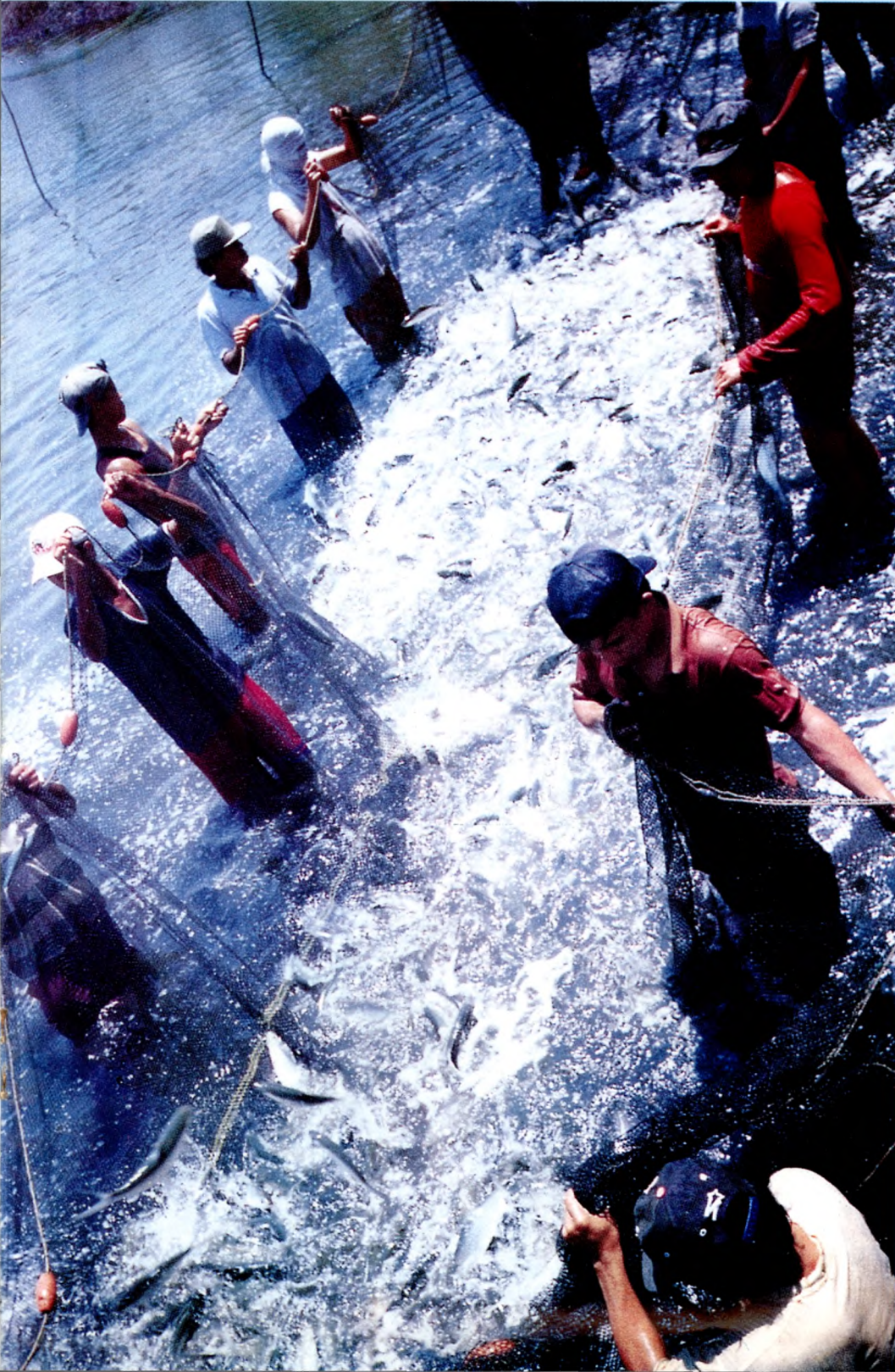


*Aquaculture
for food sufficiency
and industry stability*

1996 Highlights



AQUACULTURE DEPARTMENT
Southeast Asian Fisheries
Development Center

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Cover story:

A bountiful harvest of milkfish.

Milkfish (*Chanos chanos* Forsskal) is the leading aquaculture commodity in the country, topping all other species in terms of production volume. Milkfish became the No. 1 priority for fish research for 1995-97 at the third seminar-workshop on Aquaculture Development in Southeast Asia or ADSEA III.

COVER PHOTO BY N. SUMAGAYSAY

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Thrust of the Aquaculture Department

Technology verification and transfer

1996 marked a change in the thrust of the SEAFDEC Aquaculture Department (AQD). The Department took a strong hand in technology verification and technology transfer even as it continued research on economically important food fishes in the region.

Most of the research results got published in refereed journals, strengthening the Department's stature in the international scientific community. Researchers have produced a prodigious amount of research papers in the 23 years of the Department's existence. These publications are but raw materials out of which viable aquaculture technologies are developed. In the face of global food insufficiency, it has become imperative that this considerable research output be translated to technologies which the industry can use.

Dr. Rolando R. Platon, Department Chief, defined the thrust of his administration in his inaugural address at the Turn-Over Ceremonies, April 30, 1996:

"...We will have a strong hand in technology verification and aquaculture extension, and bridge the gap between AQD's considerable research output and the industry's need for sustainable technologies. I have spent the last several years with the industry, and we can only describe ourselves as technology hungry. AQD must verify and then demonstrate and extend the technologies it can generate.

"...Ours then is a crucial role to make food sufficiency a reality in our region, and I could see that being hastened by production-oriented research to be followed by vigorous technology verification and extension."



