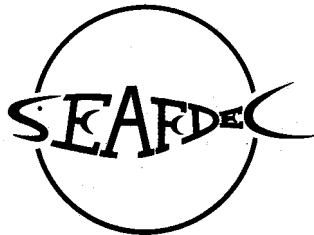

ANNUAL REPORT '74

AQUACULTURE DEPARTMENT
SOUTHEAST ASIAN FISHERIES DEVELOPMENT CENTER

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SOUTHEAST ASIAN FISHERIES
DEVELOPMENT CENTER

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Message from the Chief of the Department



The year 1974 ushered in, for the Aquaculture Department, a period of construction of research and other support facilities, even as its directions and the magnitudes of its operations were being defined and set.

As the year drew to a close, the Department received expanding support from the sponsoring government, Japan, and the host government, the Philippines, as well as from foreign governments and international organizations outside of the South-east Asian region.

The year 1974 also saw the development of a transitional organizational structure that operated as a task force to achieve scheduled levels of performance. And as the initial skeletal staff expanded to assume greater functions, the research program of the Department sharpened along definitive lines and received initial impetus.

It is within this framework that I am pleased to report on the Department's second year of performance.

Dominiano K. Villaluz
D. K. VILLALUZ
Chief

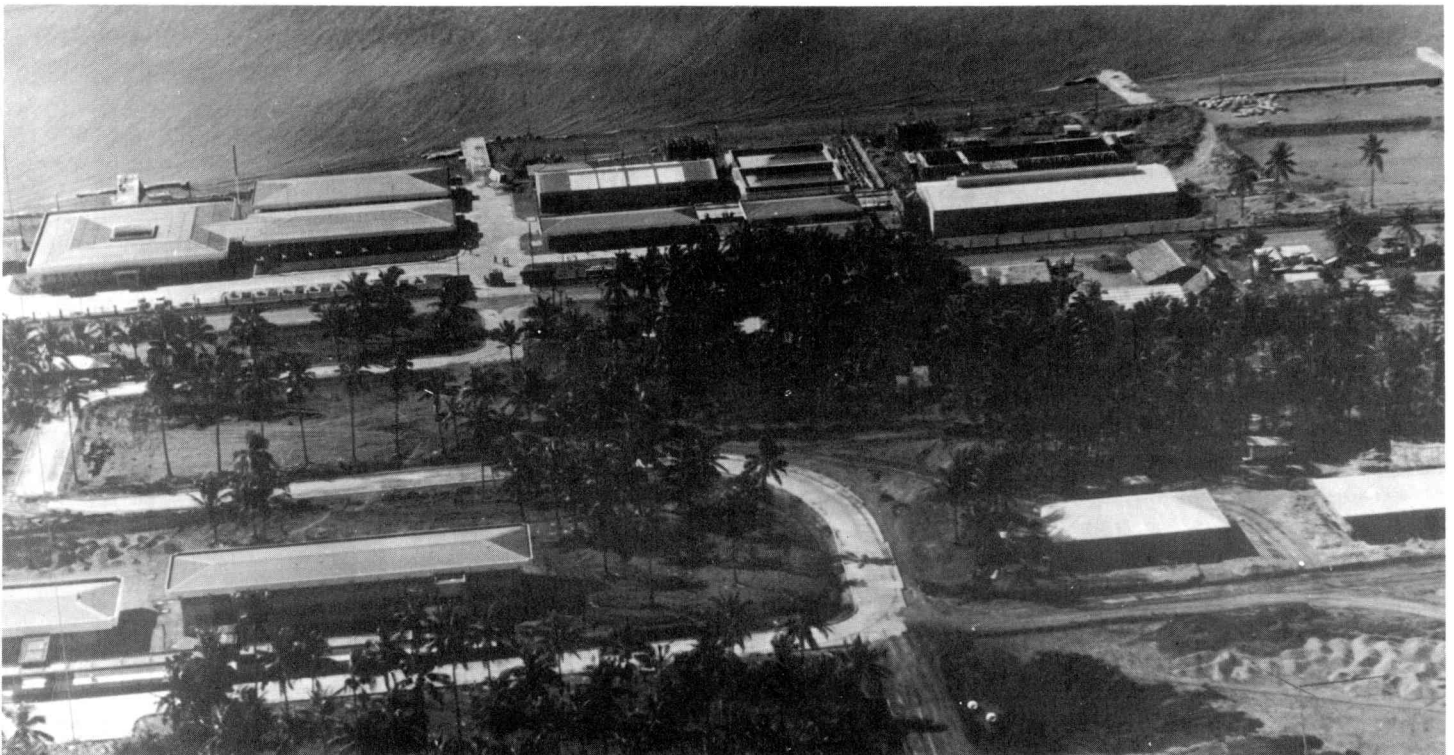
Administrative matters

A. PROJECT SITE DEVELOPMENT

As contained in the First Annual Report for Calendar Year ending December 31, 1973, the Département operates 2 stations: one at Tigbauan in the Province of Iloilo where the hatcheries, laboratories, training, administrative and auxiliary service facilities are being constructed; the other at Leganes, also in the same province, where experimental shrimp and prawn ponds have been completed.

A number of substations have also been established.

Since its formal establishment in July 1973, the Department has expanded its aggregate site area from 12.8 ha to 136 ha broken down as follows:



Aerial view of the main station at Tigbauan, Iloilo.

40 ha at the Tigbauan station and 96 ha at the Leganes station for experimental prawn ponds.

Total cost of various physical facilities already constructed is estimated at \$2.3 million.

About 90 per cent of the buildings have been completed with the rest scheduled for completion February 1975.

Project sites. On March 23, 1974, His Excellency, President Ferdinand E. Marcos issued Presidential Proclamation 1246 reserving 40 ha of public domain in Tigbauan, Iloilo, for the use of the Department, thus expanding the original project site 14 times. Although the reserved area is part of the public domain, the Department has, as of

December 31, 1974, settled private claims to some 30 ha of the site, and negotiations are underway for acquiring the rest of the area.

In addition to the 10 ha of the project site at Leganes which have been developed into experimental shrimp ponds, the Department has acquired an additional 86 ha from the Municipality of Leganes on a long-term lease basis. The added area will be used as a pilot project to demonstrate the feasibility of prawn and shrimp cultivation on a commercial scale.

Building and other constructions. As indicated in the First Annual Report, the Department began the construction of Phase I

facilities at the Tigbauan station September 1973. The construction of Phase II facilities commenced early 1974.

Phase I facilities costing about \$530,000 consist of the Administration Building, Laboratory Building I, Dormitory, and Cafeteria. These buildings have been completed and turned over to the Department.

Except for the Dormitory which has two floors, the rest of the physical facilities in the Tigbauan complex are one-storeyed structures.

Phase II facilities consisting of hatcheries, laboratories, and other infrastructures worth about \$1.5 million were completed at year's end.



Portion of the 96-hectare experimental ponds at Leganes, Iloilo



Northeast view of the Tigbauan main station



Dormitory for trainees

Phase I facilities

Administration Building. The Administration Building (floor area: 1, 089 sq m) has an open space quadrangle at the center.

Laboratory Building I. The Laboratory Building I (floor area: 525 sq m) consists of an audio-visual room, 3 lecture rooms, and facilities for food and water analyses as well as fish-pond engineering.

Dormitory. The Dormitory (floor area: 924 sq m) is located some 200 m inland on the other side of the national road. Of its 20 rooms, 12 are provided with common lavatories and can each accommodate 2 trainees. Provided with private baths, each of the remaining 8 rooms can accommodate 2 guests or lady trainees.

Cafeteria. The Cafeteria (floor area: 240 sq m) is adjacent to the Dormitory and connected with it by a covered walk.

Phase II facilities

Laboratory Building II. Laboratory Building II (floor area: 525 sq m) fronts the beach and includes facilities for studies in chemistry, biology, pond culture, and seed production. Each room is provided with fresh and salt water, air, gas, electricity, safety devices, and shower valves.

Hatcheries. The hatcheries consist of 2 structures: a roofed hatchery with 6 tanks capable of holding 50 tons of water each and another 6 tanks at 120 tons each; and an open air hatchery of 4 tanks with a capacity of 200 tons each. Total hatchery volume is 1,820 tons.

The 50-120 ton hatchery tanks are raised 2 m from the ground, with the 120-ton units centrally clustered and the 50-ton units at the opposite ends.

Catwalks along the hatchery tanks have been designed to enable sun rays to strike the entire tank surface.

