laboratories were established. Pond culture studies were conducted at Leganes Brackishwater Station, where a brackishwater pond system was constructed in 1973, until phased out in 1990. The Igang Marine Station was established in 1974 for fish broodstock development and management. The Binangonan Freshwater Station was established in July 1977 in Laguna de Bay. Other stations and project sites (see map) were set up where and when the need arose for milkfish research, shrimp and milkfish spawner (*sabalo*) collection, pilot studies on green mussel and oyster culture, seafarming studies, and other support and outreach activities.

1. **Tigbauan Main Station**
(1973- present)
Tigbauan, Iloilo
2. **Leganes Brackishwater Substation** (1973-1990)
Leganes, Iloilo
3. **Binangonan Freshwater Substation** (1977- present)
Binangonan, Rizal
4. **Igang Marine Substation**
(1974- present; fish broodstock development and management)
Nueva Valencia, Guimaras
5. **Bay, Laguna** (1984-87; freshwater pond culture)
6. **Naujan, Occidental Mindoro**
(1977-80, 1983-87; milkfish breeding)
7. **New Washington, Aklan**
(1974-75; shrimp spawner collection)
8. **Batan, Aklan** (1975-86; shrimp hatchery and nursery)
9. **Pontevedra, Capiz** (1974-75; shrimp spawner collection)
10. **Roxas City, Capiz** (1973; shrimp spawner collection)
11. **Sopian Bay, Capiz** (1975; mussel research)
12. **Hamtik, Antique** (1973-76; shrimp spawner collection)



13. **Pandan, Antique** (1975-79; milkfish breeding and broodstock development)
14. **Malalison, Culasi, Antique**
(1991- present; seafarming and coastal management)
15. **Himamaylan, Negros Occidental** (1974-75; shrimp spawner collection)
16. **Ilog, Negros Occidental**
(1974; shrimp spawner collection)
17. **Zamboanga City** (1975-77; shrimp hatchery and seafarming)
18. **Naawan, Misamis Oriental**
(1973-74; shrimp breeding)

The Binangonan Freshwater Substation, the Igang Marine Substation, and the Manila Office.



Mollusc culture techniques were developed at Sapian Bay in Capiz, and some studies on milkfish breeding and broodstock were conducted at the Pandan project site (bottom) in Antique in the late 1970s.



Manpower support

The permanent staff increased from an initial 30 in 1973 to 669 in December 1985, but was reduced to 364 in December 1992, as shown in the distribution of personnel over the 20 year-period. The permanent staff were supplemented by some expatriate researchers and consultants.

Distribution of SEAFDEC/AQD personnel (on 31 December of each year)

	1973	1975	1980	1985	1990	1991	1992
Research	-	-	-	379	166	164	166
Training and Information	-	-	-	55	37	37	31
Administration	-	-	-	235	126	130	124
Finance	-	-	-	-	25	22	22
Office of the Chief	-	-	-	-	21	21	21
Total	30	350	656	669	375	374	364

Note: (-) means no breakdown of data available

Expatriate staff (long-term)

1. Dr. Hiralal Chaudhuri Aquaculture, 1976-79, 1986-87
2. Dr. Chua Thia Eng Aquaculture training, 1980-85
3. Mr. Philippe Dhert Aquaculture, 1987-90
4. Mr. Satoru Fukumoto Fisheries, 1986-91
5. Dr. Shiro Hara Aquaculture, 1978-86
6. Dr. Noboru Hoshino Fisheries, 1974-79
7. Mr. Junji Imayoshi Fisheries, 1991-93
8. Mr. Shigemi Kambara Fisheries, 1974-77
9. Mr. Utao Kobayashi Fisheries, 1974-76
10. Dr. Hiroshi Kohno Fish biology, 1985-88
11. Dr. Shigeru Kumagai Zoology, 1974-81
12. Dr. Tsuneo Kume Fisheries, 1988-90
13. Mr. Pinij Kungvankij Aquaculture, 1982-85, 1987-89
14. Mr. Hideo Mochizuki Aquaculture, 1977-79
15. Mr. Hiroshi Motoh Fisheries, 1974-81
16. Ms. Margaret Mulholland Aquaculture, 1987-89
17. Mr. Akimasa Nagai Fisheries, 1988-90
18. Mr. Goro Nezaki Aquaculture, 1984-86
19. Mr. Bent Nielsen Limnology, 1979-82
20. Dr. James Norfolk Oceanography, 1979-81
21. Mr. Yoshitetsu Nukiyama Fisheries, 1975-80
22. Mr. Flemming Pettersen Limnology, 1979-80
23. Dr. Mariano de Ramos Statistics, 1984-85
24. Mr. Karsten Schroeder Marine biology, 1989-92
25. Dr. Patrick Soletchnik Marine biology, 1982-83
26. Mr. Masonori Suemitsu Aquaculture, 1979-83
27. Dr. Yasuhiko Taki Fisheries, 1983-85
28. Mr. Mitsuru Yamasaki Fisheries, 1981-85
29. Mr. Shigehisa Yamasaki Planktology, 1978-79
30. Mr. Yoshibumi Yashiro Marine biology, 1981-84, 1987-89
31. Dr. Norio Yasunaga Microbiology, 1991-present
32. Mr. Tsugihiko Yokogawa Microbiology, 1975-78
33. Ms. Brigette Van Moeffart Aquaculture, 1987-90
34. Dr. William Vanstone Physiology, 1975-78

JICA experts at AQD (L-R): Dr. Shiro Hara, Mr. Hiroshi Motoh, and Dr. Norio Yasunaga.



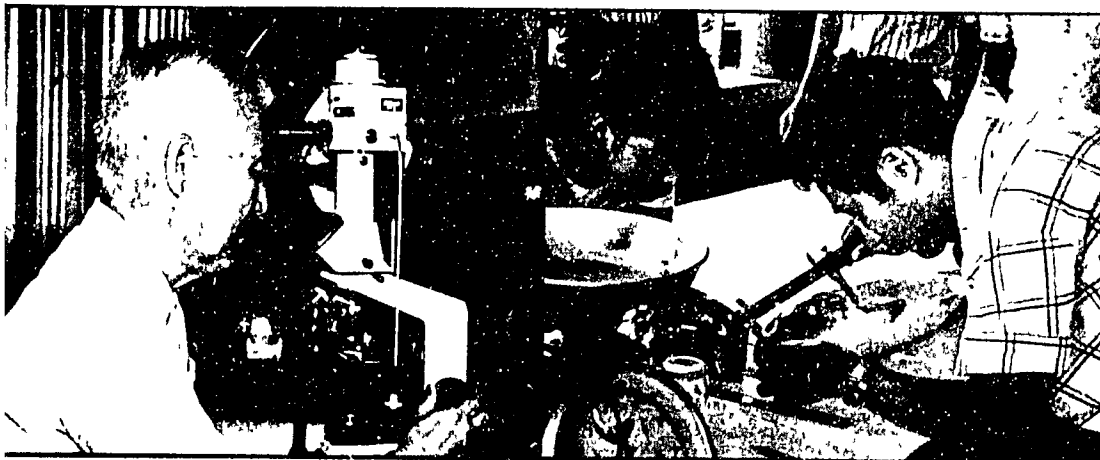
- 35. Dr. Robert Wear
- 36. Mr. Soichiro Shirahata

Marine biology, 1978-79
 Aquaculture, 1991-present

Expatriate staff (short-term)

- | | |
|-----------------------------|---|
| 1. Mr. Etienne Bossuyt | <i>Artemia</i> biology, 1977, 1980 |
| 2. Dr. Ching Ming Kuo | Reproductive physiology, 1979 |
| 3. Dr. Les Curtin | Fish breeding, 1981 |
| 4. Dr. Roger Dawson | Marine chemistry, 1981 |
| 5. Dr. Parameswara Dinamani | Pathology, 1978 |
| 6. Dr. Kees Groot | Fisheries, 1976 |
| 7. Dr. Michael Hine | Shellfish culture, 1978 |
| 8. Dr. Kazutsugu Hirayama | Fish biology, 1984 |
| 9. Dr. Akio Kanazawa | Nutrition, 1978, 1979, 1984, 1985 |
| 10. Dr. Ryusuke Kado | Marine biology, 1982 |
| 11. Mr. Shusaka Kadowaki | Aquaculture, 1979 |
| 12. Dr. Juichi Kato | Fishpond engineering, 1977 |
| 13. Dr. Gunzo Kawamura | Physiology, 1980 |
| 14. Dr. Hiroshi Kohno | Fish biology, 1984 |
| 15. Dr. Hiroshi Kurata | Fish culture, 1976 |
| 16. Dr. T.J. Lam | Reproductive physiology, 1979, 1980, 1981 |
| 17. Dr. Cheng-Sheng Lee | Physiology, 1979 |
| 18. Dr. I-Chiu Liao | Reproductive physiology, 1978, 1979 |
| 19. Mr. George Mantzarlis | Computer science, 1982 |
| 20. Dr. Koyokumi Muroga | Pathology, 1981, 1982 |
| 21. Dr. Takeshi Murai | Fish nutrition, 1981, 1982 |
| 22. Mr. Haruo Nakajima | Fish breeding, 1978, 1980 |
| 23. Dr. A. Neelameghan | Information science, 1988, 1989 |
| 24. Mr. Luke de Ruyck | <i>Artemia</i> biology, 1983 |
| 25. Mr. Pete Ryan | Fisheries, 1976 |
| 26. Dr. Gerald Schroeder | Pond culture, 1984 |
| 27. Dr. Tetsushi Senta | Ecology, 1976, 1977 |
| 28. Dr. Kenneth Simpson | Biochemistry, 1982 |
| 29. Dr. Patrick Sorgeloos | <i>Artemia</i> biology, 1977, 1980, 1981 |
| 30. Dr. Volker Storch | Histology, 1982 |
| 31. Dr. Philip Tortell | Marine biology, 1975, 1976 |
| 32. Mr. Junichi Tsukidate | Seaweeds, 1990 |
| 33. Dr. Ken Roger Uwate | Economics, 1984 |
| 34. Mr. Gunther Vogt | Fish nutrition, 1984 |
| 35. Dr. Robert Wear | Marine biology, 1976, 1978, 1979 |
| 36. Dr. Hiroshi Yabu | Seaweeds, 1992-present |

Expatriate staff boost the research capability of the Department.



37. Dr. Isamu Yamaji
38. Mr. Michael Yunker

Planktology, 1978
Nutrition, 1984

Research consultants

- | | |
|--------------------------------|---------------------------------|
| 1. Dr. Gaudiosa Almazan | Limnology, 1982 |
| 2. Dr. Rodolfo Arce | Aquaculture, 1981-82 |
| 3. Ms. Priscilla Borja | Fisheries, 1978-79 |
| 4. Dr. Arsenio Camacho | Aquaculture, 1979-81 |
| 5. Dr. Zenaida Catalan | Limnology, 1982 |
| 6. Dr. Paciente Cordero | Seaweed culture, 1983 |
| 7. Mr. Benjamin Gabriel | Aquaculture, 1983 |
| 8. Mr. Abraham Gaduang | Extension, 1983 |
| 9. Dr. Edgardo Gomez | Marine biology, 1981-82 |
| 10. Dr. Rafael Guerrero III | Aquaculture, 1981-82 |
| 11. Dean Rogelio Juliano | Fisheries, 1977-78 |
| 12. Dr. Flor Lacanilao | Fish physiology, 1978-79 |
| 13. Mr. Andres Mane | Fisheries, 1977-80, 1983-85 |
| 14. Mr. Rodolfo Mateo | Fish biology, 1983-86 |
| 15. Mr. Epictetus Patalinhug | Economics, 1984 |
| 16. Dr. Herminio Rabanal | Aquaculture, 1983-85 |
| 17. Dr. Celso Roque | Coastal management, 1986-87 |
| 18. Dr. Neon Rosell | Mollusc culture, 1990-91 |
| 19. Dr. Rudy Tan | Statistics, 1978-80 |
| 20. Dr. Gavino Trono, Jr. | Marine botany, 1981-83, 1988-90 |
| 21. Mr. Agustin Umali | Fisheries, 1977-78 |
| 22. Prof. Rodolfo Ventura | Aquaculture economics, 1981 |
| 23. Dean Domiciano K. Villaluz | Aquaculture, 1983-85 |
| 24. Dr. Carlos Zapatos | Toxicology, 1984-85 |

Staff development program

A staff development program was launched in 1974 through fellowship grants for studies leading to advance degrees, for non-degree training in foreign and local institutions, and for attendance in conferences, seminars, and workshops. A graduate program leading to M.Sc. Fisheries major in Aquaculture was undertaken by AQD in 1976 in collaboration with the University of the Philippines - Visayas.