Dr. Rolando Platon took his oath of office on April 30, 1996 as the sixth AQD Chief. He holds a Ph.D. Aquaculture Engineering degree from the University of British Columbia as a fellow of the International Development Research Centre of Canada. He has two masteral degrees in engineering, one from the University of the Philippines (Chemical Engineering) and the other from the Northwestern University in Illinois, U.S.A. (Environmental Engineering).

Mr. Yasuho Tadokoro is AQD's Deputy Chief starting July 8, 1996. He served as Director of Fisheries Technical Cooperation at the Japan International Cooperation Agency from 1987 to 1994. He obtained his degrees from Kyoto University (Fisheries, 1970) and Meiji University (Law, 1977).

A Visit

With a message

“Pollution, environmental degradation, food shortage, and other adverse effects of a galloping population growth are harsh realities that we should live with. As scientists and researchers, we should be aware of these; our job is to delay the inevitable. Use science and technology to delay or if possible neutralize the adverse effects of rapid population growth.”

That was the message of Department of Agriculture Secretary Salvador Escudero to the officials and staff of AQD when he visited, April 26. Secretary Escudero encouraged the staff to keep being attuned to the local needs of the industry. He wished for the research institution to become more aggressive in its local presence.



DA Secretary Salvador Escudero (right) tour AQD facilities with Dr. Rolando Platon, AQD Chief. The Secretary came to boost production-oriented research to cope with population demand.

Visioning Workshop

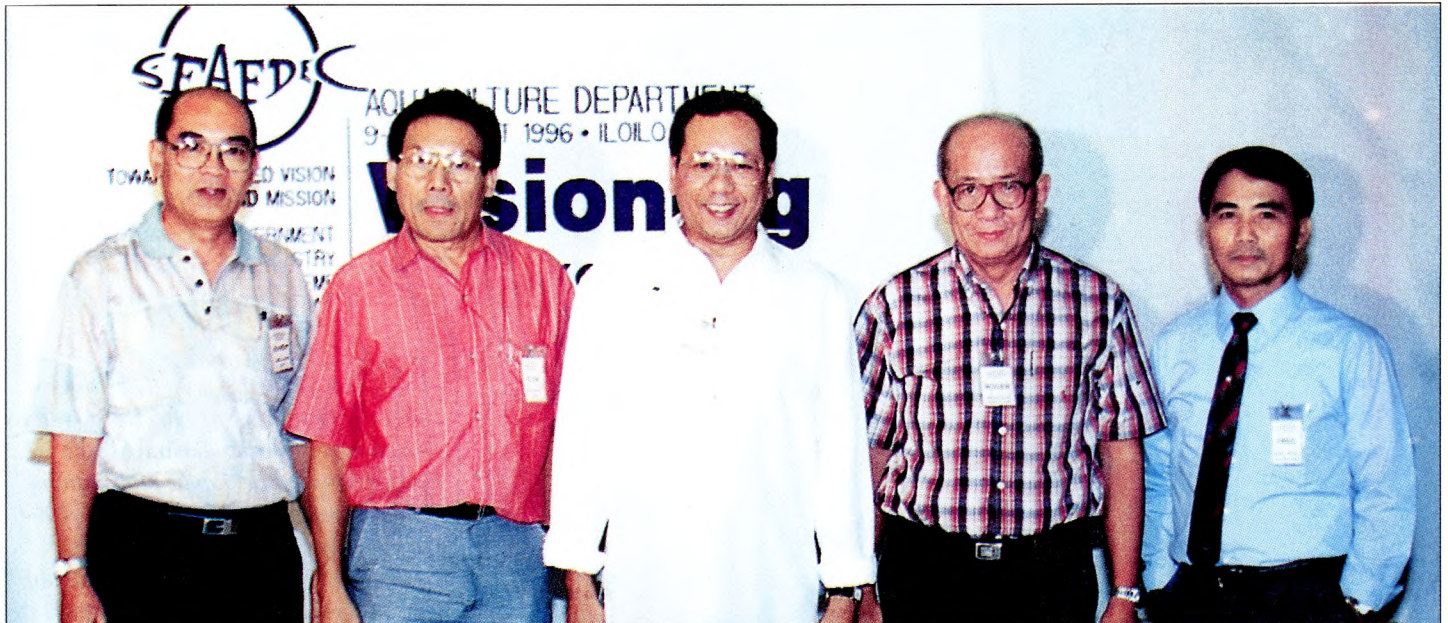
Setting directions: “AQD shall be a dynamic, socially relevant regional research and development organization for sustainable aquaculture responsive to the needs of the industry and society.”

AQD held a ***Visioning Workshop***, August 9-10, in Iloilo City to reexamine AQD priorities and redefine its goals and objectives within the mandates of the institution.

The workshop was the starting point in the AQD strategic planning process and was designed as a vehicle to formulate and validate the overall AQD vision. It focused on what the employees want AQD to be, the research institution’s distinctiveness and resources, the “downsides” to progress, and the support systems needed.

The output of the workshop was a vision statement for the institution as quoted above.

Incumbent as well as former AQD Chiefs share a common vision. Left to right: Dr. Efren Ed. C. Flores, Dr. Flor J. Lacanilao, Dr. Rolando R. Platon, Dr. Rogelio O. Juliано, and Dr. Alfredo C. Santiago, Jr.