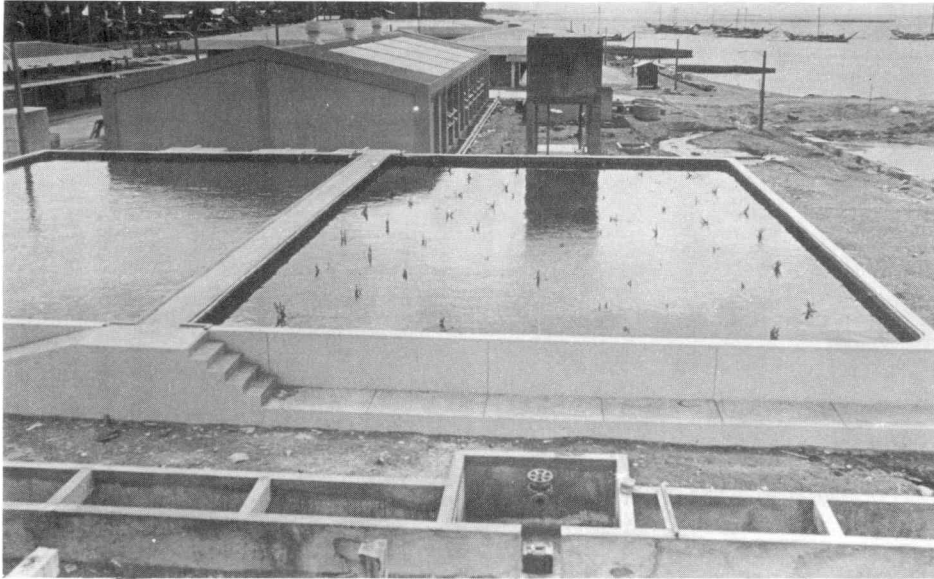
The translucent coralex roofing admits the wavelengths needed for the culture of diatoms and other feeds and prevents changes in the physico-chemical conditions of the water caused by rain and other outside factors. Although the tanks are shaped in squares or quadrangles, the corners have been rounded to facilitate water movement for aeration through the use of air compressors. The tank walls have been pressure-plastered to reinforce the water-proofing.



Roofed hatchery



Open-air hatchery



Concrete nursery ponds

Each tank is provided with a harvesting pit below, and water from the tank is drained through a series of canals leading to an open pond some 50 m away.

The hatcheries are supplied with fresh and salt water from 3 concrete tanks, each with a volume of 300 cu m. Two of the concrete tanks contain salt water pumped from the sea along a pipe extending 100 m offshore. The inland end of the pipe connects with a pump pit 1.8 m in diameter and 2.5 m below the lower low tide level, so that the pit will always be filled with salt water. Water from the pit is pumped up with the use of 2 centrifugal pumps operating alternately to yield 800-1,000 gal per min. The third tank contains fresh water.

Two electrically-powered monorails hanging from the roof will expedite the delivery of hatchery supplies and materials from one end of the building to the other. On both ends of the hatcheries are the wet laboratories, each with a floor area of 100 m.

Construction of the 200-ton hatcheries, redesigned as open-air structures, commenced October 1974 and is scheduled for completion early 1975. The roof was eliminated because the conditions in a 200-ton tank would not alter significantly even if exposed to rain and sunlight due to the relatively great volume of water.

Nursery Ponds. Open-air nursery ponds (40m x 20m x 1.3m) consisting of 2 compartments (total volume: 728 cu m) have been constructed adjacent to the 200-ton hatcheries.

As in the hatcheries, the tank walls have been pressure-plastered. Ramps have been installed to facilitate the delivery of nursery supplies and materials. Harvesting pits are attached to the compartments and water is drained through a pipe leading to the open pond. The nurseries are also provided with catwalks and aeration facilities, and raised pathways have been built alongside the tanks to permit easy viewing of nursery operations.

The nursery ponds will be used for the rearing of juvenile prawns up to a period of 2 mo after postlarva (P)₂₅ as well as for studies on salinity tolerance, depth variations, feeding requirements, stocking rates, predation, cannibalism, and polyculture.

Open Pond. At the farthest end of the Tigbauan station is an open pond (floor area: 3,000 sq m), 1.5 m deep, used for cultivating juvenile prawns for experimental purposes. Since sandy soil cannot hold water, a cost-benefit study on the use of butyl rubber to line the pond bottom and walls could pave the way for converting thousands of hectares of idle beach into fishponds.

Field Laboratory. The Field Laboratory (floor area: 300 sq m) provides facilities for biological and chemical analyses, water analysis, and bacterial examination. It is provided with a sterile room for the culture of bacteria serving as prawn feed and for studies on bacteria infecting prawn fry. Incubators, ovens, and jars are provided in the sterile room.

Wet Laboratory. The Wet Laboratory (floor area: 525 sq m) is used for the culture of food organisms such as **Chlorella**, rotifers, brine shrimps, and diatoms; for studies on the life cycle of crustaceans and fishes and their various food needs, parasites, and predators; and for bioassay studies on undersirable organisms.

Of its floor area, 400 sq m consist of bare floor on which are placed 4 doz fiberglass tanks. The round fiberglass tanks are 1 m wide and 1 m deep, while the rectangular ones are 1 m wide, 2 m long and 1/2 m deep. To vary conditions, 10 per cent of the floor area is unlighted.

The Wet Laboratory is provided with offices and storeroom.

Food Preparation Building. Now completed, the Food Preparation Building is adjacent to the hatcheries. At its center is a series of 3 freezing compartments 2.7 m high with a floor area of 80 sq m each. The freezer walls are insulated with asphalt adhesive, aluminum foil,

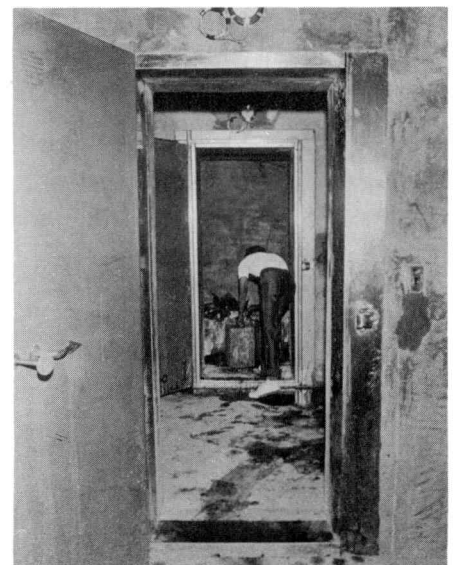


Field laboratory



Wet Laboratory

and styrofoam. The freezers (temperatures at 0°C, -5°C, -25°C) will be used for storing food for prawn fry as well as for processing harvested prawns. At both ends of the building are facilities for food preparation and tubs for sorting harvested prawns.



Freezing compartments

Housing units. A total of 4 representative units of guest houses and staff cottages are part of the scheduled Phase II construction program. However, to enable research and administrative personnel to transfer immediately to the Tigbauan site from Iloilo City where they temporarily reside, the Department has begun the construction of 20 housing units costing \$300,000.

Also under construction are guest house units (individual floor area: 500 sq m) each consisting of 3 bedrooms, 3 baths, dining and receiving rooms, kitchen, maids' quarters, utility room, carport, and a terrace facing the sea. Each of the two two- and three-bedroom units has a floor area of 300 and 400 sq m respectively.

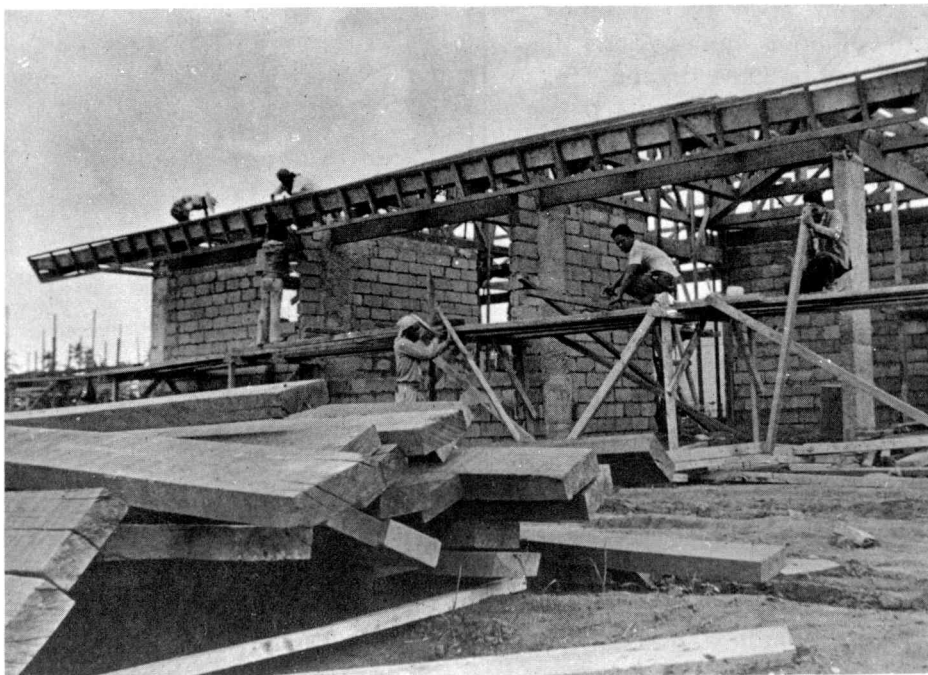
Physical plant complex. Part of Phase II facilities is a redesigned physical plant complex scheduled for construction before the end of the current year. The complex will include a motor pool, gasoline pumping station, motor repair and maintenance shop, machine shop, carpentry shop, storerooms and offices.