Many of the personnel who availed of the Staff Development Program eventually resigned from SEAFDEC/AQD. But AQD's loss is the industry's gain. Except for a very few who joined the academe, many SEAFDEC/AQD staff now work in the private sector and are still actively involved in aquaculture development in the Philippines and in the region.

Number of SEAFDEC/AQD employees who completed graduate studies and non-degree training under the staff development program

	1973-75	1976-80	1981-85	1986-90	1991	1992
Degree program						
Ph.D.	-	1	5	7	1	1
M.Sc./M.A./M.Ag.	-	30	42	11	2	3
Non-degree program						
Short-term training	8	92	87	146	47	42
Attendance in meetings, seminars, conferences, etc.	22	159	152	120	110	94

Personnel who obtained degrees through the staff development program¹

Ph.D. program

1. Enrique Avila ²	Biology	U Heidelberg, 1987
2. Teodora Bagarinao	Marine biology	U California-San Diego, 1991
3. Susana Baldia	Aquatic environmental science	Ehime U, 1992
4. Relicardo Coloso	Nutritional science	Cornell U, 1990
5. Arnil Emata	Physiology	Louisiana State U, 1990
6. Roselyn Duremdes-Fernandez	Fish virology	Hokkaido U, 1993
7. Ronaldo Ferraris ²	Zoology	U Hawaii, 1982
8. Alcestis Llobrera ²	Food science and technology	Texas A&M U, 1983
9. Jose Llobrera ²	Fisheries	Texas A&M U, 1983
10. Clarissa Marte	Zoology	National U Singapore, 1990
11. Rolando Platon ²	Bio-resource engineering	U British Columbia, 1985
12. Gerald Quintio	Fisheries science	Hokkaido U, 1990
13. Arthur Sanchez ²	Oceanography	U Washington, 1982
14. Alfredo Santiago, Jr. ²	Fisheries	Auburn U, 1980
15. Corazon Santiago	Fish nutrition	Auburn U, 1985
16. Raul Suarez ²	Zoology	U Hawaii, 1981

M.Sc.or M.A. or M.Aq. program

1. Belen Acosta ²	Aquaculture	U Philippines, 1983
2. Veronica Alava	Aquaculture	U Philippines, 1979
3. Jesus Manolo Almendras	Zoology	U Philippines, 1982
4. Edgar Amar	Aquaculture	U Philippines, 1987
5. Jocelyn Antiporda ²	Zoology	U Philippines, 1984
6. Florentino Apud ²	Aquaculture	U Philippines, 1980
7. Nieves Aquino-Toledo	Fisheries	Kagoshima U, 1988
8. Teodora Bagarinao	Marine biology	U California-San Diego, 1982
9. Jose Baldia ²	Zoology	U Philippines, 1984
10. Susana Baldia	Zoology	U Philippines, 1984
11. Dan Baliao ²	Aquaculture	U Philippines, 1979
12. Elvira Baluyot ²	Biology	U Santo Tomas, 1978
13. Lillian Bandonil-Tiro ²	Marine biology	U Philippines, 1981
14. Jesse Banno ²	Aquaculture	U Philippines, 1981
15. Vicente Bañada ²	Aquaculture	U Philippines, 1981
16. Isidra Bombeo-Tuburan	Aquaculture	U Philippines, 1981
17. Ma. Cecilia Baticados ²	Botany, aquaculture	U Philippines, 1981, 1983
18. Myrna Bautista	Food science	U Philippines, 1981
19. Robmar Buensuceso ²	Aquaculture	U Philippines, 1990
20. Manuel Carlos ²	Aquaculture	Central Luzon State U, 1987
21. Candelaria Casalmir ²	Environmental engineering	U Philippines, 1981
22. Antonio Castillo, Jr.	Fisheries	Miyazaki U, 1989
23. Nelson Castillo ²	Bio-resource engineering	U British Columbia, 1981
24. Ma. Teresa de Castro	Environmental engineering	U Philippines, 1982
25. Socorro Castro ²	Ecology	U Santo Tomas, 1977
26. Mae Catacutan	Fish nutrition	Kagoshima U, 1982
27. Deny Chavez	Marine ecology	Free U Brussels, 1992
28. Relicardo Coloso	Biochemistry	U Philippines, 1980
29. Kaylin Corre	Aquaculture	U Philippines, 1983
30. Erlinda Cruz-Lacierda	Marine biology	U Philippines, 1981
31. Mario Dimaano ²	Aquaculture	U Philippines, 1984
32. Corazon Dueñas ²	Zoology	U British Columbia, 1981
33. Victoriano Duray ²	Aquaculture	U Philippines, 1980
34. Roselyn Duremdes-Fernandez	Aquaculture	U Philippines, 1982
35. Demetrio Estenor	Marine ecology	Free U Brussels, 1989

36. Fe Dolores Estepa	Aquaculture	U Philippines, 1982
37. Armando Fermin	Aquaculture	Central Luzon State U, 1986
38. Porfirio Gabasa, Jr. ¹	Fisheries	Kagoshima U, 1982
39. Rolando Gapsin	Marine ecology	Free U Brussels, 1992
40. Grace Garcia	Aquaculture	U Philippines, 1991
41. Luis Maria Garcia	Zoology	U Alberta, 1984
42. Dante Gerochi ²	Aquaculture	U Philippines, 1985
43. Nelson Golez	Agricultural chemistry	Kyoto U, 1989
44. Ernesto Gonzales ²	Economics	Asian Social Institute, 1981
45. Ilda Gorriceta-Borlongan	Chemistry	U Philippines, 1982
46. Nicolas Guanzon, Jr.	Agriculture	Kyoto U, 1993
47. Gilda Javellana	Zoology	U Philippines, 1987
48. Nephersonia Jumalon ²	Aquaculture	U Philippines, 1980
49. Yong-Chan Kim ²	Economics	U Philippines, 1981
50. Rodrigo Lacierda	Aquaculture	U Philippines, 1984
51. Jocelyn Ladja	Aquaculture	U Philippines, 1987
52. Alcestis Llobrera ²	Microbiology	Texas A&M U, 1980
53. Ma. Rovilla Luhan	Aquaculture	U Philippines, 1991
54. Imelda de Mesa ²	Statistics	U Philippines, 1980
55. Romeo Milan ²	Applied hydrology	U London, 1980
56. Ma. Grace Miñoso	Environmental sanitation	U Ghent, 1992
57. Jonathan Nacario ²	Zoology	U Philippines, 1981
58. Fermin Palisoc	Zoology	U Philippines, 1982
59. Monina Parazo	Nutritional chemistry	Kagoshima U, 1987
60. James Paw ²	Aquaculture	U Philippines, 1985
61. Dioscoro de la Peña ²	Aquaculture	U Philippines, 1983
62. Milagros de la Peña	Aquaculture	U Philippines, 1983
63. Veronica Peñasflorida	Animal science	West Visayas State U, 1979
64. Beato Pudadera ²	Aquaculture	U Philippines, 1980
65. Rosario Pudadera ²	Aquaculture	U Philippines, 1979
66. Gloria Pution ²	Aquaculture	U Philippines, 1983
67. Emilia Quintio	Aquaculture	U Philippines, 1980
68. Gerald Quintio	Aquaculture	U Philippines, 1980
69. Pura Requentina ²	Aquaculture	U Philippines, 1980
70. Edgardo Reyes ²	Aquaculture	U Philippines, 1981
71. Maximiano Rivera, Jr. ²	Aquaculture	U Philippines, 1986
72. Eduard Rodriguez	Fisheries science	Nagasaki U, 1989
73. Ma. Suzette de la Rosa-Licop ²	Zoology, aquaculture	U Philippines, 1980, 1982
74. Ma. Rowena Romana-Eguia	Fish genetics	Swansea U, 1985
75. Jessica Saliente	Aquaculture	U Philippines, 1989
76. Corazon Santiago	Fish nutrition	Auburn U, 1978
77. Susana Siar	Rural sociology	U Philippines, 1991
78. Precilla Subosa	Environmental engineering	U Philippines, 1980
79. Fernando Suñaz ²	Fisheries	Tokyo U, 1982
80. Marlo Tabbu ²	Aquaculture	U Philippines, 1981
81. Nilda Tabbu ²	Aquaculture	U Philippines, 1983
82. Catherine Tamse	Aquaculture	U Philippines, 1980
83. Josefa Tan-Fermin	Zoology	U Philippines, 1982
84. Elsie Tech	Marine biology	U Philippines, 1979
85. Leonardo Tiro Jr. ²	Biology	U British Columbia, 1981
86. Joebert Toledo	Fisheries	Hiroshima U, 1990
87. Pepito Valera ²	Aquaculture	U Philippines, 1985
88. Leo Michael Ver	Marine biology	U Philippines, 1981
89. Angelito Vizcarra ²	Bio-resource engineering	U British Columbia, 1982
90. Adam Young ²	Marine biology	U Philippines, 1981

¹As of March 1993; ²Resigned from SEAFDEC/AQD; ³Deceased

Technology generation

The first twenty years of AQD were spent in research and development, and in training and information dissemination. More than one thousand studies on various aquaculture commodities have been completed (310 in 1976-80, 406 in 1981-85, 240 in 1986-90, and 53 in 1991-92). Research activities focused on economically important species in the region, and covered the following areas:

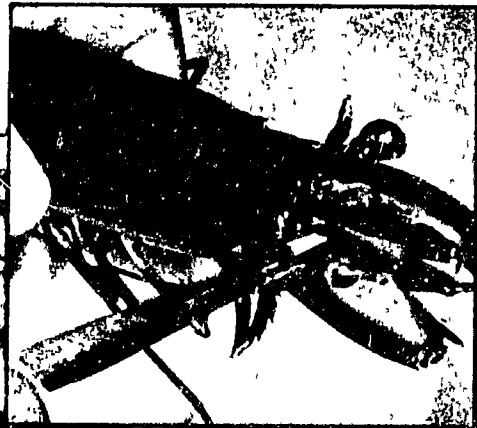
1. Production of adequate supply of quality seeds including genetic improvement of stocks for aquaculture
2. Improvement of culture techniques including improvement in the design of aquaculture facilities
3. Development of cost-effective feeds and propagation of natural food organisms
4. Identification of disease agents, pests, and predators, and development of preventive and control measures
5. Development of sustainable seafarming and searanching techniques to enhance coastal resources
6. Socioeconomics of aquaculture systems and
7. Environmental impact of aquaculture

The three-year plans of research activities are approved by the SEAFDEC Council. The research activities during the period 1989-1991 were based on priorities identified during the *Seminar on Aquaculture Development in Southeast Asia (ADSEA I)*; those during 1992-1994, on ADSEA II. ADSEA III is planned for 1994 to identify research priorities for 1995-1997.

The important research advances were made during the last 20 years. The most significant contribution of SEAFDEC/AQD to the fishery industry in the region is the wealth of research-based aquaculture technologies. Some of these technologies have found their way into the aquaculture production systems of other countries through the training and information dissemination programs.

Milkfish is one of the priority species studied at SEAFDEC/AQD.





SEAFDEC/AQD research in 1980s has focused on the giant tiger shrimp; research on seaweed is relatively new.

The rapid expansion of the shrimp industry in the Philippines and in the region is largely due to SEAFDEC/AQD's research on the giant tiger shrimp. Shrimps have been a major dollar earner for many countries, notably Indonesia, Thailand, Vietnam, and the Philippines. SEAFDEC/AQD has generated technologies in broodstock development, hatchery and nursery operations and management, and pond grow-out culture. Advances were made in disease prevention and control in hatcheries and ponds, and in feed development for various life stages.

In the Philippines before 1973, shrimps were harvested as incidental crops from milkfish ponds. About ten years later, technologies in shrimp propagation and culture were developed at SEAFDEC/AQD and picked up by the industry. Production increased from 1,805 tons in 1982 to 9,290 tons in 1983 and 26,360 in 1984. Production declined in 1991 and 1992 due to (1) pond destruction brought about by natural calamities, (2) pollution and degradation of coastal waters, and (3) diversification to other commodities such as fishes.

SEAFDEC/AQD made other scientific breakthroughs and advances in fish culture. The existing culture technology was refined and milkfish yields from brackishwater ponds in the Philippines increased from an annual average of about 110,000 metric tons in the 1970s to about 190,000 metric tons per year in the 1980s.

SEAFDEC/AQD, with financial and technical assistance from the International Development Research Centre (IDRC) of Canada conducted research on milkfish from 1975 to 1985. Research focused on artificial propagation, seed production, feed development, and ecology. Spontaneous spawning of milkfish in floating cages and completion of the life cycle in captivity were achieved in the early 1980's. In December 1980, the Philippines launched the National Bangus Breeding Program with 12 spawning centers. Spawning of milkfish in concrete tanks at SEAFDEC/AQD and in ponds in Taiwan assures the industry of alternative egg sources where floating cages are not feasible.