RESEARCH

"To promote and undertake aquaculture research relevant and appropriate for Southeast Asia"

True to its mandate, SEAFDEC AQD conducted research on the priority species identified during the third seminar-workshop on Aquaculture Development in Southeast Asia or ADSEA III held July 25-29, 1994 in Iloilo City, Philippines. The ADSEA seminar-workshops ensure that research and training are relevant and proactive to the economic realities of Southeast Asia.

Research studies were undertaken in AQD's three stations: Tigbauan Main Station (Tigbauan, Iloilo), Igang Marine Substation (Igang, Guimaras), and Binangonan Freshwater Substation (Binangonan, Rizal).

Significant accomplishments in 1996 are in the following pages.



Tigbauan Main Station, a 40-hectare complex, has R&D, housing, and recreational facilities. It also serves as the headquarters of AQD.



Igang Marine Substation (above) is equipped with floating net cages for the maturation and spawning of commercially important fishes.

Binangonan Freshwater Substation (right) serves as a guardian of Laguna de Bay through use of predictive models developed from ongoing studies. Research focuses on freshwater species and lake ecology.



Research Studies

Pushing the frontiers of aquaculture

Milkfish

Chanos chanos



The broodstock and hatchery technology for milkfish (*bangus*) developed at SEAFDEC AQD in 1976-80, became transferable to the private sector in the mid-1980s. But the shrimp boom overshadowed these significant developments and the milkfish industry suffered production setbacks. Now, pond operators and investors are taking renewed interest in milkfish — in producing postlarvae (“fry”) in hatcheries, in growing market size fish in semi-intensive and intensive farms, and in processing value-added milkfish products.

SEAFDEC AQD responds to this renewed interest by strengthening its milkfish R&D projects. Already formulated is a milkfish broodstock diet containing high-quality fish meal, 40% protein, and 7% lipid. This diet given at 4% of body weight daily ensures high fecundity, frequent spawning, and good larval quality. A flake diet has also been formulated for milkfish larvae starting day 14 of rearing in the hatchery. The hatchery environment allows the survival of milkfish larvae with deformities. One way of significantly reducing the number of fry with deformities is by feeding these with rotifer and *Artemia* enriched with highly unsaturated fatty acids (HUFA) and vitamin C. Although a small number of hatchery-reared fry have deformities, hatchery-bred and wild-caught milkfish fry do not differ significantly in growth and production in ponds, contrary to the prejudice of some pond operators. Several private hatchery and pond operators are now collaborating with SEAFDEC AQD to fast-track the transfer and commercialization of the milkfish broodstock and hatchery technology.

With the ban on the use of Brestan and Aquatin, milkfish farmers are faced with the problem of heavy snail infestation. The biodegradable molluscicide metaldehyde is effective against the common pond snails at doses of 5-7 kg/ha under laboratory conditions. Doses as high as 175 kg/ha were also found not to be toxic to milkfish juveniles. Tests to determine the effective concentration of metaldehyde under actual pond conditions are being done.

Mud crab

Scylla serrata



Significant progress was made in all phases of mud crab (*alimango*) culture under the 3-year collaborative project with the Australian Center for International Agricultural Research (ACIAR) titled “Development of improved mud crab culture systems in the Philippines and Australia.”

A suitable broodstock diet and maturation system developed at SEAFDEC AQD resulted in consistent maturation and spawning and production of good quality larvae year-round. Rematurations

occurred in both unablated and ablated females about one month after previous spawnings with no decline in reproductive performance.

A larval rearing method, based on previous trials on feeding, salinity tolerance, and water management schemes, hastened progress in larviculture. The use of a microparticulate diet markedly improved megalopa survival (6-14%) compared to the all-natural food diet (1-5%). Megalopae were successfully reared to crablets for stocking in nursery ponds.

Progressive harvesting proved to be more economical than the traditional single harvesting, and the monoculture of male mud crab gave higher profits, return on investment, and lower production cost than the all-female monoculture.

Giant tiger shrimp

Penaeus monodon

Shrimp farmers have reason to be happy at the consistent increase in the worldwide demand for the tiger shrimp or prawn (*sugpo*) which unfortunately their production can not meet. Big losses were attributed to disease outbreaks linked to environmental degradation, and questions on the industry’s sustainability came up. Studies were thus geared to determine the extent of disease occurrence in hatcheries and to trace the route of infection of the viral disease.

Twenty hatcheries in Iloilo were sampled for viral infections. Histological examination showed 18% of the samples positive for monodon baculovirus (MBV) and 45% for hepatopancreatic parvovirus (HPV).

HPV can be transmitted directly when shrimps feed on other infected shrimps and, to a lesser extent, by feeding on food organisms such as brine shrimps that have been exposed to diseased shrimp tissues. HPV can easily be detected by preparing impression smears from fresh samples as early as postlarvae 3 (PL₃). The method is as reliable as the more tedious diagnostic method of preparing histological sections. Using the smear method, HPV was found to occur more frequently at earlier PL stages when reared at higher densities.

SEAFDEC AQD continues to improve the quality of shrimp feeds and to determine proper storage as well as processing conditions for feed and feed ingredients. Earlier studies have determined the level of aflatoxin that is toxic to shrimp and conditions that promote aflatoxin development. Also, the presence of urease in feeds has been found to significantly affect the quality of shrimp feeds. Urease is an enzyme in soybean meal that breaks down proteins and amino acids to urea. Fortunately, this enzyme can be inactivated by heating soybean meal at 120°C for 20 minutes without affecting the protein content and amino acid composition of shrimp feeds.

Grouper

Epinephelus sp.

Spawning of captive grouper (*lapu-lapu*) in 1990, the first in AQD research, ushered in studies on reproductive biology, refinement of broodstock management, development of breeding, hatchery and nursery techniques, nutritional requirements, and feed development. The distribution of wild grouper fry was also studied.