Under construction is a building (floor area: 200 sq m) which will serve as storeroom for biological supplies as well as main distribution panel for the electrical system in the project site.

Another building (floor area: 48 sq m) houses the pumps and Rootes blowers for the hatcheries.



Guest houses for visiting experts



Staff cottages under construction



Construction of the internal road system

Five jettys running perpendicular to the shoreline have been constructed at intervals of 50-75 m. The 4-m wide central jetty intended to be used eventually as a pier has been built to extend 34 m from the shoreline. The other 4 jettys are 30 m long and 3 m wide.

With the construction of the jettys, natural sedimentation has extended the shoreline towards the sea and expanded the area of the project site by an additional area of about 15,000 sq m.

Road system. Started in 1973 and still ongoing is the construction of concrete roads 6 m wide and 0.2 m thick over a total of 2.8 km, including drop

inlets and catch basins for drainage. The construction of the internal road system is being undertaken by the Alpha Company of the 552nd Engineering Construction Battalion, 51st Engineering Brigade of the Armed Forces of the Philippines. At year's end the engineering battalion had completed 1km of the road system.

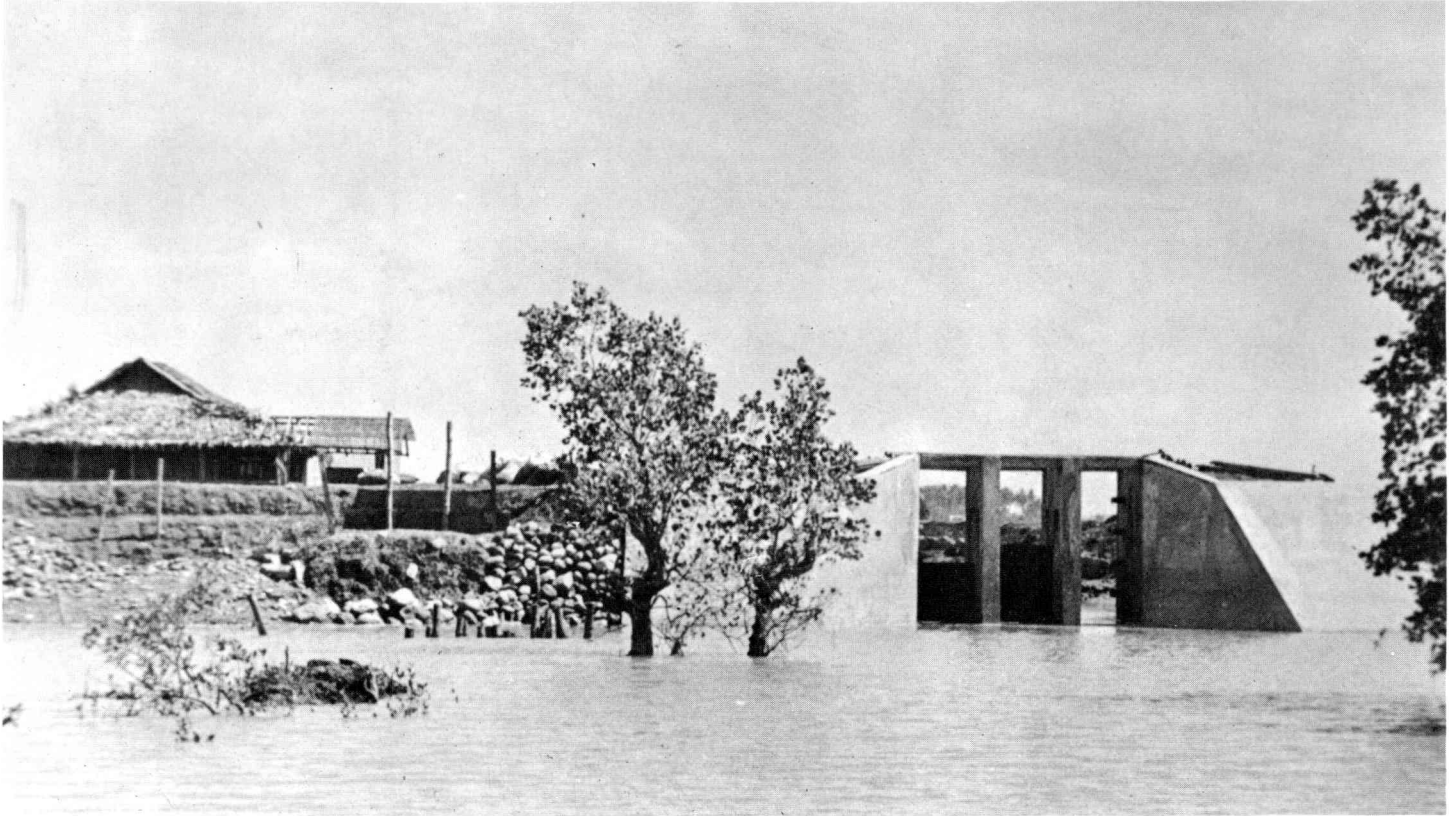
Earth fillings requiring 300 cu m of soil, bulldozing of the road system, and the excavation of 4,500 cu m of soil in the construction of the open pond have been completed by the battalion.

Water system. To tap sources of fresh water, the Department hired the services of a water drilling company which constructed a deep well at a depth of 600 ft.

The Department has also completed a spring development project to provide the tap water needed in research facilities and administrative offices.

The spring project site, about 150 m inland, has a capacity of 20 gal per min and water is sent to the buildings through a booster pump.

The electrical, water, telephone, and drainage systems in the Tigbauan site will all be underground.



Main gate of the Leganes experimental ponds

Leganes station

As stated earlier, the Department has acquired an additional 86 ha to augment the initial 10 ha for experimental prawn ponds. The 86 ha are now being developed as a pilot project to demonstrate the feasibility of prawn production on a commercial scale.

At present, the initial 10-ha prawn ponds at Leganes consist of 6 cultivation ponds at 1-ha each and 4 nursery ponds at 0.2 ha each. The culture ponds were completed June 1973. Construction of the nursery ponds which began September 1974 was completed a month after. Still undeveloped is a 1-ha pond

intended for the trainees when the 10-month training program commences in 1975.

Of the 6 culture ponds 4 have been split into 2 compartments each, and the remaining 2 into 4 compartments each. Studies in stock manipulation are conducted in these ponds.

The 4 nursery ponds and 2 of the culture ponds are aerated by PVC pipes and hoses as well as Rootes blowers.

An electrical system has been installed to provide power for pond aeration and for aquaria studies on various aspects of prawn cultivation.

Substations

As part of the research studies related to completing the life cycle of the tiger prawn *Penaeus monodon*, the Department has established a substation in the coastal village of Igang, Municipality of Nueva Valencia, Island of Guimaras near Iloilo. Construction of substation facilities has been completed including the installation of 8 pens 250 sq m each. Each pen is lined with nylon nets having 1.9-cm mesh and an internal nylon screen lining around the nets. Outside the nylon nets bamboo fencing has been constructed.

Ten prawn cages (3m x 1m x 1m each) made of bamboo have



Maturation pens at Igang, Guimaras Island



The substation at Naawan, Misamis Oriental

been constructed and submerged at depths of 3-20 fathoms. At present some 3,000 prawns ranging 6-15 mos are contained in these pens and cages.

About 18 km from Tigbauan by sea, the Leganes site can be reached 45 min by speedboat. The site is also accessible from the Municipality of Jordan, 24 km north of Iloilo City and 15 min away by speedboat.

The Department has developed 2 primary substations for studies on the sources and population of gravid prawns.

One is in the Municipality of Himamaylan, Negros Occidental, where a year-round survey of prawn natural breeding grounds is being conducted.

Another is at Naawan, Misamis Oriental, in Northern Mindanao. Prawns in the Leganes ponds are grown from fry hatched in the Naawan hatcheries of the Mindanao State University. A Memorandum of Agreement between the Department and the University has been signed to encourage cooperative studies in seed production.

Three substations were organized last year on the Island of Panay for studies on prawn spawners. One is in Hamtik, Antique, another in New Washington, Aklan, and the third in Roxas City, Capiz.

B. ORGANIZATIONAL STRUCTURE

As envisioned under its Plan of Operation approved during the Sixth SEAFDEC Council Meeting, the Department is to develop 4 research divisions — Seed Production, Pond Culture, Food and Water Quality, and Engineering — and a supporting General Affairs division.

Initial responsibilities were concentrated on the construction of research and support facilities, hence the nucleus of the organization was administrative in nature.

Nevertheless, the Department developed and implemented a research program and acquired a skeletal staff to undertake research using facilities that had then become available.

The initial liaison office organized at Iloilo in 1973 expanded to provide logistical support to the construction program at Tigbauan, while that in Metropolitan Manila intensified efforts to insure and stabilize local funding support.

Eventually the core administrative structure was organized into the following units: administrative, personnel, supply and property, finance, accounting, auditing, physical plant, security, auxiliary services, training and extension.