Research on breeding and seed production of grouper, sea bass, snapper, and rabbitfish aim at producing fry on demand at minimum cost. Spontaneous spawning of grouper (*Epinephelus suillus*), hormone-induced spawning of red snapper (*Lutjanus argentimaculatus*), and improved spawning, hatchery and nursery techniques for sea bass (*Lates calcarifer*) are expected to solve the problem of fry supply.

SEAFDEC/AQD is also committed to the development of freshwater aquaculture. Research on tilapia and carps have been conducted since 1977, and later on catfish. Refinement of culture technology contributed to increased production of tilapia in the Philippines, from an annual average of about 12,000 metric tons in the 1970s to about 48,000 metric tons in the 1980s. Tilapia research at AQD has shifted to genetics and to the nutritional requirements of fry and fingerlings. Research on carps and catfish includes the improvement of methods for induced spawning and seed production.

AQD's contributions to the development of the aquaculture industry in the region include the many bits and pieces of laboratory findings that have been filling up the knowledge gaps. The small-scale hatchery technology for shrimps, the nursery and pond-rearing techniques for shrimp and milkfish, and the improved culture techniques for oysters and mussels, cage culture of tilapia, pen culture of milkfish, disease and pollution control, feeds and feeding methods, identification of seaweed species for culture, and management of wild *Gracilaria* stocks have all benefited from research at AQD. As a result, the aquaculture industry has developed significantly and total production has increased.

The environmental impact of aquaculture and the cost-effectiveness of developed technologies have recently become part of AQD concern. More studies are planned for ecologically sound aquaculture. As a pilot study, an integrated seafarming and searanching project has been undertaken in Malalison Island off western Panay. The project will demonstrate the effectiveness of participatory research involving the fisherfolk in making aquaculture sustainable.

Publications

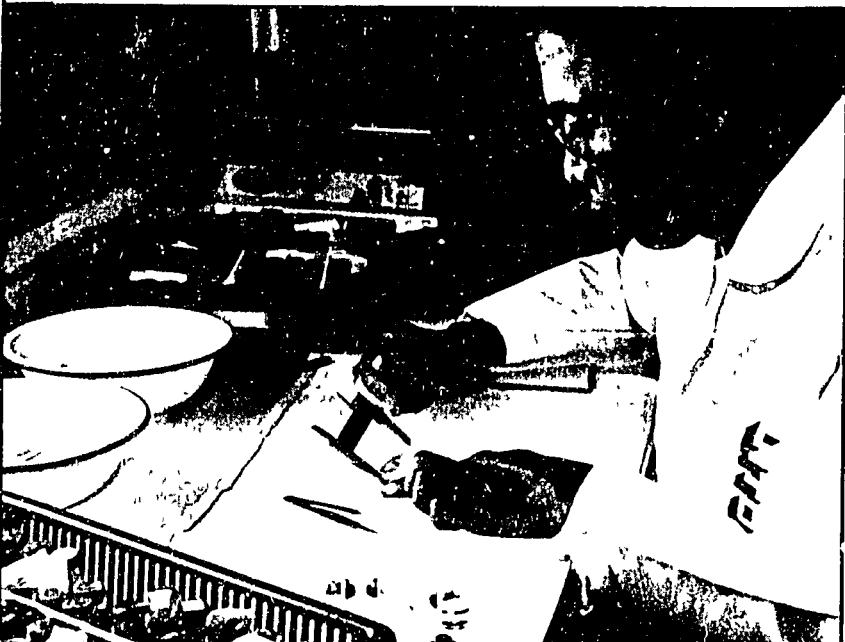
Research results are published by SEAFDEC/AQD researchers in scientific journals, books and proceedings, and presented in scientific meetings. From 1976 to 1992, a total of 542 papers on various aquaculture commodities have been published. Fourteen of the publications received best paper awards from the scientific community from 1987 to 1992.

Number of research papers published by SEAFDEC/AQD researchers in scientific journals, proceedings, and others, by species, 1976-1992

	1976-80	1981-85	1986-90	1991-92	Total
Sea Bass	-	2	15	6	23
Grouper	-	-	2	5	7
Snapper	-	-	-	1	1
Rabbitfish	-	-	14	3	17
Mullet	-	1	-	-	1
Milkfish	18	38	58	16	130
Tilapia	2	10	25	5	42
Carps	-	-	10	3	13
Catfish	-	-	-	5	5
Giant tiger shrimp	29	20	49	17	115
White shrimp	8	4	4	2	18
Mud crab	1	-	1	-	2
Molluscs	2	3	5	2	12
Seaweeds	-	-	1	7	8
Others	12	38	78	20	148
Total	72	116	262	92	542



**AQD's award-winning researchers (counterclockwise):
Ma. Cecilia Baticados, Oseni Millamena, and Angelito Gonzal**



Research awards

- The 1987 Naga Award, given by the International Center for Living Aquatic Resources Management (ICLARM), was won by Angelito Gonzal, Emiliano Aralar, and Josefina Ma. Ferriols-Pavico for their paper "The effects of water hardness on the hatching and viability of silver carp (*Hypophthalmichthys molitrix*) eggs," published in *Aquaculture*.

The paper describes the effect of water hardness on silver carp eggs. If the water hardness is too low, as in soft waters, carp eggs burst prematurely as a result of high osmotic pressure. If water hardness is higher than 500 mg/l CaCO₃, carp eggs do not swell properly, and embryos develop abnormally.

Higher hatching rate could be attained when eggs are incubated in water hardness levels of 300-500 mg/l CaCO₃. The technique developed from this paper has contributed to the success of carp seed production in Laguna de Bay in the Philippines.

- The First Dr. Elvira O. Tan Memorial Award for Fisheries Research (1987), given by the Philippine Council for Aquatic and Marine Research and Development (PCAMRD), was won by Ma. Cecilia Baticados, Relicardo Coloso, and Roselyn Duremdez-Fernandez for their paper "Studies

on the chronic soft-shell syndrome in the tiger prawn *Penaeus monodon* Fabricius in brackish-water ponds published in *Aquaculture*.

The paper includes the results of a survey of brackishwater ponds in Panay to assess the occurrence of soft-shell syndrome in shrimps. The disease can be predicted with 98% accuracy under poor soil and water conditions and poor management practices in the ponds. Laboratory studies showed that a 96-h exposure to pesticides as low as 0.0154 ppm could result in soft-shelling of shrimps. Soft-shelling could be reversed successfully by feeding the shrimps with mussel meat at 14% of their body weight per day.

Good water and soil quality and proper nutrition are very important in maintaining shell quality in shrimps. This findings has important implications to the industry since soft-shell syndrome adversely affects the market price of shrimps and the income of farmers.

- The 1988 Dr. Elvira O. Tan Memorial Award for Fisheries Research was won by Oseni M. Millamena, Jurgenne H. Primavera, Rosario A. Pudadera, and Rosemarie V. Caballero for their paper "The effect of diet on the reproductive performance of pond-reared *Penaeus monodon* Fabricius broodstock," and by Felicitas Piedad-Pascual for her paper "Effects of supplementary lecithin and lipid sources on the growth and survival of *Penaeus monodon* juveniles." Both papers were

AQD's award-winning researchers (L-R): Dr. Felicitas Pascual, Celia Pitogo, and Renato Agbayani



published in the Proceedings of the First Asian Fisheries Forum.

The paper of Millamena et al. showed that cod liver oil and lecithin are suitable lipid sources for successful maturation and spawning of tiger shrimp in ponds. Captive broodstock offers a convenient alternative to wild spawners whose supply is limited and seasonal. A nutritionally adequate diet is needed to ensure good reproductive performance of tiger shrimp in captivity.

The paper of Dr. Pascual determined how much lecithin should be added to the diet and the lipid source that would give good growth and survival of *Penaeus monodon*. Shrimps were fed diets containing various levels of soy lecithin and three lipid sources, namely: cod liver oil, crude degummed soybean oil, and purified soybean oil. Shrimps gained weight when the level of lecithin in the diet was increased from 0 to 2% regardless of the lipid source. Those fed crude degummed soybean oil had the highest survival rates at all levels of lecithin. The data will enable nutritionists and feed millers to formulate cost-effective shrimp or fish diets.

• The 1989 Best Paper Award in Fisheries and Aquatic Resources, given by the Bureau of Agricultural Research of the Philippine Department of Agriculture (DA-BAR), was won by Celia Pitogo, Ma. Cecilia Baticados, Erlinda Cruz, and Leobert de la Pena for their paper "Luminous bacterial disease of *Penaeus monodon* larvae in the Philippines," published in *Aquaculture*.

Affected larval samples were obtained from hatcheries in Iloilo, Capiz, and Aklan provinces on Panay Island. Examination showed that the luminescence was mainly due to densely packed bacteria, *Vibrio harveyi*, in the tissues of shrimp larvae. Poor larval rearing conditions favor the multiplication of this otherwise ubiquitous bacterium. Artificial infection experi-

ments showed that significant mortalities can occur if the population of *V. harveyi* is increased. Chemical control of *V. harveyi* infections is limited by the low tolerance of shrimp larvae to effective doses of drugs. Use of drugs also leads to the development of resistant strains of bacteria. Efforts now focus on preventive measures against the disease — by understanding the ecology of the bacteria, and the epidemiology of the disease.

• The 1990 DA-BAR Best Paper Award in Socioeconomics was won by Renato Agbayani, Dan Baliao, Nilo Franco, Romulo Ticar, and Nicolas Guanzon, Jr. for their paper "The economic analysis of the modular pond system of milkfish production in the Philippines" published in *Aquaculture*.

The paper analyzed the economic viability of producing milkfish in brackishwater ponds using the modular system. Grow-out culture is carried out in three stages using three adjacent ponds with areas increasing in the proportion of 1:2:4. The fish are transferred from one pond to the next bigger one every 30 days. The farmer can have six crops per year compared to only three in the straight-run method. The estimated average investment for the modular pond system was ₱18,550/ha in 1989. The returns on investment and on equity were 69%, with a payback period of 1.24 years.

• The 1991 Dr. Elvira O. Tan Memorial Award for Fisheries Research (Best Paper in *Aquaculture*) was won by Myrna Bautista, Oseni Millamena, and A. Kanazawa for their paper "Use of kappa-carrageenan microbound diet (C-MBD) for *Penaeus monodon* larvae," published in *Marine Biology*.

The paper describes the formulation of an

AQD's award-winning researchers (L-R) : Myrna Bautista, Dr. Anicia Ponce, and Dr. Corazon Santiago



Economical and nutritious feed for shrimp larvae using kappa-carrageenan as binder. C-MBD alone or in combination with natural food resulted in better growth, survival, and metamorphosis of shrimp larvae from zoea 1 to post-larvae 1 than a commercial larval diet. A low-cost nutritionally efficient feed for shrimp larvae will help hatchery owners produce more fry.

- The 1991 DA-BAR Best Paper Award in Aquaculture Engineering was won by Oseni Millamena, Eva Aujero, and Ilda Borlongan for their paper "Techniques on algae harvesting and preservation for use in culture as larval food" published in Aquaculture Engineering.

The study addresses one of the major problems in shrimp hatcheries — the limited and unstable supply of natural food. Methods of algal harvesting and preservation were developed for four phytoplankton species: *Chaetoceros calcitrans*, *Skeletonema costatum*, *Tetraselmis chui*, and *Isochrysis galbana*. Simple freezing preserves the harvested algal concentrates which remain viable for culture purposes. Sun-dried *Chaetoceros* or *Tetraselmis* may be used as partial or total replacement for live algae to rear shrimp larvae. The techniques developed in this study would make surplus phytoplankton available during other times of shortage.

- The 1991 DA-BAR Best Paper Award in Farming Systems was won by Anicia Hurtado-Ponce for her paper "Vertical rope cultivation of *Gracilaria* (Rhodophyta) using vegetative fragments," published in Botanica Marina.

The paper determined the effect of spacing interval on the growth rate and yield of *Gracilaria* sp. cultured on vertical ropes in a floating net cage.

- The 1991 DA-BAR Second Best Paper Award

in Fisheries and Aquatic Resources was won by Corazon Santiago, Mercedes Aldaba, Manuel Laron, and Ofelia Reyes for their paper "Reproductive performance and growth of Nile tilapia (*Oreochromis niloticus*) broodstock fed diets containing *Leucaena leucocephala* leaf meal," published in Aquaculture.