The study on the semi-intensive culture of grouper using copepods as food to first-feeding larvae showed promising results. Larvae fed initially with copepods tended to be bigger and survival higher compared to larvae which fed on rotifers.

The study on the fatty acid requirements of juvenile grouper showed that after 10 weeks of feeding, best growth and survival were obtained in groups of fish fed a diet containing 1% highly unsaturated fatty acids (HUFA). Poorest weight gain was observed in the group fed the diet with no HUFA supplementation and lowest survival in fish fed the diet containing the highest (2.5%) HUFA supplementation. This information is needed in the formulation of feeds for the nursery and grow-out culture of grouper.

Sea bass

Lates calcarifer



One of the most important constraints in the further development of sea bass (*apahap*) culture is the lack of a cost-effective practical feed which can replace the use of fish by catch. Thus, nutrition and feed development for the Asian sea bass which is a high-value commodity are major research thrusts for this species.

The protein, lipid and carbohydrate requirements were determined in separate studies to be 42.5%, 10%, and 20%, respectively. In additions, a 1:1 combination of cod liver oil and soybean oil was found optimal for juvenile sea bass. The requirements for the indispensable amino acids methionine, tryptophan, lysine, and arginine were found to be 2.9, 0.42, 4.5, and 3.8% of the dietary protein, respectively. Requirements for the other indispensable amino acids as well as fatty acids are presently being determined. The information from studies on the nutrient requirements are being used to design test diets from indigenous and inexpensive ingredients for a cost-effective feed.

Ongoing work on the nutritional evaluation of locally available ingredients from agricultural by-products has shown the possibility of using leaf meals such as ipil-ipil (*Leucaena*) and kangkong (swamp cabbage) as well as legumes such as white cowpea and green mung bean as partial substitutes for fish meal in sea bass diets. The use of properly processed plant protein sources rid of anti-nutritional factors as partial substitutes for fish meal could eventually lessen the cost of producing the feed and may improve the profitability of sea bass culture. However, research efforts have to be sustained to improve the performance of feeds by optimizing the formulations as more information on the nutrient requirements as well as nutrient digestibility become available. The performance of the feeds should also be eventually tested under field conditions and verified in commercial ponds or floating cages to assess the economics of its culture.

Snapper

Lutjanus argentimaculatus



Early studies on the mangrove red snapper (*maya-maya*) focused on the refinement of broodstock management and breeding techniques. Snapper broodstock spawn naturally in captivity. Otherwise, they can be easily induced to spawn by injecting either LHRH-a or HCG. Natural spawning, high fecundity, and good egg and larval quality make the mangrove red snapper a choice species for culture.

Efforts are now underway to refine hatchery and nursery techniques and determine the nutritional requirements of snapper in order to develop artificial feed for the nursery and grow-out phases of culture.

Ornamental marine fish

Seahorse



Being archipelagic, the Philippines has one of the most diverse reef fish fauna in the world. It provides a rich supply for the marine ornamental fish trade. To prevent depletion of the stocks in the natural waters, research was started on the development of captive breeders for fry production and juveniles.

The seahorses — *Hippocampus histrix* and *H. erectus* — are now breeding regularly. The hatchery rearing is being refined, and prospects for sea ranching are being explored.

Nile and red tilapia

Oreochromis niloticus



Previous studies have shown the technical and economic feasibility of tilapia culture. The sex ratio and stocking density of broodstock in tanks and cages have been determined as well as the effects of supplemental feeds, stocking rates, and size at stocking for optimum growth in the grow-out culture.

In 1996, a modified mass selection technique based on collimation (early size-grading and culling of large fry) was applied on the Nile tilapia. A 3% response to selection was obtained after one generation of size-specific mass selection. "Collimated" mass selection is simple enough to be a low-cost feature of artisanal farming practice, and is capable of generating economically significant improvement of a population after a single generation. In another study, introgressive hybridization of red tilapia with Nile tilapia and subsequent size-specific mass selection resulted in a 3.3% response to selection after one generation.

Five tilapia strains screened for tolerance to saline environment showed the best growth rate in brackishwater. Growth in seawater was comparable to growth in freshwater.

Catfish

Clarias macrocephalus

The Asian Catfish *Clarias macrocephalus* (hito), a favorite freshwater food fish, is a native species in the Philippines but is getting scarce. Artificial propagation was carried out to prevent the permanent loss of *C. macrocephalus* in the wild. Studies conducted include the determination of the optimum season for artificial propagation, development of a protocol for induced spawning, and methods to minimize the existing practice of sacrificing males during artificial fertilization.



Although ripe eggs are present year-round in the ovaries of captive catfish, this species does not spontaneously release eggs in captivity. Changes in reproductive parameters (gonadosomatic index, oocyte diameter, fecundity), serum steroid hormone levels (testosterone and estradiol-17 β) in female catfish, as well as reproductive (egg production, ovulation rate) and larval (fertilization and hatching rates) performance suggest that January to April are not the best months to induce *C. macrocephalus* to spawn. Male *C. macrocephalus*, however, can readily be used as source of milt for artificial propagation at any time, except in January. Artificial propagation is carried out by giving simultaneous intramuscular injection of 0.05 μ g LHRHa + 1 μ g PIM (pimozide) per gram body weight. Eggs stripped and fertilized within 16-20 h post-injection yield high ovulation, fertilization, and hatching rates. Males, however, do not release milt and have to be sacrificed to obtain milt. An artificial seminal plasma was developed to immobilize sperm so that milt obtained from macerated testis and seminal vesicles can be stored. High fertilization rates (89-94%) were observed when milt diluted at 1:100 with the catfish artificial seminal plasma was activated with 0.6% NaCl to fertilize 5 to 10 g of ovulated eggs. By this method, the small quantities of milt obtained from sacrificed males can be used to fertilize more eggs.