Due to the dearth of scientists and technicians in the country, the Department restrained expansion of its research staff. The 4 research divisions provided under its Plan of Operation were temporarily integrated into a single research division headed by a coordinator.

During the year the Department developed a staffing pattern for both administration and research flexible enough to absorb changes and meet conditions which had not been anticipated.

Salary scales and ranges have been developed and implemented. Various occupational groups identified to fit into an organization devoted to aquaculture research and development have been categorized within those salary scales and ranges. The administrative and accounting procedures embodied in separate manuals have been implemented.

In accordance with the requirements of international organizations, personnel benefits and incentives have been devised to facilitate the recruitment of the best researchers in the country.

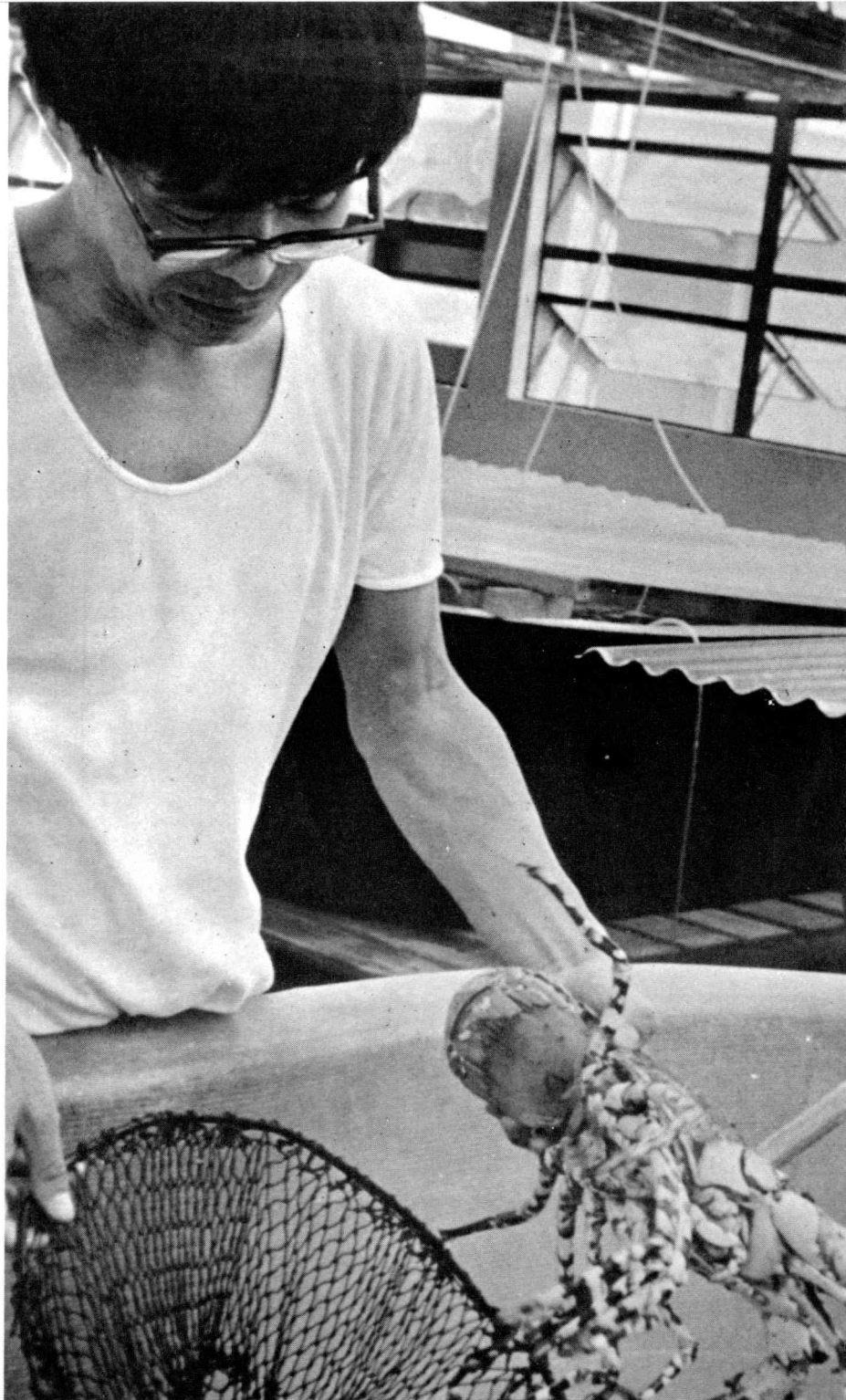
During the year the personnel grew from an initial 30 in July 1973 to more than 200 at year's end.

Administrative staff

Among the major appointments in the administrative staff, which is headed by Dean Domiciano K. Villaluz as chief of the Department, are as follows:

1. Dr. Q.F. Miravite — formerly vice-president for Academic Affairs and Development, Mindanao State University; resigned from that institution May 1974 to devote full time to the Department as its director for General Affairs; responsible for funding support for the Department;
2. Atty. Juanito M. Garay — formerly with the Presidential Staff at Malacañang, Manila; as deputy director for General Affairs, he takes charge of the administrative operations of the Iloilo stations;
3. Prof. Jose Agbayini, Jr. — formerly dean of the MSU College of Public Administration and Community Development; head of the training and extension unit of the Department.

The Department has recruited key personnel to head the following offices: Accounting, Cashiering, Supply and Property, Physical Plant, Personnel Affairs, and Auditing.



Rock lobster, *Panulirus* sp. in fiberglass tank

Japanese experts

During the year the following Japanese experts, whose services are funded by the Japan International Cooperation Agency (JICA), were recruited and assigned to the Department:

1. Mr. Noboru Hoshino — director, Fisheries Division, Okayama Prefecture Development Corporation; B.S. Fisheries, Hokkaido University, Hokkaido;

2. Mr. Utao Kobayashi — formerly with Seto Inland Sea Farming Fisheries Association; graduate of Tokyo University of Fisheries, Shimonoseki;

3. Mr. Shigemi Kambara — senior researcher, Kagawa Fisheries experimental station; B.S. Fish Propagation, Nagasaki University;

4. Mr. Hiroshi Motoh — senior researcher, Marine Culture Station, Ishikawa Prefecture; B.S. Zoology, Kanazawa University;

5. Mr. Yoshitetsu Nukiyama — fisheries expert, Overseas Fisheries Cooperation Foundation; B.S. Fish Propagation, Tokyo University of Fisheries; and

6. Mr. Shigeru Kumagai — instructor-researcher, Yashima Aquarium, Kagawa Prefecture; B.S. Zoology, Hiroshima University, Hiroshima.

A request for the assignment of another Japanese expert in biochemistry is at present pending with the JICA. Efforts are also being undertaken for the recruitment of a Deputy Chief of the Department who, as prescribed in the Agreement, will be a Japanese.



Researchers examine gonads of prawn spawner

Filipino research staff

Among the more important appointments in the local research staff are as follows:

1. Mr. Porfirio Manacop — M.S. Fisheries, Stanford University, California; consultant to the Asian Development Bank for Vietnam before he joined the Department;

2. Dr. Benjamin Cariaso — Ph.D. Entomology, University of California; associate professor and department chairman, College of Agriculture, University of the Philippines at Los Baños;

3. Dr. Cesar Villegas — Ph.D. Agriculture, Iowa State University; formerly with the Philippine Atomic Energy Commission prior

to his joining the Department;

5. Mr. Adriano Atencio — B.S. Zoology and Chemistry; special studies in Limnology in West Germany;

6. Mr. Ricardo Esguerra — advanced studies at the University of California; with the Development Bank of the Philippines in charge of fisheries development programs at the time he joined the Department;

7. Mr. Virgilio Uyenco — B.S. Chemistry, University of the Philippines; special studies in Oceanography, University of Washington and Food Technology, Massachusetts Institute of Technology;

8. Mr. Pascual Acosta — special studies in Fishpond Engineering, Auburn University; with the Development Bank of the Philippines at the time he joined the Department;

9. Mr. Alfredo Santiago, Jr. — formerly Director of the Mindanao State University Sulu College of Technology and Oceanography; underwent a 10-month advanced training in hatchery operations in Japan;

10. Mr. Antonio Villaluz — B.S. Fisheries, Mindanao State University; also went to Japan for advanced training in hatchery operations.



Salinometer for water analysis

Equipment

During the year, the Department received Japanese-donated laboratory and training equipment valued at about 27 million yen allocated for Calendar Year 1973 but were received only in the succeeding year.

Also allocated by the Japanese Government to the Department during the year are various laboratory and training equipment costing 204 million yen, part of which had been shipped to the Philippines before the end of the calendar year.

During the year the Department purchased out of its own local funds about \$300,000 worth

of equipment including intercom system, furniture, office equipment, freezing units, and vehicles.