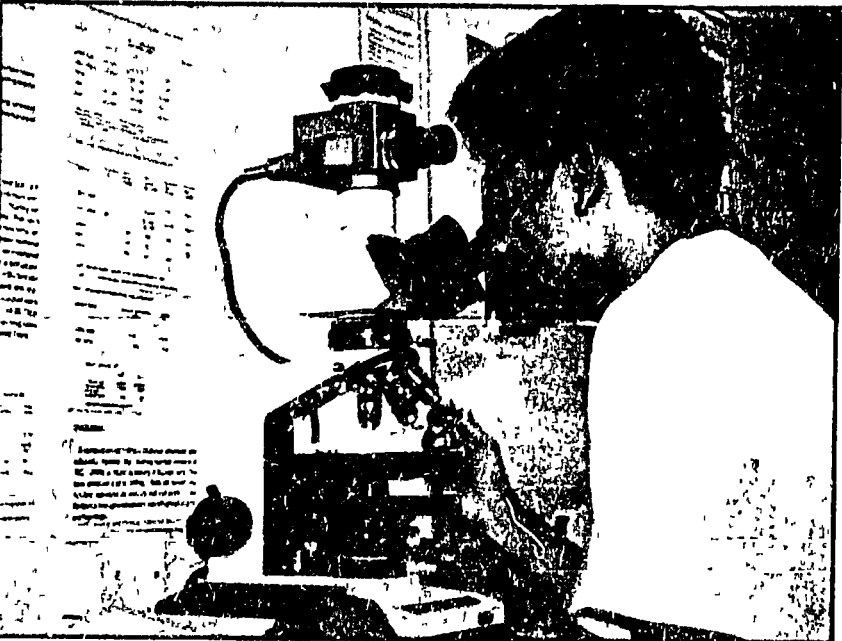
The legume *Leucaena leucocephala* is one of the cheap non-conventional feedstuffs in the tropics. However, "ipil-ipil" contains a toxic amino acid called mimosine that has adverse effects on some land animals.

The paper showed that diets with "ipil-ipil" leaf meal alone as a protein source caused weight loss and decrease in fry production and gonadosomatic index of Nile tilapia. "Ipil-ipil" leaf meal in the diet of Nile tilapia broodstock should not exceed 40%, equivalent to 0.76% dietary mimosine. Therefore, the use of "ipil-ipil" as a component of diets for Nile tilapia broodstock may be encouraged.

- The 1991 DA-BAR Second Best Paper Award in Socioeconomics was won by Renato Agbayani, Dan Baliao, Giselle Samonte, Reuel Tumaliuan, and Romeo Caturao for their paper "Economic feasibility analysis of the monoculture of mud crab *Scylla serrata* Forsskal," published in Aquaculture.

Mud crab, locally known as "alimango," is the most expensive crab species in the domestic and export markets of the Philippines. The paper determined the economic viability of mud crab monoculture in ponds. Sensitivity analysis showed that even if the price of mud crab decreased by 30%, its monoculture would still be economically viable. Milkfish growers can allocate a portion of their ponds for mud crab culture to diversify their crops and take advantage of the higher returns on investment.

**AQD's award-winning researchers (counterclockwise):
Neila Sumagaysay, Giselle Samonte, and Armando Fermin**



- The 1992 Dr. Elvira O. Tan Memorial Award for Fisheries Research (Best Paper in Aquaculture) was won by Neila Sumagaysay, Faith Marquez, and Yvonne Chiu-Chern for their paper "Evaluation of different supplementary feeds for milkfish (*Chanos chanos*) reared in brackishwater ponds," published in *Aquaculture*.

The paper showed that pelleted diets containing 22 and 27% protein can increase yields more than rice bran can. Energy is the first limiting factor when biomass in ponds is still low, in which case, fish farmers can give rice bran and other high-carbohydrate diets. But as biomass increases, dietary protein, vitamins and minerals become limiting, and pelleted diets are advisable.

- The 1992 DA-BAR best Paper Award for Fisheries and Aquatic Resources was won by Armando Fermin for his paper "LHRH-a+domperidone-induced oocyte maturation and ovulation in bighead carp, *Aristichthys nobilis* (Richardson)" published in *Aquaculture*.

The paper showed that luteinizing hormone-releasing hormone-analogue in combination with a dopamine antagonist, domperidone, can successfully induce spawning in bighead carp. The study contributes to the carp hatchery technology by way of more efficient and cost-effective spawning agents.

- The 1992 DA-BAR Second Best Paper in Socioeconomics was won by Giselle Samonte, Anicia-Hurtado Ponce, and Romeo Caturao for their paper "Economic analysis of bottom line and raft monoline culture in *Kappaphycus alvarezii* var *tambalang* in Western Visayas, Philippines" published in *Aquaculture*.

The paper evaluated the culture practices of seaweed farmers in Western Visayas in terms of production and economic efficiency. Higher seeding rate and higher yields are obtained with the raft monoline method compared with the bottom line method. Both methods are profitable, but the bottom line method is more cost-efficient.

- The Fourth Place in the 1992 Philippine Science Talent Search conducted by the Philippine National Academy of Science and Technology, was won by Neila Sumagaysay for her paper "Utilization of feed and rice straw compost for milkfish (*Chanos chanos*) production in brackishwater ponds" published in the *Journal of Applied Ichthyology*.

The paper demonstrates the potential of an agricultural by-product as alternative source of nutrients for milkfish production. Rice straw compost can partially replace feed pellets for milkfish in brackishwater ponds.



Technology transfer

To complement the research efforts, a training and information program at AQD transfers technology and packages research findings into production guides. The program comes in the form of regular training courses, individual training programs, aquaculture degree programs, scientific conferences, seminars, workshops, outreach lectures and seminars, and in-house production of communication materials.

More than 10,000 individuals have undergone training at SEAFDEC/AQD since 1974 and they now constitute the industry's work force for research and development. The regular training courses conducted were on various aquaculture technologies. Among the well-received courses were Brackishwater Pond Culture, Freshwater Aquaculture, Shrimp Hatchery and Nursery Operations and Management, Marine Finfish Hatchery/Nursery Operations, Fish Health Management, Fish Nutrition, Aquaculture Management, Culture of Natural Food Organisms, and Aquaculture Course for Social Scientists. The trainees came from Malaysia, Singapore, Thailand, Philippines, Indonesia, Brunei Darussalam, Bangladesh, India, Sri Lanka, Fiji, Kiribati, Iran, Saudi Arabia, Pakistan, and other countries in Asia and the Pacific. Individual training of local fishery students is also an effective way of augmenting the knowledge and skills in aquaculture.

A graduate program was conducted by SEAFDEC/AQD in collaboration with the Network of Aquaculture Centres in Asia (NACA) and the University of the Philippines - Visayas, leading to the degree Master in Aquaculture. Participants came from Indonesia, Korea, Vietnam, People's Republic of China, India, Sri Lanka, Pakistan, Brunei Darussalam, as well as from SEAFDEC Member Countries. The program generated more than 170 aquaculture professionals from 1980 to 1989.

Mature technologies are also translated into manuals, pamphlets, leaflets, radio and TV broadcasts, and video cassettes. A total of 257 communication materials were produced in 1976-80, 248 in 1981-85, 398 in 1986-90, and 60 in 1991-92.

Consultative meetings and round-table discussions with the industry and the academe were regularly convened to involve these sectors in setting the research directions of SEAFDEC/AQD. These meetings also provided necessary feedback for AQD's research and development activities. The seminar series ADSEA I in 1987 and ADSEA II in 1991, for example, assessed the relevance of AQD's research and training programs to the aquaculture industry in the region. The discussions served as basis for the three-year programs of SEAFDEC/AQD.

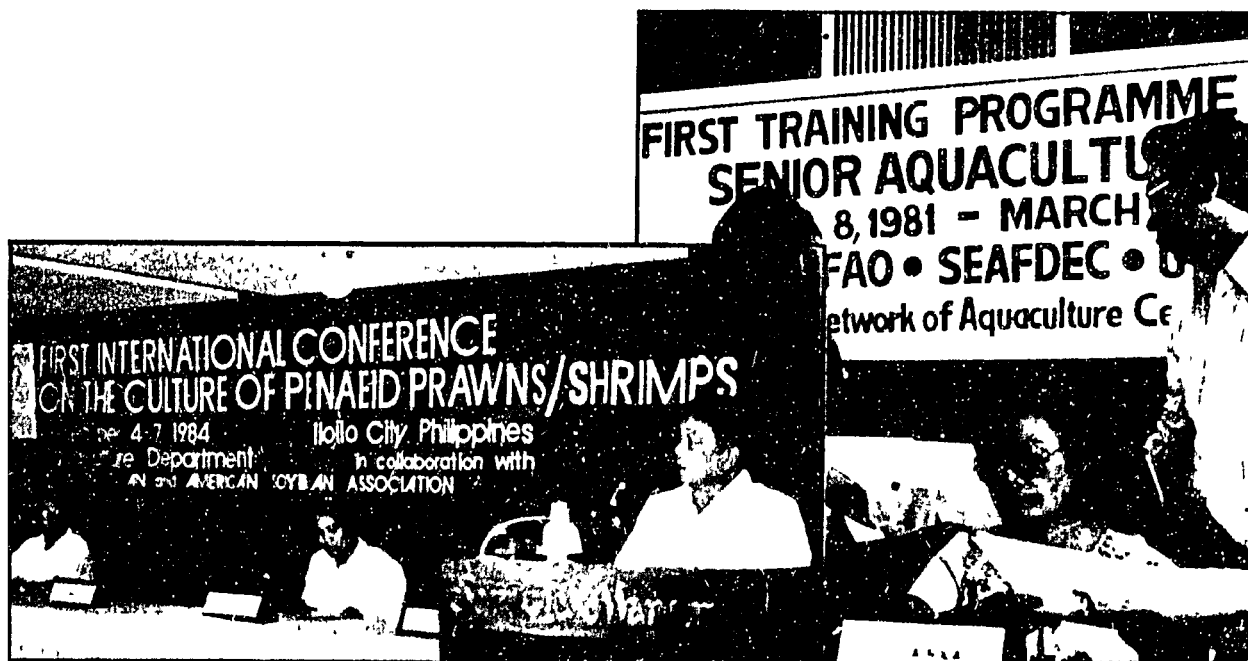
Conferences, symposia, and workshops were important venues for exchange of information. The National Bangus Symposium in 1975, the First International Milkfish Conference in 1976, and the Second International Milkfish Conference in 1983 assessed and reviewed the state-of-the-art of milkfish research. The Round-table Discussion on Problems Related to the Use of Hormones in the Induction of Gonadal Development and Spawning of Tropical Fishes held in 1981 also focused on milkfish. The National Prawn Industry Development Workshop in 1984 and the First International Conference on the Culture of Penaeid Prawns/Shrimps in 1984, assessed and reviewed the state-of-the-art of research on penaeid shrimps, particularly *Penaeus monodon*.

The International Seminar on Fisheries Research Management in 1977 discussed enhancement of capability for research management in support of fisheries. The International Workshop on Cage and Pen Culture in 1979 evaluated design concepts and techniques used in aquaculture.

The Regional Symposium on the Culture and Use of Algae held in 1981 updated information on algal research. The National Workshop on Aquaculture Development Strategies for the Philippines, followed by the International Workshop on Aquaculture Development Strategies for Asia, both in 1978, determined industry requirements related to data base, training and extension, and research.

On-site training, outreach seminars, and aquaculture clinic during fairs and exhibits were conducted by SEAFDEC/AQD to assist fishfarmers and other sectors of the local aquaculture industry. SEAFDEC/AQD researchers visited various project sites and thus facilitated feedback and exchange of information.

The SEAFDEC/AQD Library was set-up in 1976 to support the information dissemination program. It has one of the biggest collections of aquaculture materials in the region. As of December 1992, the library collection consisted of 10 914 monographics, 5693 pamphlets, 2570 SEAFDEC publications, and 3740 journal volumes. Speedy retrieval of information is facilitated through the Library's Compact Disc-Read Only Memory (CD-ROM) Drive.



Exchange of aquaculture information in the region was hastened through the SEAFDEC/AQD's Brackishwater Aquaculture Information System (BRAIS), a collaborative project between SEAFDEC/AQD and IDRC from 1984 to 1989. BRAIS established an information network involving Indonesia, Malaysia, Thailand, and the Philippines.