Abalone

Haliotis asinina



Abalone are ideal species for aquaculture because they are herbivorous, are easy to culture and propagate, and fetch a high price in the export market. The tropical donkey-ear abalone is smaller than the cold-water abalone, but it grows faster and reaches a market size (50 g body weight, 6 cm shell length) in 1 year instead of 3-5 years. The donkey-ear abalone grows faster in marine floating cages than in indoor tanks. The best food for juveniles in cages is *gulaman*, the red algae *Gracilaria* spp.

The tropical donkey-ear abalone matures sexually at 4-5 cm shell length. Both wild-caught and hatchery-bred adults can be induced to spawn by totally draining the holding tanks and then replacing the water after 45 min. Larger, wild-caught females spawn more eggs more frequently than smaller hatchery-bred females.

Seaweeds

Kappaphycus alvarezii

Seaweeds (*gulaman*) that produce agar and carrageenan are among the Philippines' top export products. Various species of *Gracilaria* have been studied for abundance in the wild, growth and productivity under cultivation, and agar quality. *Gracilaria heteroclada* can be grown in ponds and produces high-quality agar; it can also be grown in polyculture with shrimps and can serve as biofilter to remove pollutant nutrients.



Cultivation of the seaweed *Kappaphycus alvarezii* is a big industry in the Panagatan Cays, a coral atoll in the northern Cuyo East Pass. The green and brown varieties of *Kappaphycus* are both high-yielding although they differ slightly in carrageenan quality according to culture methods and duration and time of the year.

Community Fishery Resources Management CFRM



Implemented in 1991, the CFRM project addresses the pervading issue of poverty typical among coastal communities such as Matalison Island in Antique. The development-oriented project involves an interdisciplinary approach to coastal resource management directed at the sustenance of marginal fishers with very few alternative livelihood opportunities.

The organization of a fishers' association and advocacy training, initial but critical developmental intervention measures, prepared the community to maintain exclusive use rights over its resources. The revival of a consumers' store, trials on seaweed farming and marketing, and hog raising and fattening continue to develop livelihood endeavors in the community.

In addition to rehabilitation of degraded natural reef habitats, the deployment of 27 concrete artificial reefs in Gui-ob reef, the recently designated marine sanctuary, provided island fishers the opportunity to participate in community-based management of their resources. To date, protective management of Gui-ob reef has gradually increased both density and biomass of several target fishes, notably surgeonfishes, that may well enhance fish yields in nearby areas. Evaluation of the socioeconomic, institutional, and environmental impacts of these development intervention measures will continue in subsequent years. The long-term view is to replicate CFRM in other coastal communities in the country.

Footnote:

Details of the foregoing studies will be published in the **1996 ANNUAL REPORT** of the SEAFDEC Aquaculture Department.

Research Awards

Recognition from the scientific community

Over the years, scientific papers by AQD researchers have won research awards attesting to the quality of research conducted in the institution.

In 1996, two AQD papers won the prestigious Dr. Elvira Tan Memorial Award for both the aquaculture and marine fisheries categories. Teresa R. de Castro and Nicolas G. Guanzon, Jr. won the aquaculture category for their paper "Growth of *Gracilaria* Sp. (Gracilariales, Rhodophyta) in brackishwater ponds at different stocking densities." The paper offers a viable option in the culture of *Gracilaria*. *Gracilaria* is a source of agar used in the manufacture of food additives, stabilizers, chemicals, and the like.

The marine fisheries category was won by three other AQD researchers — Edgar C. Amar, Ronald M.T. Cheong, and Maria Victoria T. Cheong — for their paper "Small-scale fisheries of coral reefs and the need for community-based resource management in Malalison Island, Philippines." It has profound significance on minimizing overfishing by fishing communities and on their use of community-based fishing practices.

The memorial award is sponsored annually by the Philippine Council for Aquatic and Marine Research and Development (PCAMRD) for outstanding research in various fields of fisheries development.

Research Collaboration

Pooling of resources and expertise

International organizations, universities, and private companies continued to collaborate with AQD on specific research projects and on staff development. Collaboration allows AQD researchers to pursue degree programs and to attend scientific meetings and training abroad. Likewise, researchers from SEAFDEC Member-Countries and other institutions conduct research or train at AQD.

For research

- Australian Center for International Agricultural Research (ACIAR)
- Daka A.M.B.A. Denmark
- European Union (EU)
- International Center for Living Aquatic Resources Management (ICLARM) also in cooperation with the Danish Government
- International Development Research Centre (IDRC) of Canada
- International Foundation for Science (IFS)
- Lonza Ltd., Switzerland
- University of Hohenheim, Germany

Research Papers

Source of primary information

Research papers published in scientific journals and in conference proceedings provide the raw material for training and extension modules that the industry can use. Produced during the year were 22 publications in journals and 3 in conference proceedings. Ten papers were accepted for publication (in press). Presented in scientific meetings were 27: 21 for oral presentation and 6 for posters.

Presented in in-house seminars were 48 papers which included those of 15 invited scientists, researchers, and guests from foreign and local institutions.