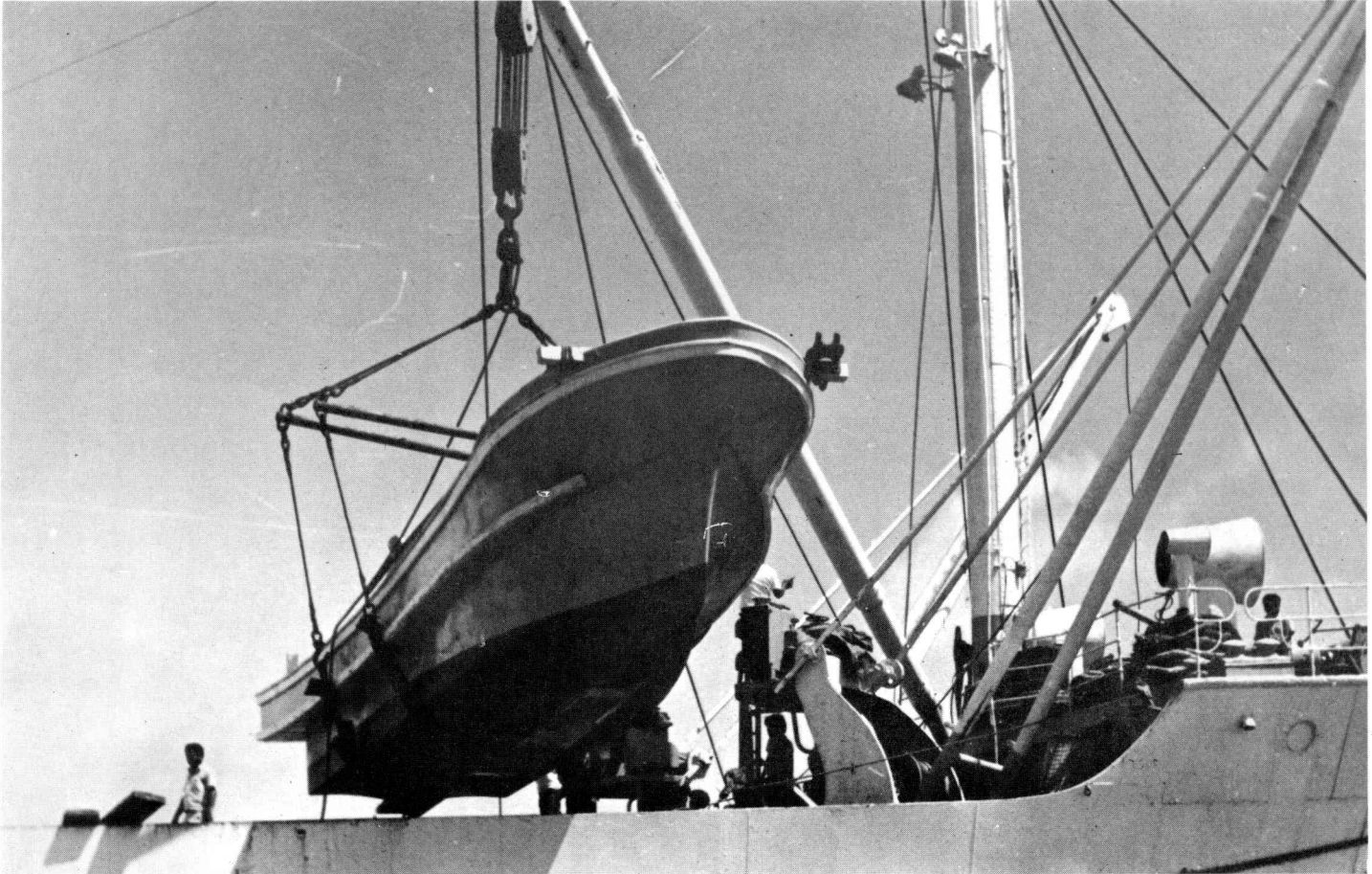
C. FUNDING

Total income generated by the Department to sustain its budgetary requirements for 1974 totalled \$3,166,322.

Philippine contribution. Of the Philippine contribution for 1974, \$68,182 came from the Bureau of Fisheries; \$151,515 from the Department of Agriculture and Natural Resources (DANR); \$75,758 from the Department of Natural Resources (after the

Department was created out of the old DANR); \$113,363 from the National Sciences Development Board (NSDB); \$1,145,833 from the National Government, of which \$179,924 was reflected in the budget appropriation for the Mindanao State University and \$1,145,833 in the budget appropriation for the Bureau of Fisheries and Aquatic Resources (BFAR).

Contributions from foreign governments. The contributions from foreign governments originally estimated at \$300,000 in the 1974 budget rose to \$1,430,528, an increase of almost 400 per cent. Of this amount,



Research vessels . . .

the Government of Japan contributed \$1,388,528 or 97 per cent of the total from external sources.

Japanese contribution. The Japanese contribution, received early 1974 amounting to \$136,364, represents the balance of the proceeds from the sale of the second Japanese rice donation valued at \$393,940 committed to the Department for 1973. An initial \$257,576 which was part of the amount was received in 1973 and was, therefore, reflected in the financial statement for that calendar year.

Also included in the Japanese contribution is \$378,788 representing the proceeds of the third Japanese rice donation.

Additional Japanese contribution consists of laboratory and training equipment valued at ¥231,000 or \$759,132, part of which has been received by the Department.

Similarly, this particular contribution in kind amounting to about \$500,000 was reflected in the 1973 budget but is again reflected in the 1974 budget since the equipment did not arrive in 1973. However, the total value of the equipment

represents an increase of 50 per cent over the \$500,000 estimated in the 1973 budget.

The rest of the Japanese contribution is in the form of services of Japanese experts assigned to the Department, as well as the money value of training grants allocated to the Department for advanced studies in Japan amounting to \$123,244.

New Zealand contribution. The New Zealand contribution equivalent to \$28,000 represents the NZ\$20,000 committed by the New Zealand delegation to the Department during the Ninth Ministerial Conference held in Manila November 1974.



... and laboratory equipment form part of the Japanese Government contribution

Australian contribution. The Australian contribution of \$14,000 represents the proposed one-fourth share of the Department in two grants of A\$20,000 each, the remaining three-fourths having been allocated to the two other SEAFDEC Departments and the Secretariat.

Miscellaneous income. Income from other sources, originally estimated at \$121,520, amounted to only \$12,000 because the hatcheries failed to operate on time.

Unexpected balance from previous year. Included in the income for 1974 is an unexpended balance of \$168,870 representing savings from the operations of the Department during 1973.

D. AUDIT

The Department has made arrangements with the authorized auditor of the SEAFDEC, Turquand, Youngs and Company, a firm based in Bangkok. A contract of services with the firm has been signed, with the

audit fees to be arranged by the SEAFDEC Secretary-General. The auditing firm is expected to send its representatives to Iloilo early 1975 to audit the books of accounts of the Department and prepare its financial statements for submission to the SEAFDEC Council of Directors.

The Department has created an internal auditing unit to insure control over the custody and disbursement of funds.

Activities of the Department

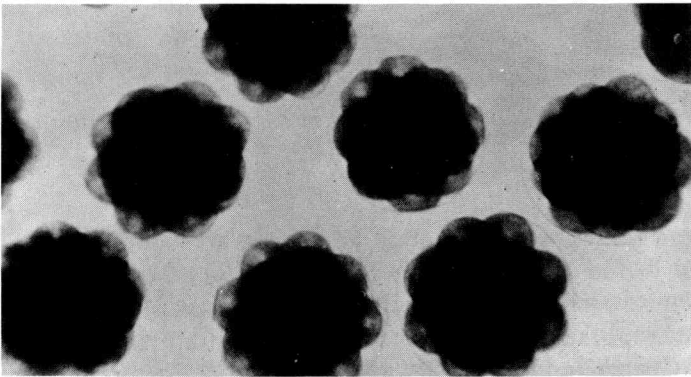
During the year the Department continued research studies on various aspects of tiger prawn *P. monodon* (Fabricius) cultivation at Leganes, Iloilo, and on seed production at Naawan, Misamis Oriental. A number of other research projects were conducted at Leganes and other substations pending completion of the Department's hatcheries and laboratory facilities at Tigbauan.

The Department also organized a multidisciplinary, two-conference series attended by the

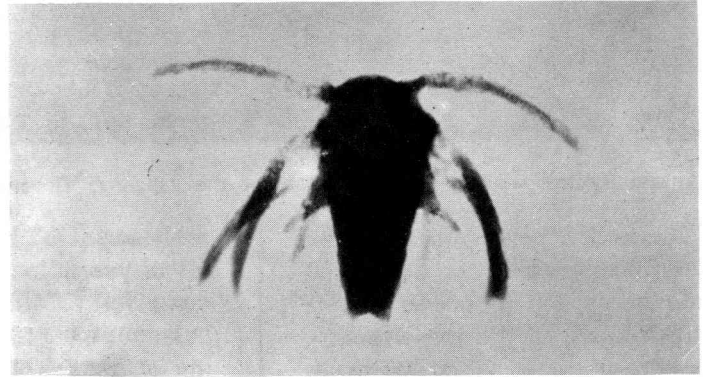
country's leading scientists in an effort to identify problems in the development of the prawn industry.