*Number of participants in SEAFDEC/AQD
regular training courses (1975-92), by 5-year period*

	1975	76-80	81-85	86-90	91-92	TOTAL
1. Brackishwater Pond Culture (21)	24	163	146	149	-	482
2. Shrimp Hatchery and Nursery Operations (30)	-	9	162	273	29	543
3. Aquaculture Methodology (32)	-	203	90	-	-	293
4. Aquaculture Engineering (6)	-	45	24	-	-	69
5. Sanitation and Culture of Tropical Bivalves (4)	-	-	24	11	-	35
6. Freshwater Fish Hatchery (2)	-	-	19	-	-	19
7. Freshwater Aquaculture (12)	-	-	134	41	-	175
8. Marine Finfish Hatchery (8)	-	-	12	70	32	114
9. Fish Health Management (6)	-	-	-	54	28	82
10. Fish Nutrition (4)	-	-	-	26	25	51
11. Aquaculture Management (3)	-	-	-	13	33	46
12. Aquaculture Project Development and Management (6)	-	130	62	-	-	192
13. Culture of Natural Food Organisms (2)	-	-	-	12	13	25
14. <i>Artemia</i> Culture (1)	-	-	-	15	-	15
15. Milkfish Hatchery (2)	-	-	-	17	-	17
Total	24	620	673	681	160	2158

*Number of sessions conducted in parenthesis.

*Number of participants in the other training
programs of SEAFDEC/AQD (1975-92), by 5-year period*

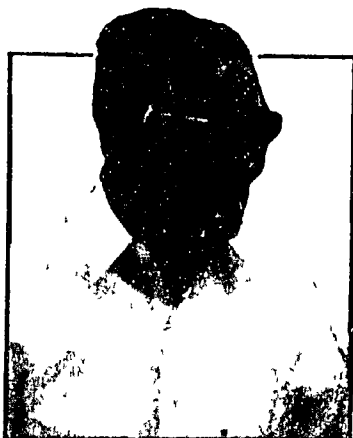
	1975	76-80	81-85	86-90	91-92	TOTAL
1. Aquaculture graduate program*	-	81	128	59	-	268
2. Seminars and workshops for local participants	117	1595	2633	2307	588	7240
3. Student practicum/ internship training	-	267	425	443	227	1362
4. Scientific conferences and meetings	260	455	1131	206	188	2240
Total	377	2398	4317	3015	1003	11 110

*UNDP/FAO NACA-UPV-SEAFDEC/AQD Senior Aquaculturists Training Course leading to the degree Master of Aquaculture

Dean D.K. Villaluz Memorial Lecture Series

In mid-1980s, SEAFDEC/AQD instituted the research seminars where the research staff can present their findings for initial review prior to publication or presentation in scientific meetings. The seminars also became a venue for the research staff to interact with visiting scientists and guests.

In 1992, the Department started dedicating a seminar series to the late Dean Domiciano Villaluz, the first SEAFDEC/AQD Chief, to be held every anniversary celebration. The memorial lecture series is an acknowledgement of the late Chief's able leadership during the Department's organizational and formative years and his contribution to the development of the aquaculture industry in the country and Southeast Asia.



Dean Domiciano K. Villaluz: a researcher, a fishery expert, an educator, and an environmentalist

Dean Villaluz was a researcher, a fishery expert, an educator, and an environmentalist. Born on 30 July 1909 at Angono, Rizal, Dean Villaluz started his career with the government as early as 1931 when he was assigned Instructor in Zoology at the University of the Philippines (UP). He finished his M.Sc. Zoology at UP in 1937. Working with the Bureau of Science, Department of Agriculture and Commerce, he conducted research on oyster farming, and became instrumental in the establishment of oyster farms at Binakayan, Cavite, and in setting up the Limnological Station at Tanay, Rizal.

Dean Villaluz obtained special training in aquaculture and sea products from the Imperial Fisheries Institute (now Tokyo University of Fisheries) in 1939-41, and in shrimp hatchery management in 1946 from the University of Washington-College of Fisheries as a U.S. State Department scholar.

Dean Villaluz joined the Rehabilitation Finance Corporation (RFC) in 1951 and established the RFC system of financing fishponds. In 1963, he joined the Mindanao State University (MSU) in Marawi City and organized its College of Fisheries. At MSU, he pioneered the research on the reproduction, larval development, and cultivation of the giant shrimp, *Penaeus monodon*.

In recognition of his work toward the development of aquaculture in the Philippines, Dean Villaluz was appointed as the first Chief of SEAFDEC/AQD in 1973. He served as Chief until his retirement from active service with the government in 1979. Dean Villaluz died on 28 April 1986 in Angono, Rizal.

For his contribution to the development of the aquaculture industry in the Philippines, Dean Villaluz received various awards, the most prestigious of these were:

1. Rizal Pro Patria Award given by the President of the Philippines in October 1976, on the Diamond Anniversary of the Department of Agriculture;
2. Gregoria y Zara Scientist Award in 1974 from the Philippine Association for the Advancement of Science and the National Science Development Board;
3. Outstanding Service Award in 1974 from the Philippine Federation of Fish Farm Producers;
4. UP Alumni Award in 1977, given by the UP Alumni Association; and
5. Pantas Award in 1979 from the Philippine Council for Agriculture and Resources Research (PCARR).

The First Dean D.K. Villaluz Memorial Lecture was delivered by SEAFDEC/AQD Scientist Jurgenne H. Primavera in July 1992 on the 19th anniversary celebration of the Department. She spoke on charting the future research directions of the shrimp industry in the Philippines. Ms. Primavera has been credited with developing the broodstock of the giant tiger shrimp in captivity. This achievement helped boost the shrimp hatchery industry.

This year's Dean D.K. Villaluz Memorial Lecture, second of the series, is *Advances on milkfish culture* by Scientist Clarissa L. Marte. Dr. Marte is one of the researchers pioneering in induced breeding of milkfish in the country.

Technical cooperation

Countries and institutions involved in aquaculture and fisheries provided additional technical and financial assistance in the research and development activities at AQD. Among them were the following:

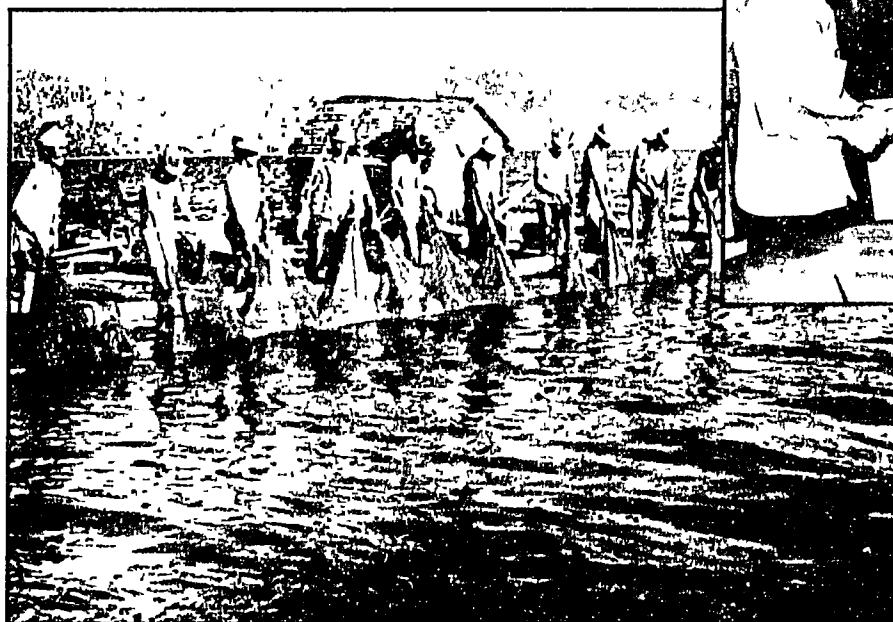
Non-member governments

1. Government of Australia: staff development (1976-77, 1986-93)
2. Government of Belgium (also in collaboration with *Artemia Reference Center*): *Artemia* research (1980-84, 1987-90; staff development (1980-93); exchange of expertise (1977, 1980-81, 1987-90)
3. Government of Canada: staff development (1986-93)
4. Cuba (Through the State Committee for exchange of expertise, 1979): staff development (1979)
5. Government of France: exchange of expertise (1981-84); staff development (1982-83, 1985, 1987-92)
6. Government of Israel: staff development (1978)
7. Government of the Federal Republic of Germany (also in collaboration with University of Hohenheim milkfish research (1989-92); exchange of expertise (1989-92); staff development (1992)
8. Government of New Zealand: mussel and oyster research (1976-77, 1980-83); exchange of expertise (1976-77, 1979-82); staff development (1982-83)
9. Government of the Netherlands: third country training (1988-89)
10. Government of Romania (also in collaboration with Research and Design Institute for Danube Delta and Nucleu Fisheries Research Center): exchange of information (1977)

International/regional organizations and agencies

11. Agriculture Development Council (ADC): research on mangroves (1977); training seminar (1977)
12. Asian Productivity Organization (APO): staff development (1992)
13. Aquaculture Coordination Project of the Centre National pour l'Exploitation des Océans (AQUACOP-CNEXO): exchange of information (1980) and expertise (1980)

Former Department Chief Villaluz and officials of a collaborating agency: a partnership aimed at increasing food production.





*Research on seed production
under the Fisheries Sector
Program of the Philippine
Department of Agriculture*

14. American Soybean Association (ASA): research on fish nutrition (1983-85); exchange of information (1983-85); staff development (1983-84)
15. Southeast Asian Ministries of Education Organization through the Regional Center for Tropical Biology (BIOTROP): exchange of information (1982); staff development (1991-92)
16. Bay of Bengal Programme (BOBP); staff development (1991); exchange of information (1990-92)
17. Danish International Development Agency (DANIDA): research on lake ecology (1980-84); exchange of expertise (1980-84)
18. East-West Center (EWC): exchange of expertise (1976)
19. Indian Council for Agricultural Research (ICAR): exchange of expertise (1977-80)
20. International Center for Living Aquatic Resources Management (ICLARM): socioeconomics research through the Asian Fisheries Social Science Research Network (AFSSRN) (1986-88, 1991-92); exchange of information (1981-93); seafarming research (1991-92)
21. International Center for Marine Resources Development (ICMRD) of the University of Rhode Island: staff development (1981-82, 1986, 1988-89)
22. International Development Research Centre (IDRC) of Canada: milkfish research (1975-85); seafarming and coastal management research (1989-93); mollusc culture research (1992-93); fish genetics (1989-93); fish microbiology (also in collaboration with Simon Fraser University, 1989-93) Brackishwater Aquaculture Information System (BRAIS) (1983-87); third country training (1985-86); staff development (1975-93)
23. International Foundation for Science (IFS) of Sweden: aquaculture research (1980-83, 1987-93); staff development (1980-83, 1987-93)
24. Institut Francais de Recherche pour l'Exploitation de la Mer (IFREMER): mollusc research (1986-87); staff development (1986-87)
25. International Institute for Rural Reconstruction (IIRR): staff development (1992)
26. Japan International Cooperation Agency (JICA): research and laboratory equipment (1974-present); fellowship (1975-present); secondment of experts (1975-present); staff development (1975-present)
27. Kuwait Institute of Scientific Research (KISR): exchange of information (1976-78)
28. Food and Agriculture Organization through the Network of Aquaculture Centres in Asia (NACA): third country training (1980-90); shrimp research (1982-85, 1987-89); exchange of expertise (1980-90); staff development (1980-88, 1990)
29. Overseas Development Ministry (ODM) of the United Kingdom through the British Council: shrimp pond culture (1979-83); exchange of expertise (1979-83); exchange of information (1980-85)
30. Oceanic Foundation of Hawaii: research on *Mugil cephalus* (1976-77)
31. Oceanic Institute of Hawaii: milkfish research (1978-86): exchange of expertise (1979-82); staff development (1982-84); exchange of information (1979-82, 1986)

32. Pacific Biological Station (Nanaimo, British Columbia): ultrasonic tracking of milkfish (1976)
33. Southeast Asian Regional Center for Graduate Study and Research in Agriculture (SEARCA): Aquabusiness Project Development and Management (APDEM) training course (1979-83)
34. South China Sea Fisheries Development and Coordinating Programme (SCSP): third country training (1981); exchange of expertise (1976-81) and information (1976-81)
35. Tungkang Marine Laboratory: exchange of expertise (1976, 1978-80) and information (1976, 1978-80)
36. University of Heidelberg: exchange of expertise (1982-83)
37. Japan Society for the Promotion of Science (JSPS): Ph.D. fellowship (1992-present)
38. Japan Information and Cultural Center (JICC): graduate research fellowship (1980-present)
39. Japan Ministry of Education International Scientific Research Program: research grant (1993-95)

National institutes/agencies

40. Armed Forces of the Philippines (AFP): internal road system construction (1973-78)
41. Bureau of Fisheries and Aquatic Resources (BFAR): aquaculture development (1973-present); training workshops (1973-present); technology verification/transfer (1984-85); communication materials development (1985); National Bangus Breeding Program (1980-89)
42. Cagayan Integrated Agricultural Development Project, Inc. (CIADPI): aquaculture development (1982-83)
43. Department of Agriculture-Bureau of Agricultural Research (DA-BAR): aquaculture development (1988-present); Fisheries Sector Program (1990-present)
44. Department of Agriculture-VI (DA-VI) [also in collaboration with Cooperative de Traitement des Produits de la Peche (CTTP) of France: aquaculture research (1991-present)]
45. Development Academy of the Philippines (DAP): aquaculture technology resource management (1978-80)

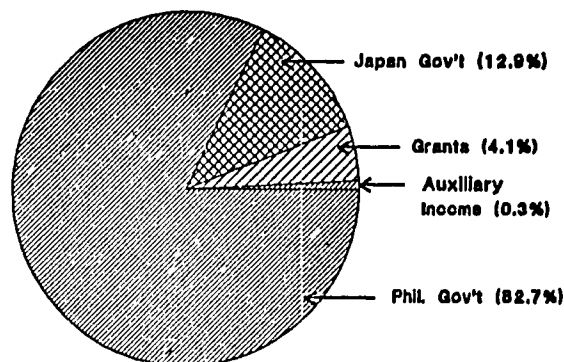
IDRC of Canada contributes the most in terms of research grants, funding projects on milkfish breeding, seafarming, mollusc culture, and fish genetics and microbiology. The Brackishwater Aquaculture Information System or BRAIS was also an IDRC-assisted project.