Number of Research Publications and Studies by commodity, others (1996)					
Commodity others	Research Studies	Research Papers			
		In Science Journals	In Proceedings	In Press	Presented in Meetings Oral Poster
Milkfish	16	2	2	3	2 -
Grouper	9	-	-	2	2 -
Red snapper	5	-	-	-	- -
Rabbitfish	-	-	-	-	- -
Sea bass	5	3	-	1	1 -
Ornamental Marine Fish	1	-	-	-	- -
Tilapia	5	2	-	-	- -
Catfish	5	1	-	1	- -
Carp	1	-	-	-	- -
Giant tiger shrimp	14	8	1	1	10 5
Mud crab	6	-	-	-	- -
Window-pane oyster	2	-	-	-	- -
Abalone	3	1	-	-	- -
Seaweeds	4	2	-	-	- -
CFRM	2	1	-	-	1 -
Lake Ecology	5	-	-	-	1 -
Others	1	2	-	2	2 1
Diseases	-	-	-	-	2 -
TOTAL	84	22	3	10	21 6

- Japan International Cooperation Agency (JICA)
- Department of Agriculture, Philippines (Fisheries Sector Program)

For staff development

- IDRC of Canada
- University of Ghent, Belgium
- University of Hohenheim, Germany
- Japan (Japanese Government Research Scholarship Program, Ministry of Education [MONBUSHO])
- Japan Society for the Promotion of Science
- JICA

Technology Verification Project

Linking up with the industry

The Technology Verification Project (TVP) closely adhered to the Administration's thrust of food sufficiency and industry stability. The private sector was involved to complete the R&D process of research, technology generation, verification, refinement, and transfer.

TVP intensified technology verification activities by field-testing specific culture systems in selected farm sites. Feedbacks from the industry were geared to refine technologies found to enhance productivity and profitability.

TVP linked up with farmer-cooperators in the following activities:

- Documentation of existing industry practices on the use of probiotics to prevent occurrence of luminous bacteria in intensive prawn farms in Bago City and Bacolod City
- Verification of the culture of grouper (*lapu-lapu*) in brackishwater ponds in Sum-ag Bacolod City
- Verification of the culture of mud crab (*alimango*) in brackishwater ponds in E.B. Magalona, Negros Occidental
- Evaluation of the nursery and grow-out culture of milkfish from hatchery seeds in Himamaylan and E.B. Magalona in Negros Occidental; Roxas City, Capiz; and Carles, Iloilo
- Documentation of the nursery and grow-out of sea bass (*apahap*) in brackishwater ponds in E.B. Magalona, Negros Occidental
- Verification of the culture of mud crab in mangroves using nylon net enclosures in Puerto Princesa, Palawan
- Verification of broodstock management and seed production of economically important cultured finfishes in Puerto Princesa, Palawan

TVP was actively involved in **Oplan Sagip-Sugpo**, a task force organized upon order of DA Secretary Salvador Escudero and chaired by the AQD Chief. TVP led in the concerted effort of government agencies and the private sector in rehabilitating the shrimp culture industry.



Dan Baliao (left), head of TVP, gives advice to fishfarmers at Brookes Point, Palawan.



Rich harvest resulted from the TVP project on the culture of mud crab in E. B. Magalona, Negros Occidental.

Technical meetings SICCPPS, AQUACHEM



DA Undersecretary Joemari Gerochi, SEAFDEC Council Director for the Philippines, addresses participants, guests, and observers at the SICCPPS opening ceremonies.

AQD convened the *Second International Conference on the Culture of Penaeid Prawns and Shrimps* (SICCPPS) in Iloilo City, May 13-17, 1996 with more than 300 participants and observers from 30 countries attending.

SICCPPS reviewed the shrimp researches of the past, identified research gaps, and proposed strategies to make the shrimp industry sustainable. Eleven papers presented in the scientific sessions were on biology, ecology and physiology, seed production, nutrition and feed development, diseases, genetics and biotechnology, and socioeconomics. Another 45 papers were presented orally and 30 were presented as posters. The proceedings of the SICCPPS will be published in Elsevier's *Aquaculture Journal*.

Important recommendations for research were establishment of breeding programs, formulation of diets to match composition of shrimp diets in the wild, finding alternatives to eyestalk ablation, environmental manipulation and maturation systems, environmental manipulation and culture techniques, early identification of vibriosis, study on the epidemiology of white spot disease in the region, environmental impact of culture systems, and pond design and management.

AQD hosted the *Meeting on the Use of Chemicals in Aquaculture in Asia* (AQUACHEM) at its headquarters in Tigbauan, Iloilo, May 20-22, 1996. Attended by more than 100 participants and observers from 21 countries, AQUACHEM synthesized and updated information on the use of chemicals in aquaculture with emphasis on the various aquaculture systems and species utilized.

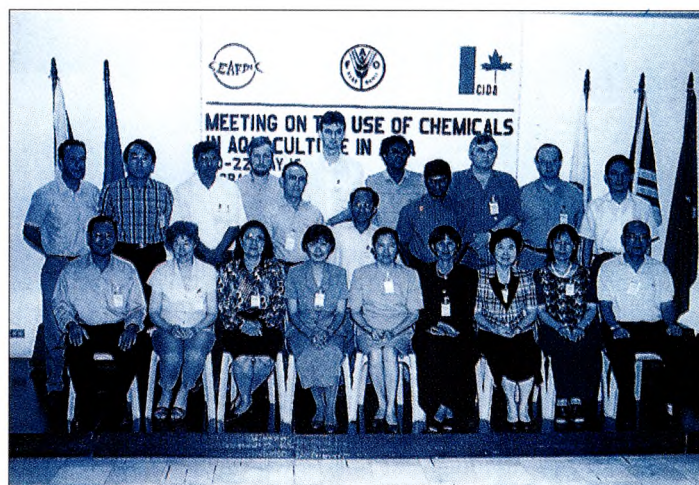
Presentations included antibacterial chemotherapy in aquaculture, ecological effects of chemical usage in aquaculture, transferable drug resistance plasmids in fish-pathogenic bacteria, use of chemicals in aquafeeds, effects of use of chemicals in aquaculture, on human health, regulations on the use of chemicals in aquaculture,

and use of organic manures, fertilizers and soil and water conditioners in aquaculture. Also presented were 14 country overview papers on the use of "aquachemicals."