To hasten the development of efficient techniques in prawn cultivation, the Department launched the Fishpond Cooperators' Training Program under which fry produced in Naawan were distributed free of charge to the cooperators. Under the supervision of the research staff, the cooperators performed experiments on the fry with the data at present being evaluated.

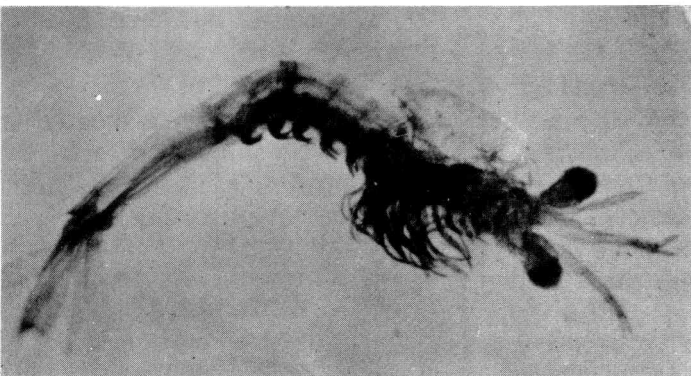
Members of the research staff attended fisheries conferences abroad while Department officials intensified efforts in trips abroad to tap greater funding support from foreign sources.



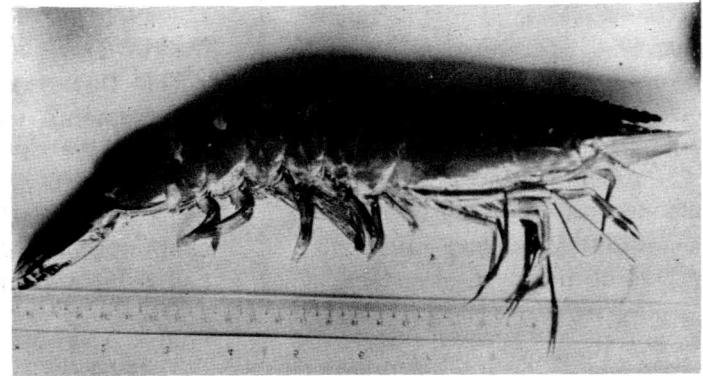
Eggs



Nauplius



Postlarva



Adult

Life cycle stages of tiger prawn *P. Monodon*

A. RESEARCH ACTIVITIES

During the year the following studies were conducted at the following stations:

Leganes station

1. **Studies on postlarval transport.** A total of 1.2 million fry from P₁₁ to P₁₅ have been transported in 12 shipments ranging 8-12 hrs from the Nawan hatcheries to the Leganes ponds. The first 2 batches were shipped in borrowed and chartered planes while the rest were made on regular commercial flights. Aside from the economic aspects, comparative studies on the resistance of the different larval stages have been conducted in relation to packing density, transport duration, and conditions of the medium.

2. **Stocking methods and stocking rates of *P. monodon* in the rearing ponds.** Various methods have been made to check the possible causes of population reduction prior to the rearing period, including acclimatization problems of the fry upon arrival at the rearing site. Stocking rates have been tried in different kinds of prawn ponds: fertilized vs. unfertilized, rich soil vs. poor soil, sandy loam vs. clay loam, aerated vs. unaerated, large-sized vs. small-sized. Stocking rates have changed from 1 fry per sq m to 4 fry per sq m.

3. **Food and feeding habits of *P. monodon*.** Studies on food are concentrated on the development of certain natural organ-

isms in ponds, particularly **lablab** (a biological complex consisting of green algae, bacteria, and bottom-dwelling invertebrates that form a mat on the pond bottom) as well as other food items such as fresh fish, clam meat, rice and corn meal. Laboratory studies on food preferences of juvenile and postjuvenile ***P. monodon*** have also been conducted.

4. **Survival and growth rates of *P. monodon* in rearing ponds.** Ages ranging from P₈ to P₃₅ have been tried in the studies on survival and growth rates. Preliminary data utilizing 1-ha ponds indicated an average survival of 45 per cent in unfertilized ponds and 60 per cent in fertilized ponds. Subsequent trials at 1.5 fry per sq m stocking were



Fry in plastic bag are examined before they are transported to experimental ponds

also conducted during the rainy months.

5. **Dual culture of *P. monodon* and *Chanos chanos*.** Preliminary studies on the dual culture of the 2 species showed *P. monodon* with the stocking rate of 30,000 per ha at P₂₅ along with 1,000 *Chanos chanos* fingerlings grew much slower compared with a group of 6,000 *P. monodon* stocked in another 1-ha pond along with 2,200 *Chanos chanos*.

6. **Studies on predation control, cannibalism, and competition.** Preliminary studies showed that the development of efficient techniques to control predators, competitors, and cannibalism is one of the important aspects in the cultivation

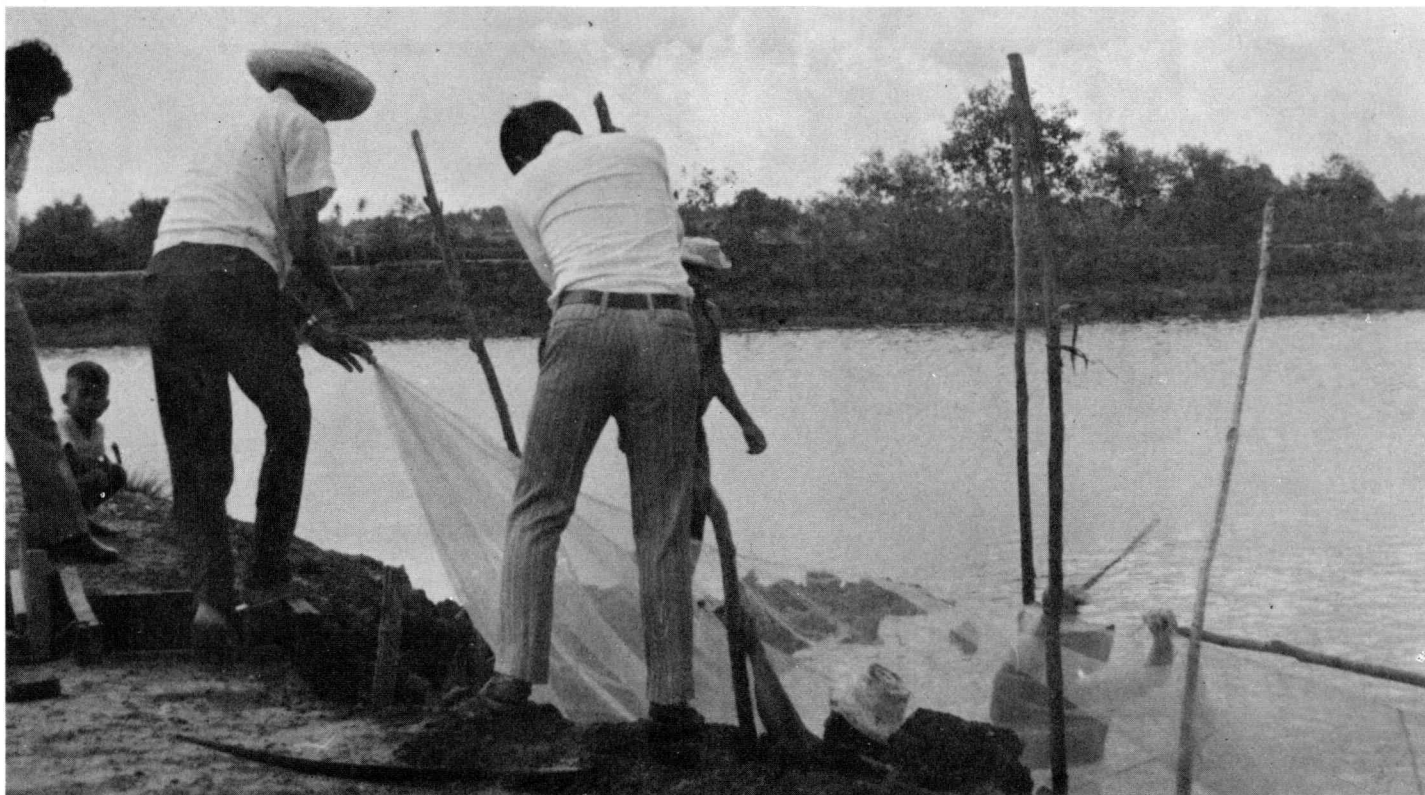
of *P. monodon*. Predators and competitors have been identified through analysis of stomach contents of predators and assessment of physical injuries as a result of cannibalism.

7. **Preliminary data from fish-pond cooperators.** Data on survival rates gathered by fish-pond cooperators are still inconclusive. Such factors as oxygen level, salinity, and alkalinity, need to be studied further so that optimum conditions can be established in the culture of prawns.