46. Department of Science and Technology (DOST): aquaculture research (1991); exchange of information (1990)
47. Educational Development Program Implementing Task Force (EDPITAF): training workshops (1975)
48. National Food and Nutrition Research Institute (FNRI): feed sample analysis (1976-78)
49. *Kilusang Kabuhayan at Kaunlaran* (KKK): aquaculture development (1982-83)
50. Laguna Lake Development Authority (LLDA): lake resources management (1976-85); United Neighborhood for Livelihood and Development (UNLAD) (1983-85)
51. Mariano Marcos State University (MMSU): milkfish seedbank (1983-84)
52. *Masaganang Sakahan, Inc.* (MSI): technology extension (1983-85)
53. University of the Philippines-Marine Science Institute (UP-MSI): seaweed research (1988); exchange of expertise (1981-83, 1988-)
54. Mindanao State University (MSU): cooperative research on shrimp seed production (1975-78)
55. National Pollution Control Commission (NPCC): pollution indexes monitoring (1977-79)
56. Negros Prawn Producers and Marketing Cooperative, Inc. (NPPMCI): microbiology (1987-88)
57. Philippine Atmospheric, Geophysical and Astronomical Service Administration (PAGASA): hydrometeorology (1977-78)
58. Philippine Business for Social Progress-Center for Rural Technology Development (PBSP-CRTD): carp technology verification (1983-85)
59. Philippine Council for Agricultural Research and Resources Development (PCARRD): socioeconomics survey of aquaculture (1975-79); exchange of expertise (1974-86) and information (1974-86); staff development (1977-81); communication materials development (1984-85)
60. Philippine Council for Aquatic and Marine Research and Development (PCAMRD): staff development (1990-present); exchange of information (1986-present)
61. Philippine Federation of Rural Broadcasters: information dissemination (1982-84)
62. Panay State Polytechnic College (PSPC): aquaculture field testing (1981-83)
63. Technology and Livelihood Resource Center (TLRC): technology verification (1980-83) outreach seminars (1987-89); technology training (1987-89); communication materials development (1987-89)
64. University of the Philippines - Diliman: aquaculture research (1991-92)
65. University of the Philippines - Los Banos (UPLB): freshwater aquatic resources development (1978-80)
66. University of the Philippines - Visayas (UPV): staff development (1976-85); exchange of information (1976-present); aquaculture research (1991-present); exchange of expertise (1987-present)

Financial matters

Funds received by SEAFDEC/AQD from 1973 to 1992, amounting to US \$ 81,590,834 came from contributions (95.6%), grants (4.1%), and auxiliary income (0.3%). Contributions came from the Government of the Philippines (86.5%) and the Government of Japan (13.5%). Eighty-one per cent of the grants came from the International Development Research Centre (IDRC) of Canada, 5.4% from the Government of Australia, 1.9% from the Government of New Zealand, 1.8% from the International Foundation for Science (IFS), 1.4% from Asian Development Bank (ADB), 1.2% from the Oceanic Institute, 1.1% from the International Center for Living Aquatic Resources Management (ICLARM) through the Asian Fisheries Social Science Research Network (AFSSRN), 1.1% from the SEAFDEC Secretariat, 1.0% from the Technology and Livelihood Resource Center of the Philippines, and some 3.4% from various sources including IFREMER/COP (0.9%), CTP/BEL Industries (0.6%), Government of the Netherlands (0.5%), University of Hohenheim (0.3%), FAO/UNDP (0.3%), FAO/NACA (0.3%), Takeda Chemicals (0.3%), Cultor Ltd. (0.1%), Showa Denko (0.1%), and from unspecified sources (0.7%).



Benefits from the AQD training courses: What the trainees say

... knowledge and skills from the training are now used in our research activities on fish nutrition.

**Dr. Roshada Hashim, Malaysia
Nutrition (1989)**

I was assigned Head of the Grow-Out Section at our Station.

**Tawesak Youngvanichset, Thailand
Pond Culture (1986)**

... although no reward nor incentives were received after the training, the skills enabled me to provide better extension services.

**Ng Hock Sun, Malaysia
Fish Health (1990)**

I was given more responsibilities.... Knowledge and skills acquired are now translated into extension, training, and research activities.

**Erwin Pador, Philippines
Fish Health (1987), Natural Food (1981)
Prawn Development (1983)**

Our office gave me greater responsibilities as regards our project on natural food.

**Siti Azamah Hj. Mustapha, Malaysia
Natural Food (1989)**

I was made to set up a separate feed laboratory and am now assigned to process feedstuff.

**Marilou Vicencio, Philippines
Nutrition (1989)**

I was promoted to a higher position and all my project proposals are approved. I am able to apply the skills from the training in my present work.

**Chongko Saetung, Thailand
Marine Finfish Hatchery (1986)
Natural Food (1989)**

Our Station is still not able to make use of the skills acquired because of lack of equipment and chemicals for a fish health laboratory.

**Jaime Salazar, Philippines
Fish Health (1990)**

... skills on cannulation of broodstock and induced spawning using hormones have been applied at our Station.

**Jate Pimoljinda, Thailand
Marine Finfish Hatchery (1986)**

I assisted in the establishment of a Tilapia Hatchery and Nursery in our region.

**Raul Millana, Philippines
Freshwater Aquaculture (1990)**

I was permitted to set up a histology laboratory.

**Yaowarit Darayadol, Thailand
Fish Health (1989)**

I now serve as resource person in various aquaculture training courses conducted in our region.

**Moises Solidum, Philippines
Prawn Hatchery (1982), Fish Health (1987)**

I was given permanent appointment, and am now confident in my main responsibility of transferring aquaculture techniques to the fish farmers.

Elizabeth Cruz, Philippines
Aquaculture Management (1981)

I am still not able to make use of the skills acquired because of the transfer of assignment from Operations Division to Planning and Monitoring Division.

Esmeralda Paz Manalang, Philippines
Prawn Hatchery (1989)

The training course was given 3 units credit for my M.Sc. degree....the skills are useful in my present work.

Mercedita Bantaya, Philippines
Fish Health (1989)

... management gave me greater responsibilities related to the development of an aquaculture project.

Halfi Kalbi, Philippines
Fishpond Engineering (1978)

... the training was given weight as one of the criteria for promotion.

Robinson Rarang, Philippines
Oyster and Mussel Culture (1983)

I was able to impart to my students the proper aquaculture techniques learned from the training.

Ramir Terez, Philippines
Prawn Hatchery (1978), Pond Culture (1984)

I was allowed to conduct a study in line with my training, and was successful in such study.

Ruth Gaid, Philippines
Natural Food (1989)

... quick approval and funding of my project proposals. I am now given priority as resource person in seminars and training courses conducted by our School.

Grande Soriano Ponce, Philippines
Freshwater Aquaculture (1985)



I was promoted to Instructor I and was made to teach aquaculture subjects in college.

Nelita Castillo Alura, Philippines
Aquaculture Management (1990)

I was given a salary increase and higher bonus....The skills acquired are very useful in my present work.

Edwin Panoso, Philippines
Fish Health (1990)

The application of the skills from the training helped increase production from our ponds.

Allan Young, Philippines
Pond Culture (1986)

Knowledge from the training mixed with my own experience gave new idea which was applied in the farms and resulted in improved production.

Pablo Chu, Philippines
Pond Culture (1989)

I was given a promotion and increase in salary....The improved techniques learned from the training are now being successfully applied in our hatcheries.

Elizabeth Lamera, Philippines
Prawn Hatchery (1979)

I was not given the chance to apply the skills learned as my supervisor gives more credit to the advice from his foreign adviser.

Elma de la Cruz, Philippines
Pond Culture (1986)

I was given a promotion....The knowledge acquired was very useful in the expansion of our aquaculture activities and in improving existing ones.

Abdulredha Shams, Bahrain
Prawn Hatchery (1984), Natural Food (1984)
Nutrition (1984)

I was made officer-in-charge of a milkfish culture project in a government fishfarm.

Erva Tekaraba, Christmas Island
Aquaculture Management (1985)
Natural Food (1985)

I am now able to impart my knowledge of aquaculture processes. The training is also being used as an advertisement by my agency.

J.C.J. Van Zon, Holland
Aquaculture Management (1985)

The training enabled me to carry out studies on induced spawning and rearing of sea bass.

Herno Minjoyo, Indonesia
Marine Finfish Hatchery (1986)

The training enabled me to assist the planning board in regional development. I was assigned as one of the decision makers as far as aquaculture project is concerned.

Ir. Kaspel Basran, Indonesia
Aquaculture Management (1990)

... no reward nor incentive was received...but I am able to apply in the farm the skills acquired from the training.

Sachindra Mohan Chakrabarty, India
Pond Culture (1987)

I am now imparting the knowledge acquired to the training being conducted by our Office.

Dr. Al. Mathuraman, India
Prawn Hatchery (1988)

I was promoted to a higher and more reputable position....the skills acquired are now being implemented in our Laboratory.

Dr. Radharanjan Kumar Sinha, India
Artemia Culture (1988)



I am not able to use the skills from the training since I was given an administrative position after the training.

T.N. Sivadasan Asari, India
Pond Culture (1987)

Although I did not receive reward nor incentive, our institute recognizes the importance of my training and supports my present work.

Liu Heng, Peoples Republic of China
Artemia Culture (1988)

I was allowed to work on my own in the farms and more support was given to my project.

Baraniko Raobati, Kiribati
Pond Culture (1985)

I was appointed General Manager of our Hatchery and Grow-out Section.

R.P. Samarasinghe, Sri Lanka
Prawn Hatchery (1988)

I was promoted to Assistant Lecturer.

U Aung Kyi, Myanmar
Prawn Hatchery (1983), Natural Food (1983)
Pond Culture (1984)

I was chosen as one of the lecturers on aquaculture in our institution.

A.J. Dhammika Liyanage, Sri Lanka
Nutrition (1989)

The knowledge I acquired is very useful in my teaching profession.

Esther Ademoji Adesulu, Nigeria
Aquaculture Management (1985)

I was promoted to Senior Fisheries Officer. I am now able to impart the knowledge obtained to fisheries students and other individuals who are carrying out shrimp farming in my country.

Winfried Venant Haule, Tanzania
Aquaculture Management (1980)

I am now an invited lecturer on tropical aquaculture at the University of Bergen. However, I can not put to practical use some specific skills from the training as our Laboratory is working on Atlantic salmon.

Krisna R. Torrissen, Norway
Freshwater Aquaculture (1987)

I was assigned the task of assisting the village fish farmers.

John B. Iou, Yap State
Pond Culture (1986)

Two decades with SEAFDEC/AQD: The pioneers talk

Seven staff members will mark their 20th year of service with the Department in 1993.



Jake Amihan

Amang Dalusong

Greg Genzola

Jesus S. Amihan, Jake to friends, was born on 24 August 1941 at Nabitasan, Leganes, Iloilo and was employed by AQD on 1 December 1973 as Fishery Aide at the Leganes Brackishwater Substation. Jake is optimistic that SEAFDEC/AQD will develop further into a leading aquaculture center in this part of the world, given the correct procedures and maintaining the present management techniques used by the officers and staff. With 20 years of experience behind him, Jake already knows by heart how to culture crabs, milkfish (from fry to fingerlings, and fingerlings to grow-out), shrimp, tilapia, sea bass, and seaweed. From his experience, he believes that crabs should be cultured in natural pond conditions instead of concrete ponds, and that seaweed (*Gracilaria*) should be cultured not very far from the shore for they need freshwater. Jake is still active as an Aide, assisting researchers in their research and development efforts.