Following immediately was the *ad hoc* meeting, May 24-28, of the Working Group on Environmental Impacts of Coastal Aquaculture of the IMO/FAO/UNESCO-IOC/WMO/AEA/UN/UNEP Joint Group of Experts on the Scientific Aspects of Marine Environment Protection or GESAMP. Discussed were environmental and human health issues related to the use of chemicals in coastal aquaculture as practiced worldwide.

Collaboration among organizations active in the region (e.g., SEAFDEC, FAO, CIDA, NACA, Asian Fisheries Society, Asian Institute of Technology, and others) proved to be very successful.

The *ad hoc* meeting came up with baseline information out of which a set of guidelines for use of chemotherapeutants and pesticides in coastal aquaculture will be eventually formulated.



Participants in the AQUACHEM meeting pose with AQD Chief Dr. Rolando Platon (seated extreme left).

Service Laboratories

In aid of research and the private sector

AQD's five service laboratories scored a record high in accommodating requests from AQD researchers and the private sector.

The Larval Food Laboratory provided 150 tons of various cultures of phytoplankton to research studies and training courses conducted in AQD. The Centralized Analytical Laboratory analyzed 4,780 samples of feed, soil, and water. The Feed Mill Pilot Plant released 23,980 kg of feed ingredients and feed products. The Fish Health Laboratory examined 298 cases. The Microtechnique Laboratory processed 1,433 samples for histological slide preparation and released 2,935 typical and serial section slides to study leaders for histological analysis.

TRAINING

"To develop human resources for aquaculture development in the region"

AQD continued to offer training programs on various aspects of aquaculture. Regular short-term training courses were attended by participants from different parts of the world with majority coming from Southeast Asia. Lecturers were mostly AQD's professional research staff of doctorate and masteral degree holders.

The courses, duration, and number of trainees are as follows:

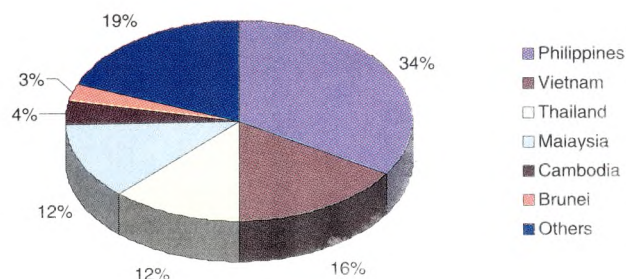
<i>Aquaculture Management</i>	Mar 26 - Apr 24	17
<i>Fish Health Management</i>	Apr 16 - May 28	14
<i>Marine Finfish Hatchery</i>	Jun 3 - Jul 3	17
<i>Freshwater Aquaculture</i>	Sep 5 - Oct 16	15
<i>Shrimp Hatchery</i>	Oct 1 - Nov 20	15
<i>Fish Nutrition</i>	Oct 23 - Dec 23	14
<i>Third Country Training on</i>		
<i>Coastal Aquaculture</i>	Jul 31 - Sep 2	14
TOTAL		106

"Laguna de Bay, Philippines: An Ecosystem Approach to Sustainable Management," a collaborative project of the European Union and AQD, included the *Ecological Modelling Course* with four research staff from AQD's Binangonan Freshwater Station participating. The course came up with a conceptual model of Laguna de Bay based on data collected in 1995.

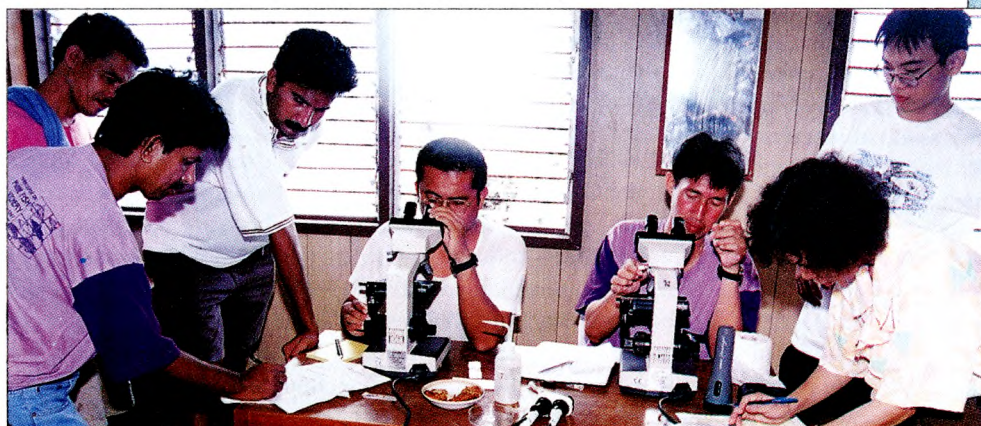
A three-year assessment survey of the aquaculture training needs in the Philippines and Southeast Asia was completed in September.

The survey showed that the regular courses offered by AQD were considered high priority by the respondents. Training courses in aquaculture research and extension methodologies, integrated and intensive farming systems, management of aquatic resources and the environment, aquaculture economics, and fish genetics were also considered important by the countries surveyed. These will be considered in the formulation of training programs for 1998-2000.