8. **Mass seed production of the giant prawn *Macrobrachium rosenbergii* de Man.** *M. rosenbergii* spawners used for this study were obtained from Guimaras Island and Jalaud

River in Leganes. At present there are 20 male and female prawns (locally known as pahi) and success has been obtained in making them mate and spawn in laboratory tanks. Spawners whose eggs were about to hatch were transferred to aquaria containing water with salinity of 1.5 - 2 per cent. As soon as the eggs hatched, the salinity of the water was gradually increased to 10 - 12 per cent.

Three feeding experiments have been carried out. *Artemia salina* nauplii served well as food up to the sixth larval stage. On the other hand, larvae survived up to the third stage only when fed with zooplanktons collected from fishponds.



Suspension nets are installed to prevent acclimatizing prawns from wandering too much.

In ongoing experiments using aquaria, earlier stage larvae fed with 15-20 *Brachionus* per ml and 3-4 *Artemia* per ml have reached the seventh stage with a survival rate of 50 per cent. At present they are being fed only with larger *Artemia* nauplii. Experiments are also being conducted on fourth stage larvae using top panlite tanks.

9. **Diatom culture with reference to the seed production of prawns.** The general method used for seed production of prawn at present is to bloom diatoms in the rearing water as food for larvae and also for the maintenance of good water quality. The diatoms must be cultured and maintained at optimal density in the rearing tanks.

Sea water rich in nutrient salt is needed for the culture and maintenance of diatoms. However, due to varying composition of sea water between seasons, it was found necessary to fertilize the sea water for use in this study. Commercial fertilizers, chicken dung, and carabao manure were used in the experiments considering their availability and cost. Varying concentrations (2-60 ppm) were tried and diatoms were found to bloom in proportion to the concentration of fertilizer in all cases and reached their peak in 2-3 days. However, growth declined in 4-5 days as the nutrient salt in the tank was presumably consumed.

Ten trials were conducted on the possibility of maintaining diatoms for 14-15 days. During the eighth, ninth, and tenth trials, diatom bloom was maintained for more than 10 days using a mixture of chicken and carabao dung.

It appears that diatoms can be maintained for a relatively long period, but it is still necessary to know the salt requirements of diatoms as well as the effects of added fertilizers on the larvae.

10. **Preliminary studies on the culture of *Brachionus* spp. using carabao manure and chicken dung as fertilizers.** In an early study on *Chlorella*, a culture basin containing sea water at 23 per cent salinity and fertilized



Twigs protect vulnerable molting prawns from predators

with carabao and chicken dung was found to contain a good number of **Brachionus spp.** (84 animals per ml). Accidentally started, the practicability of culturing **Brachionus spp.** in large numbers using carabao and chicken dung was examined. The procedure was repeated in duplicate basins containing sea water with 21 - 23 per cent salinity without seeding of **Brachionus spp.** A maximum of 200 animals per ml was obtained on the thirteenth day of culture. The effect of salinity on **Brachionus spp.** was also studied and results indicate that 20 per cent salinity gives higher **Brachionus** counts (171 - 187 animals per ml) after 12 - 14 days of culture compared

with 100 per cent sea water (120 animals per ml).

Still in progress, the optimal concentrations of chicken dung and carabao manure are also examined using pure mixed fertilization.

Igang substation

11. At the Igang substation a total of 3,000 prawn breeders, mostly 6 and 9 months old, are stocked in 5 prawn pens. The average weight of the blue-colored animals upon stocking was 33 gm. Fed on green mussels, the animals turned purplish red and increased in weight by an average of 2 gm. If completion of gonadal development will occur in the pens, these animals may be transferred to

the Tigbauan hatcheries for scheduled spawning. Some 50,000 juveniles from the Leganes ponds are ready for stocking in the Igang pens.

Himamaylan substation

12. At the Himamaylan and other substations, studies are primarily related to the regular collection of prawn spawners and fry as well as stock assessment.

Naawan substation

13. Preliminary studies on seed production of **P. monodon**. Research studies on seed production of **P. monodon** were conducted with the assistance of researchers from the Mindanao State University.

Although mass seed production of **P. monodon** has been considerably improved by the



Researchers take periodic record of oceanographic data

MSU Institute of Fisheries Research and Development (IFRD), certain problems still remain to be solved, eg., the unpredictability of fry production and the still low survival rate, which is about 7.2 per cent from nauplius to P₁₅. Experience has been gained and expertise developed in the rearing of *P. japonicus* in Japan, but there are several differences between *P. monodon* and *P. japonicus* from the structural as well as ecological and physiological standpoints. Hence, rearing techniques for *P. japonicus* cannot entirely be utilized for *P. monodon*.

Experiments were conducted in hatchery tanks to improve the survival rate of larvae from nauplii to P₁₀ to P₁₃. Previous work at IFRD indicated heavy mortality during the zoea stage, but there was relatively high survival from the mysis to the postlarval stage.

a. Feeding with cultured diatoms.

Diatom density of 20,000 to 50,000 cells per ml, which is equivalent to the optimal density for *P. japonicus* gave low survival rate of larvae (down to zero in some cases). However, relatively good results were obtained using a diatom density of less than 5,000 cells per ml. Once the optimal density of diatoms and their maintenance shall have been established, it would be more profitable and economical to feed these to zoea larvae.

b. Feeding using mixed diet of diatoms, *Sargassum* juice and bread yeast.

The mixed diet was used for the zoea, mysis, and early

postlarval stages although it led to the rapid deterioration of water in the hatchery tank sometimes causing heavy mortality. *Sargassum* is good food for larvae because attached to its branches and floats are many organisms and benthic diatoms such as *Nitzschia*, *Navicula* and *Thalassiosira*. But, *Sargassum* is difficult to gather especially during stormy weather.

c. Feeding with filamentous algal juice.

The highest survival rate during the zoea stage (more than 80 per cent) was obtained using filamentous algal juice as feed. Filamentous algae grow naturally in fishponds and mouths of rivers. This high survival rate appears to be stable up to mysis stage.

The above-mentioned results indicate that a mixed diet consisting of filamentous algal juice and bread yeast would be good for zoea although necessitating a daily changing of water. After molting to mysis 1 or 2, the larvae may have to be transferred to an outside tank containing diatom density maintained at 5,000 cells per ml and bread yeast. Heavy mortality sometimes occurs due to stress during transfer.

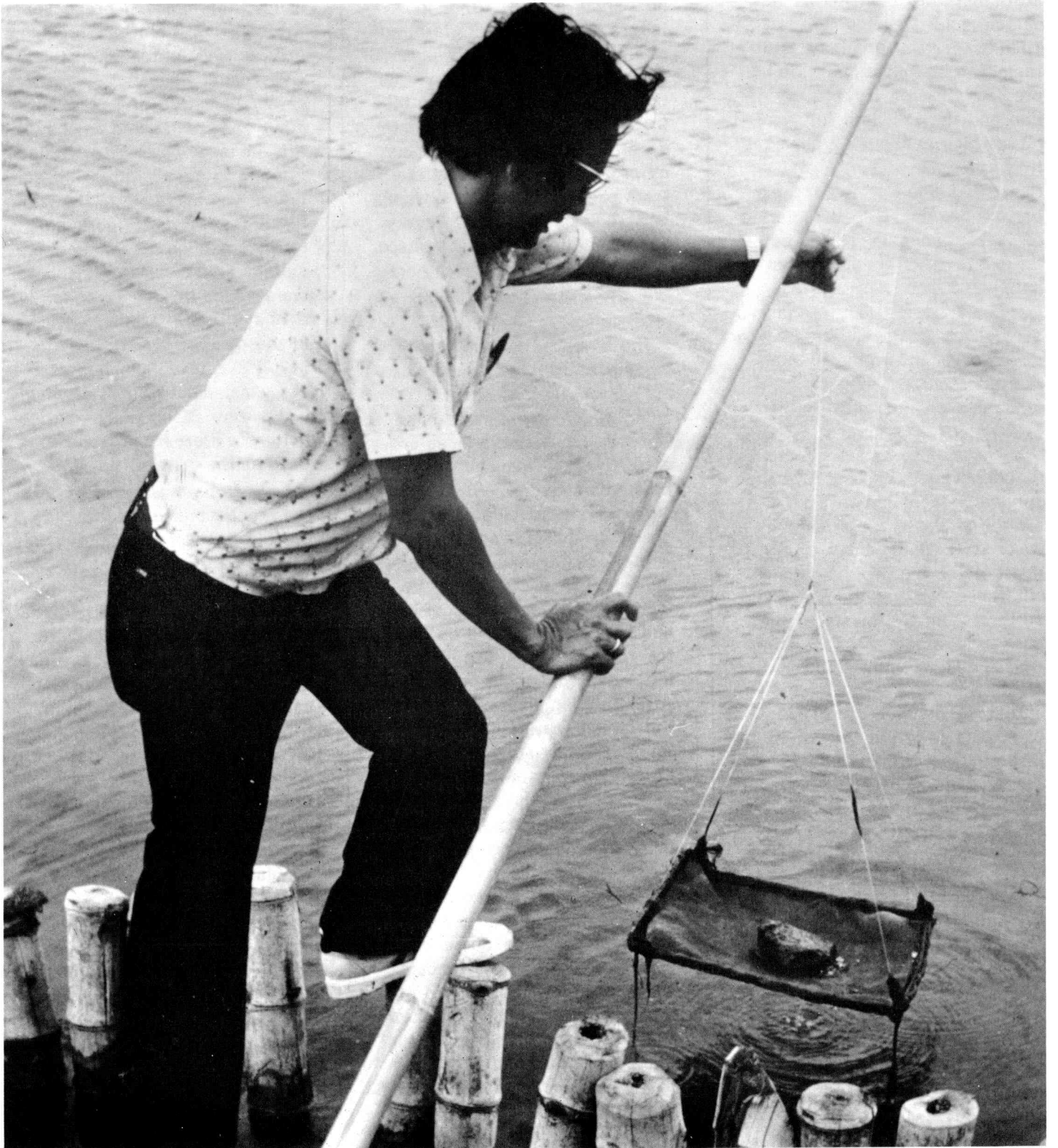
Feeding studies on postlarvae are also being undertaken. Minced clam meat and bread yeast are used under feeding methods similar to that for *P. japonicus*, except that less hatchery labor is employed for water management.