Florencio D. Dalusong, Jr. is one of the real pioneers of SEAFDEC/AQD. Fondly called Amang, he was already working with a special project on aquaculture when it was implemented at the Mindanao State University. SEAFDEC/AQD was an offshoot of that project. But Amang became a bonafide SEAFDEC/AQD employee only on 1 August 1973, when he was employed as Property Custodian for the Manila Office. Amang is a BS Commerce (major in Accounting) graduate.

He is proud to say that he has been a witness to the changes at AQD, in research as well as in its management. He said he has no regrets for the 20 years that he spent at AQD. He has already considered the Department his second home and family. He is happy to have worked harmoniously with the staff and officers of the Department, not only with the Manila-based staff but with the Iloilo- and Binangongan-based staff as well. He did not experience a big disappointment while working at the Department, except during the illegal take-over of the Department. His first reaction then was to resign especially when he was to be assigned at Binangonan, but after thinking the matter over, he opted to stay.

In AQD, Amang attended training courses on developing supervisory skills, purchasing management, and letter of credits. He still holds the position of Property Custodian which he is proud to note he has served religiously and honestly under five Department Chiefs. He is thankful to the staff and officers of the Department who helped him grow, and prays that he could still be of service to the Department for many years to come.

Amang was born on 4 May 1937 in Sampaloc, Manila. He and his family now resides at Lagro Subdivision, Novaliches, Quezon City.

Gregorio G. Genzola was born on 28 November 1945 at Guimbal, Iloilo. He joined the Department in 1 August 1973. Greg recalled one experience he cannot forget, when as Survey Aide, the first position he held at SEAFDEC/AQD, he was almost hacked to death by a bolo-wielding lot owner who did not want to part his land to SEAFDEC/AQD for sentimental reasons. Being a fast sprinter saved his life. The problem was, however, solved after the issuance of P.D. 292 by former President Marcos. From Survey Aide, Greg was promoted to Timekeeper then to Custodian of Equipment and Supplies donated by JICA, then to Supply Clerk, Storekeeper, Property Custodian, Equipment Management Supervisor, then to his present position as Acting Property and Supply Supervisor. He remembered rendering more than 12 hours overtime work without extra compensation during the early days because of his concern, and that of dozens more of his co-workers, with the development of SEAFDEC/AQD. He believed that the conflicts that occurred at SEAFDEC/AQD may be due to unfair implementation of policies. That is past. To secure the future, he believes that a thorough review of Department policies and its fair implementation would strengthen human resource management and smoothen the operations of SEAFDEC/AQD.

Greg has recently trained in Inventory Planning and Control, Basic Supervisory Course, and Asset Disposal Rules. Greg resides at Brgy. Nanga, Guimbal, Iloilo.

Dante J. Guinalon, born on 30 July 1938 in Leganes, Iloilo where he now resides, was first hired as Liaison Aide on contractual basis on 16 May 1973. SEAFDEC/AQD then was a project of the Mindanao State University. He became a permanent employee on 1 July 1974. Since then, he held various positions, the latest of which is as Property Custodian since 15 July 1992. While at SEAFDEC/AQD, he underwent training in basic computer operations and on labor management and arbitrary procedures.

Nong Dante, as he is fondly called especially by the younger set, said that it has always interest him to see people come and go especially during the "changing of the guards." AQD had undergone six transitions in its highest heirarchy, all of which he witnessed. He added that SEAFDEC/AQD's growth has been marked with turbulence and restiveness as the employees sought for direction and reforms in the Department's governance. He believes that this was due to some of the SEAFDEC/AQD's policies and actions which sometimes lack wisdom and foresight. He feels that prescriptions for the future, if they are to prove effective, must be deeply rooted in the experience of the past.

Nong Dante is the current President of the Union of SEAFDEC/AQD Employees-National Federation of Labor.

Efren M. Huervana was born on 12 July 1948 at Guan, Leganes, Iloilo. Although armed with a B.Sc. in Agriculture degree, Efren was hired by SEAFDEC/AQD as Buyer-Canvasser on 1 August 1973, during the time when its temporary office was at the Diolosa Duplex House, Villa Alegre, Jaro, Iloilo City. Efren recalled that the early days were busiest for him as that was during the infrastructure development period. Like Greg, Efren also remembered the days when they have to work beyond office hours and



Dante Guinalon



Efren Huervana



Precy Subosa



Toen Villoga

during Saturdays and Sundays without extra compensation, all for the love of an office which was then developing. Efren was later appointed Cashier, Associate Supervisor of the Purchasing and Supply Management Unit for Leganes Brackishwater Substation, then as Supervisor of PSMU Warehouse at the Tigbauan Main Station until at present where he has been appointed Administrative Assistant II for the Administration Division.

Efren noted that the harmonious relationship between subordinates and supervisors in the early days was dampened by disputes caused by personal and political motives. This has created a wide gap between the rank-and-file employees and the supervisors, which he feels still exists. However, he expressed the hope that SEAFDEC/AQD could still be steered properly by its present leaders in order to minimize disputes and be able to attain its goal and continue to operate effectively in the decades to come. While at SEAFDEC/AQD, Efren attended the Materials Management Seminar and the Training Course on Technical Writing.

Precilla F. Subosa, Precy to friends, was born in Miag-ao, Iloilo on 16 June 1949. Precy, now residing at Guimahan, Leganes, Iloilo, is a B.Sc. Chemical Engineering graduate. She was employed by SEAFDEC/AQD on 16 November 1973 as Physical Assistant to the Project Engineer, during the time when construction of facilities at Tigbauan was in full swing. Later, she was assigned Laboratory Technician, then Fishery Technician, Research Assistant, Technical Assistant, then as Research Associate. After having ample number of publications to her credit, Precy now holds the position of Associate Scientist. While at SEAFDEC/AQD, Precy trained in Instrumental Chemistry at Kyoto University, Japan, 2 September 1987 - 2 March 1988, sponsored by the Japan International Cooperation Agency (JICA). Up to now, Precy says that she can not just give up the idea of losing the Leganes Brackishwater Substation where she spent 15 years of her fruitful life. She divides her 20 years at SEAFDEC/AQD as follows: 6 years of struggle, 4 years of indecisiveness, 5 years of chaotic life, and 5 years of development. She is thankful to the Lord and to everyone for helping her grow with SEAFDEC/AQD. She asks the staff to unite and help SEAFDEC/AQD in attaining its goals in the coming years.

Rogelio J. Villoga, Toen to friends, was born on 1 June 1944 in Alacaygan, Banate, Iloilo where he still resides. From Tigbauan Main Station, where Toen is assigned, he goes home to Alacaygan everyday, a distance which he said is "quite far for his pocket."

Toen, who was employed by SEAFDEC/AQD as Aide at the Leganes Brackishwater Substation on 1 December 1973, said he is happy with his work. He noted that since he has gained a lot of experience, he can now operate his own fishfarm in his hometown after his retirement. His experience in aquaculture began when he worked at the Mindanao State University in Naawan, Misamis Oriental when SEAFDEC/AQD was still a project of MSU.

He had a wonderful time with his previous supervisors during his assignment at Leganes. He has worked under Dante Gerochi on milkfish culture, Ricardo Esguerra on sea bass culture, Jesse Banno on siganid culture, and Melchor Lijauco and Oscar Prospero on crab culture. Toen was among the last SEAFDEC/AQD staff who left Leganes, after it was closed in May 1990, as he had to maintain the remaining research study even beyond the expiration of the Leganes contract.

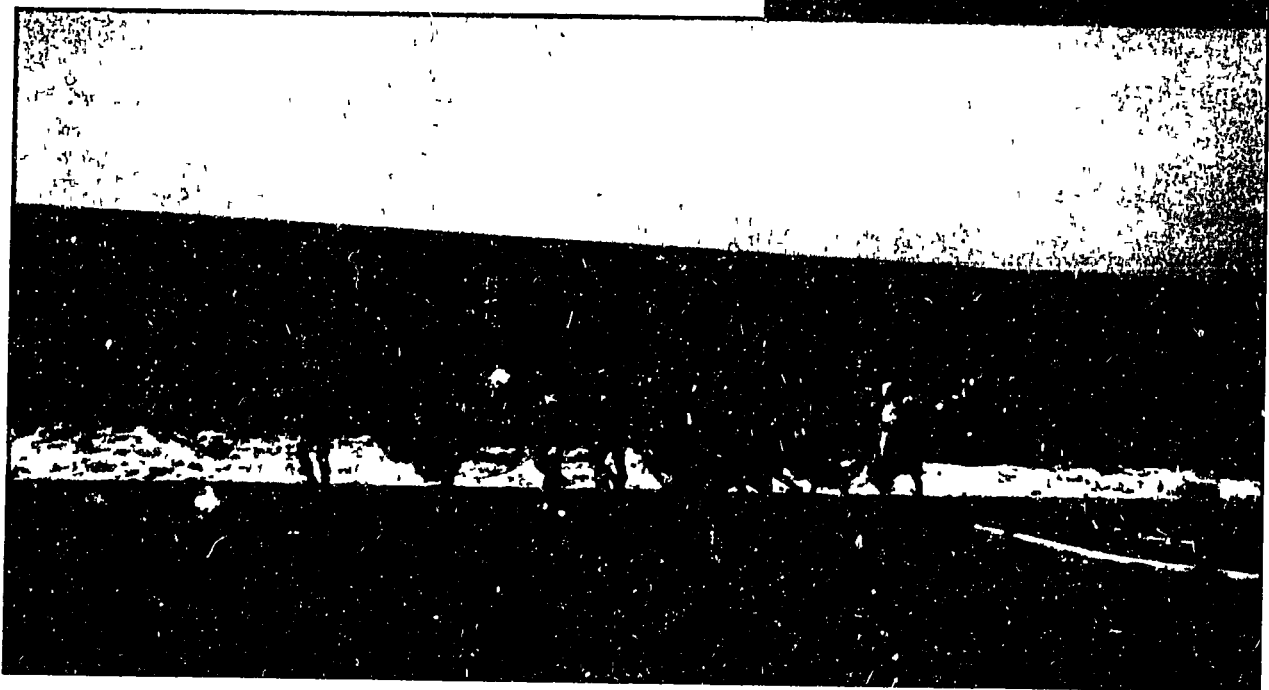
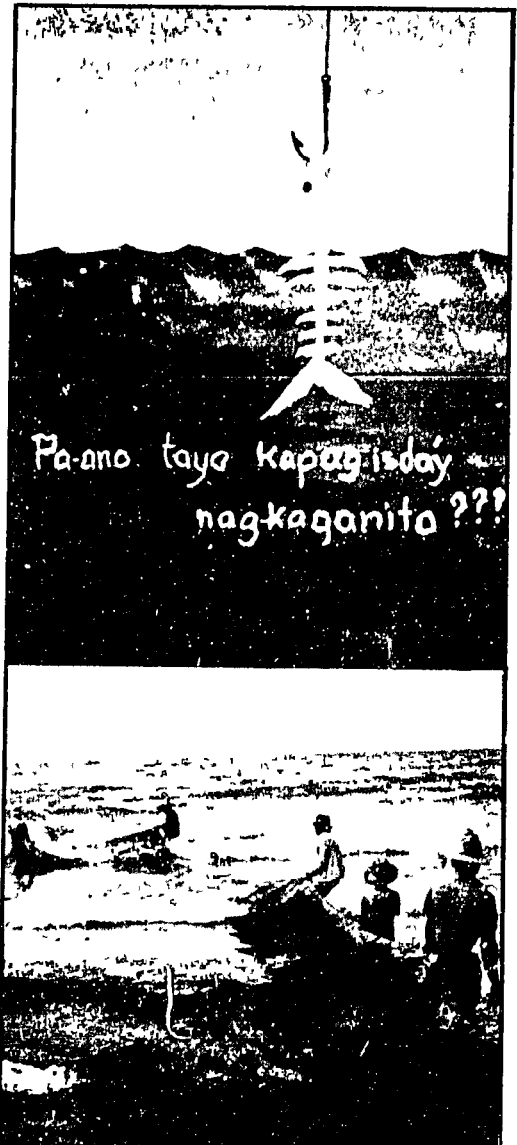
In Tigbauan, Toen said he was happy with his assignment -- the collaborative research on milkfish with the University of Hohenheim where he became under Karsten Schroeder. He is now working with the Physiology group.