Attendance in training courses by country



Participants of different nationalities in various phases of training.



INFORMATION

“To disseminate and exchange information on aquaculture”



Significant publications during the year were Aquaculture Extension Manual No. 22 titled *Simpleng gabay sa pagtitilapya PAGPAPALAKI NG TILAPYA* and Aquaculture Extension Manual No. 23 *PAGPAPAANAK O PAGPAPARAMI NG TILAPYA*, both by Ruel V. Eguia, Ma. Rowena R. Eguia, and Zubaida U. Basiao.

Regular publications are the *SEAFDEC Asian Aquaculture* (quarterly), *Aquafarm News* (bimonthly), and *Aqua Dep't News*, the internal newsheet (monthly). Nine aquaculture extension manuals were reprinted and distributed in response to demand from fishfarmers.

Under the outreach program, AQD researchers conducted a seminar on *Fish Nutrition and Water Quality* in Sultan Kudarat, Sept. 6-8, and another seminar, *Alternatives to Prawn Culture* in Bacolod City, Sept. 20.

By yearend, AQD Library collections totaled 13,146 monographic volumes, 6,986 pamphlets, 2,838 SEAFDEC publications, and 4,353 journal volumes (bound).

The Library's CD-ROM facility served 100 requests for information searching. Reputed to have the biggest collection on aquaculture literature in Asia, it accommodates the information needs of researchers, students, teachers, and industry practitioners.



FINANCE

Contributions, grants, auxiliary income

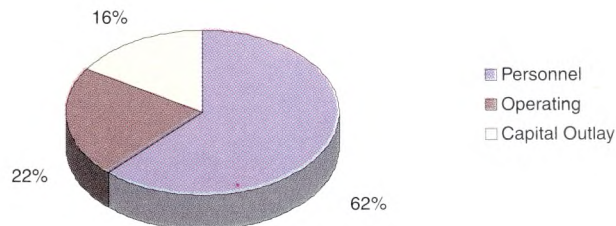
Funds for the operation of AQD are contributed by the Philippine Government. The Government of Japan contributes funds for equipment, fellowships for trainees and researchers, and a portion for operation. These are augmented by grants and AQD's auxiliary income from sale of research by-products, books, newsletters, and videos; training fees; and others.

The contributions, grants, and other income received by AQD in 1996 are as follows:

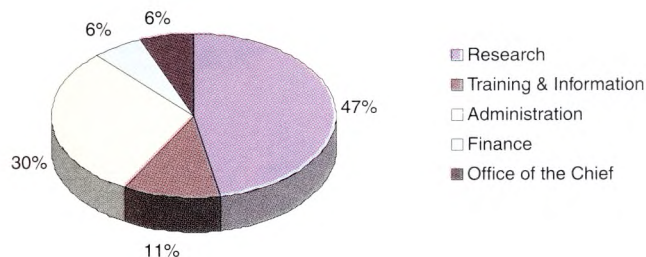
• Contributions	
Philippine Government	\$ 6,345,062.00
Government of Japan	550,306.00
Sub-total	<u>6,895,368.00</u>
• Grants	
JICA	68,943.00
European Community (INCO-DC) through the University of Hohenheim	21,859.00
Department of Agriculture/BAR/FSP	13,678.00
Department of Agriculture/BFAR	38,040.00
Canadian High Commission	13,289.00
LONZA, A.G.P.	9,972.00
PCAMRD	9,510.00
ACIAR-Department of Primary Industries	8,297.00
Tufts University	5,000.00
FAO	4,926.00
DAKA A.M.B.A.	4,763.00
Rockefeller Brothers	3,503.00
ICLARM	1,986.00
St. Mary's University of Canada	853.00
Simon Fraser University	600.00
Sub-total	<u>205,219.00</u>
• Auxiliary Income	<u>394,152.00</u>
TOTAL	<u>\$ 7,494,739.00</u>

EXPENSES

By classification



By function



SEAFDEC Profile

The Southeast Asian Fisheries Development Center (SEAFDEC) is a regional treaty organization established in 1967 to promote fisheries development in the region. Its Member-Countries are Japan, Malaysia, the Philippines, Singapore, Thailand, and recently, Brunei Darussalam and the Socialist Republic of Viet Nam.

Representing the Member-Countries is the Council of Directors, the policy-making body of SEAFDEC. The chief administrator of SEAFDEC is the Secretary-General whose office, the Secretariat, is based in Bangkok, Thailand.

Created to develop fisheries in the region in response to the global food crisis, SEAFDEC undertakes research on appropriate fishery technologies, trains fisheries and aquaculture technicians, and disseminates fisheries and aquaculture information. Four departments were established to pursue these objectives:

- **Training Department (TD)** in Samut Prakan, Thailand, established in 1967 for marine capture fisheries training;
- **Marine Fisheries Research Department (MFRD)** at Changi Fisheries Complex, Singapore, established in 1967 for fishery post-harvest technology;
- **Aquaculture Department (AQD)** in Tigbauan, Iloilo, Philippines, established in July 1973 for aquaculture research and development; and
- **Marine Fishery Resources Development and Management Department (MFRDMD)** in Kuala Terengganu, Malaysia, established in 1992 for research and training on fishery resources development and management in the exclusive economic zones (EEZs) of Member-Countries.

The SEAFDEC Aquaculture Department is mandated to:

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

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The SEAFDEC flag unfurl along with the flags of the seven Member-Countries at the AQD complex in Tigbauan, Iloilo, Philippines.