Future direction

Research and development programs of SEAFDEC/AQD are reviewed by the SEAFDEC Council every three years in order for these programs to remain relevant to the requirements of the region. Research activities focus on economically important species and are geared towards the development of aquaculture technologies appropriate for the region. The research thrusts since 1989 reflect the regional priorities identified during ADSEA I (1987) and ADSEA II (1991). ADSEA III will be conducted in 1994. In the next decade, research programs will shift to generate technologies that are environment-friendly, sustainable, and give equitable benefits to society. Conscious of the impact of aquaculture on the environment, SEAFDEC/AQD will focus more on the use of open coastal waters for seafarming and searanching, instead of the limited inland bodies of water. Training programs will be modified according to the needs of the region.

A multidisciplinary approach to research will be instituted at AQD. The natural scientists will be working with the social scientists and the fisherfolk in developing technologies. This collaboration opens many venues for investigation as problems are now viewed from different perspectives. The participation of fisherfolk in particular allows them access and understanding of the technologies developed, they who are the traditional users of the aquatic resources and who are most affected when the environment is sacrificed for the sake of progress.

In the next decade and beyond, AQD will work to make aquaculture sustainable.





Greetings

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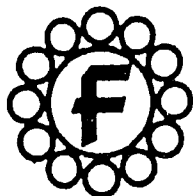
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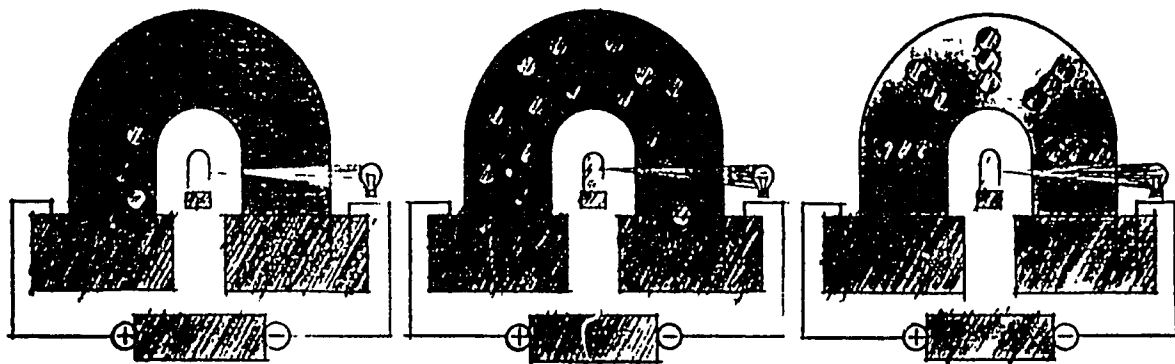
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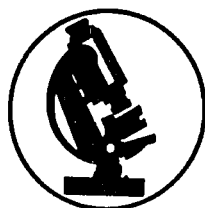
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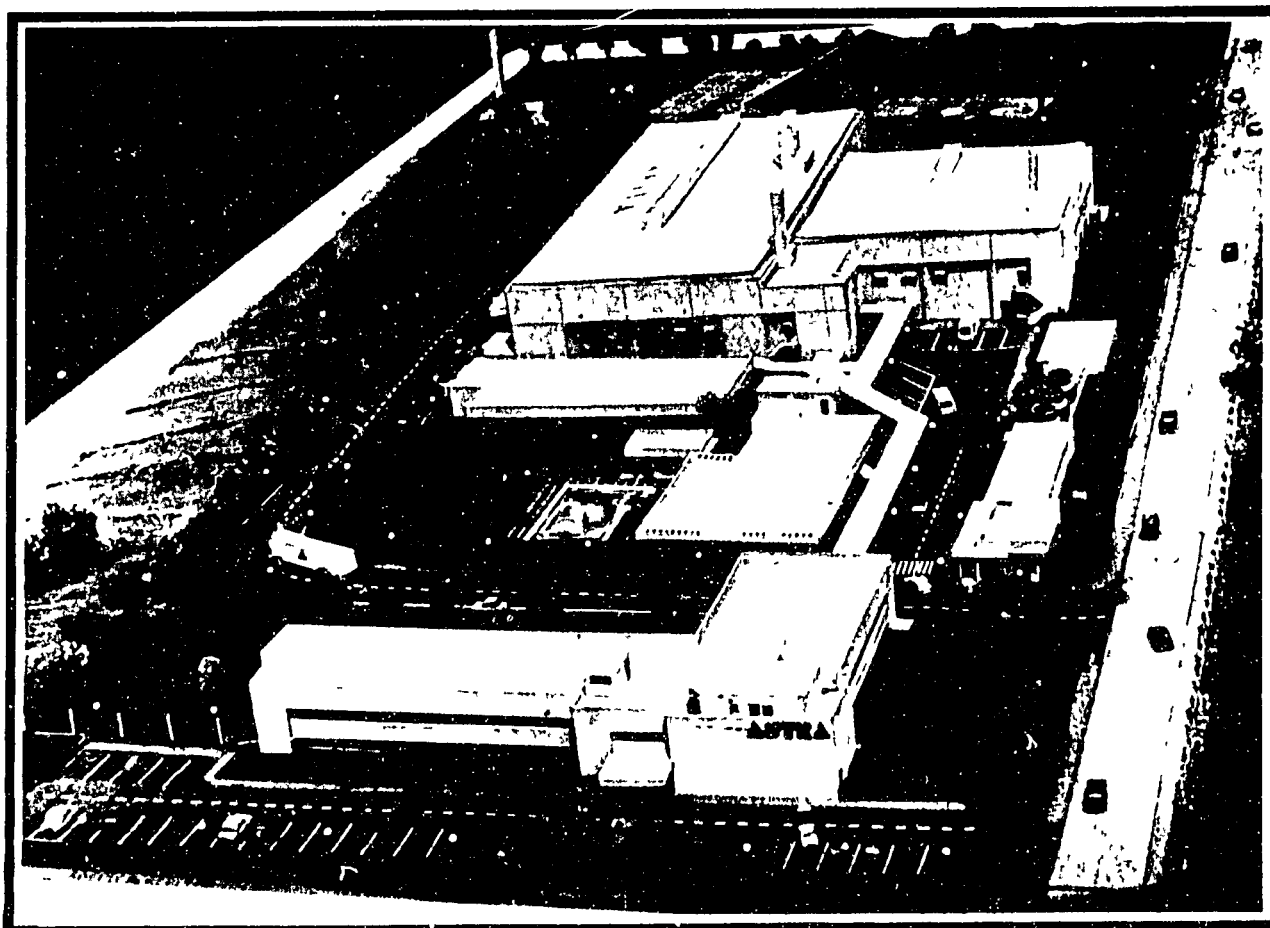
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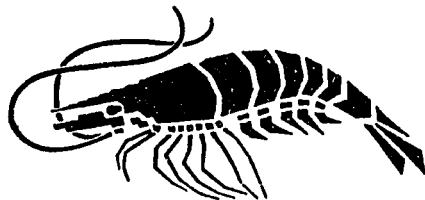
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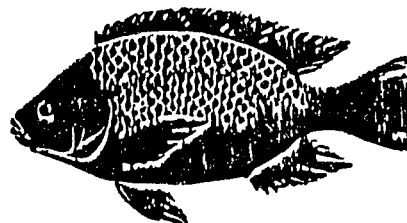


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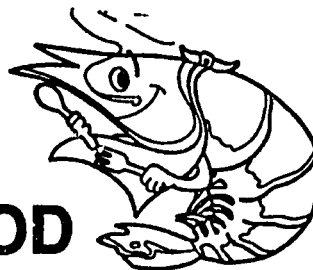
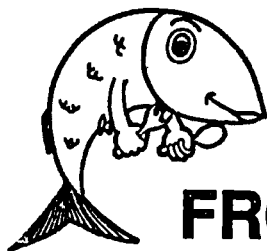
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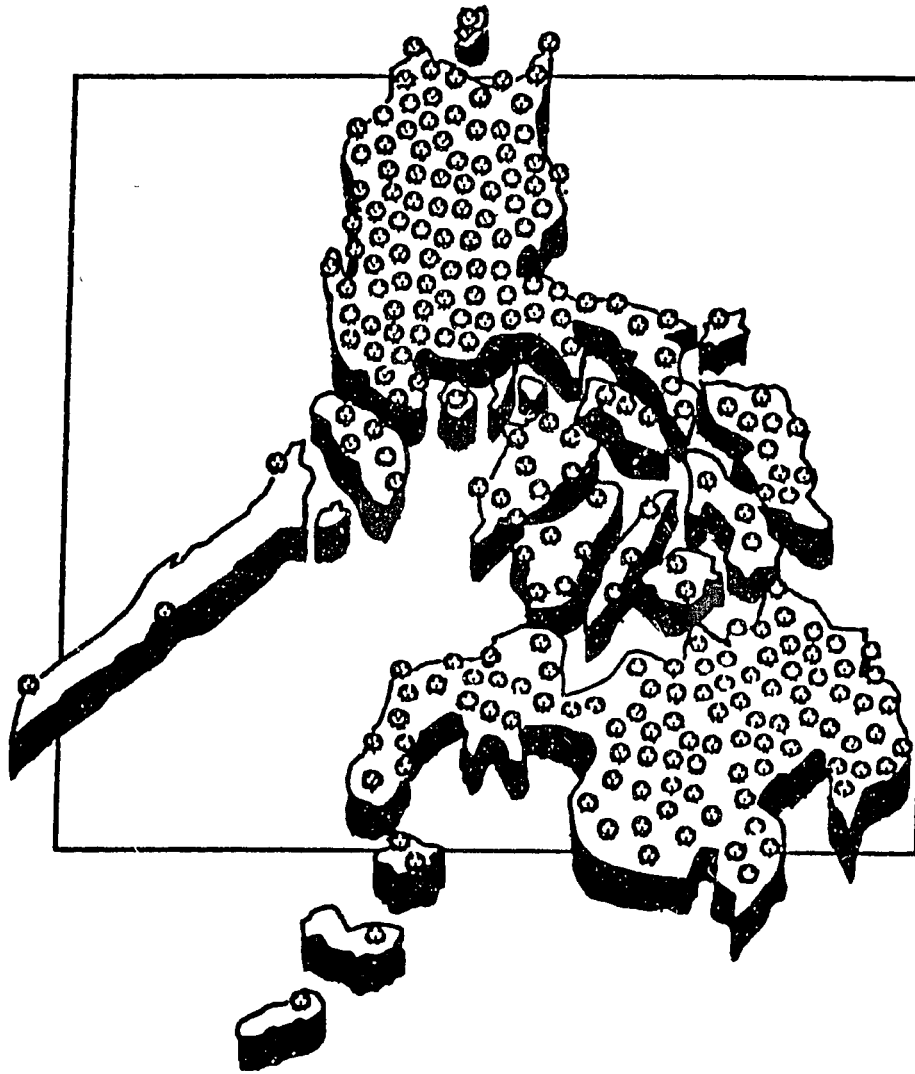
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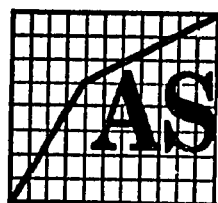
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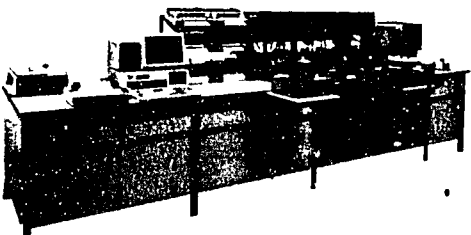


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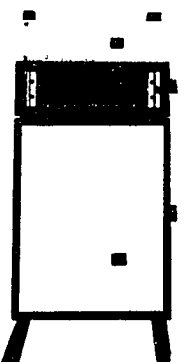
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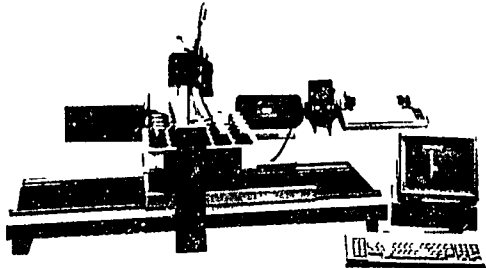


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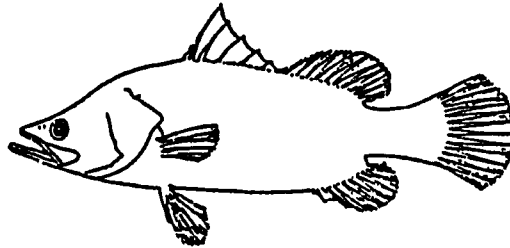


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