14. Comparative studies of *Brachionus* spp. culture using two different kinds of feed. *Brachionus* spp. were cultured

using *Chlorella* and bread yeast as feed. For *Chlorella* feeding, organic and inorganic fertilizers were used. Equal amounts of carabao manure and chicken dung were dissolved in 2 l. of filtered sea water and strained through cheese cloth. This solution was made up to 8 l. with filtered sea water. Inorganic fertilizers such as ammonium sulfate and calcium phosphate were added to sea water to give a final concentration of 1 ppm. In the case of bread yeast feeding, 0.16 gm of Fleischmann's dry yeast dissolved in distilled water was added daily to the culture. Filtered sea water was used as the control.

Brachionus was stocked into 10-l. plastic buckets containing 8 l. of filtered sea water previously treated as described above to give a density of 2 to 3 individuals per ml. These were under constant aeration. *Brachionus* counts were made twice a day, and the water temperature, pH, salinity, dissolved oxygen, nitrite, ammonia and phosphate levels were measured either daily or every other day. *Chlorella* was introduced daily into the culture in varying amounts depending upon the population cell count.

Results suggest that *Chlorella* feeding, using either organic or inorganic fertilization, gives a higher *Brachionus* peak which was obtained after 5 to 7 days of culture. Peaks in *Brachionus* counts in the cultures fed with bread were attained in 2 - 4 days but were only 50 per cent of those obtained with *Chlorella*. These counts gradually decreased to practically zero after the



Larval population counts are undertaken for stock manipulation

ninth day, but nitrite levels increased faster in the **Chlorella**-fed cultures. The **Brachionus** counts in the control gradually decreased and gave zero counts after 5 days.

15. **Preliminary studies on *Brachionus* spp. as feed for *P. monodon* and its effect on water quality.** The preference for, and proper stocking rate of, ***Brachionus* spp.** as feed for ***P. monodon*** were examined. Filtered, boiled sea water was used in all experimental runs to minimize contribution of other variables to the results. Only single feeding was done and varying amounts of ***Brachionus*** were added. No feed for ***Brachionus*** was added. In these experiments. Daily water analyses were made to

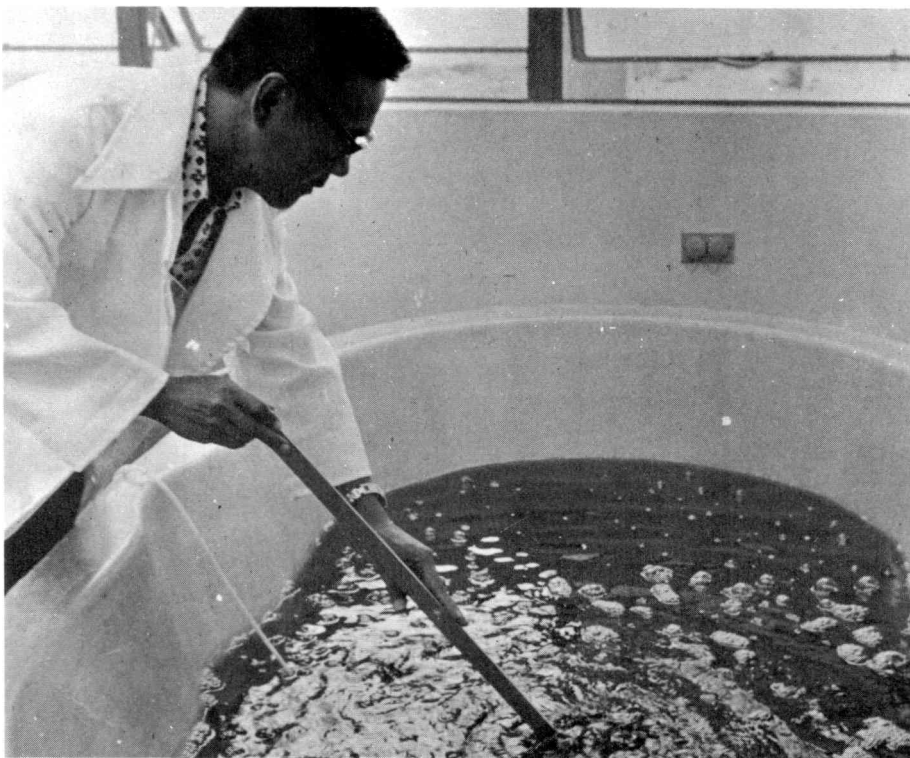
determine temperature, pH, and nitrite concentration. Periodic measurements of salinity, dissolved oxygen and ammonia were also conducted. Stocking rates of 20 larvae per l. of sea water were employed in the experiments.

Results suggest that ***Brachionus* spp.** is sufficient as feed from the mysis stage up to about P₂ at a stocking rate of 8-16 cells per ml water, giving almost 100 per cent survival. A higher rate (16 - 32 cells per ml) brought about high mortality which cannot be explained solely by changes in water quality. At low stocking rates (1 - 4 cells per ml) cannibalism was also observed, but in all cases mortality rates increased rapidly starting from the P₄ stage.

Zero survival of zoea larvae was obtained after 4 days at 4 different ***Brachionus*** stocking rates. In the case of the controls where no feeding was made, they survived up to 2 days only.

With ***Brachionus*** feeding there appears to be no increase in nitrite concentration, and ammonia levels were not much higher compared with the controls. Initial studies on feeding using ***Chlorella*** indicate an increase in nitrite levels from less than 0.1 ppm to 0.8 ppm after 4 days of feeding.

In all experimental runs, dissolved oxygen levels ranged from 4.0 to 6.3 ppm, pH from 7.90 to 8.13, and salinity increased by 5 to 10 per cent throughout the duration of the experiment.



Moina, a zooplankton, serves as food for prawn fry

C. TRAINING AND EXTENSION

In accordance with its Plan of Operation, the Department has developed interrelated training and extension programs.

The extension program is designed to hasten the transfer of technology developed in the laboratories to the end-users in the efforts to raise fish production, generate employment opportunities, and increase rural income particularly in fishpond communities.

In June 1974 the Department launched its first Cooperators' Training Program on prawn culture at Iloilo City, in cooperation with the Bureau of Fisheries and Aquatic Resources. The Department entered into an agreement with the Philippine Society for

Fisheries Research of Iloilo to undertake a research-production scheme. There were 28 participants, 16 of whom were pond owners, 3 from the Bureau of Fisheries and Aquatic Resources, and the rest, caretakers.

A second training program was launched in Tigbauan, Iloilo on October 9 - 13, 1974 involving 32 participants. A third training program for Northern Mindanao involving 30 participants was held in Naawan, Misamis Oriental on November 25 - 29, 1974.

Under the research-production scheme, the Department formulated the designs for research and production, and provided free research materials in the

form of prawn fingerlings, researchers and research aides.

The cooperators, on the other hand, made available their ponds of the size and specifications embodied in the design. They were also to provide fertilizers, chemicals, and technicians to take care of the prawn stock and the ponds.

SEAFDEC researchers and aides were allowed free entry to undertake implementation of the research designs.

After the completion of the cultivation, from stocking of fry to harvest of adults, the animals will belong to the cooperators, while the data



Fishpond cooperators learn scientific techniques of fry cultivation

monitored will belong to the Department. The cooperators were allowed freedom to culture their prawns in accordance with their traditional practices and the Department's researchers recorded those practices as benchmark information to become bases for research and improvement.

C. CONFERENCES

In January Dean Domiciano K. Villaluz, chief of the Department, along with two SEAFDEC staff researchers, Messrs. Antonio Villaluz and Alfredo Santiago, attended the conference of the World Mariculture Society at Charleston, South Carolina, U.S.A. on January 21-25, 1974. Dean Villaluz, along with Dr. Q.F. Miravite, director for

General Affairs, and Mr. Porfirio Manacop, research coordinator, attended the 1974 Session of the Indo-Pacific Fisheries Council held in Jakarta, on Oct. 26 - 30, 1974.

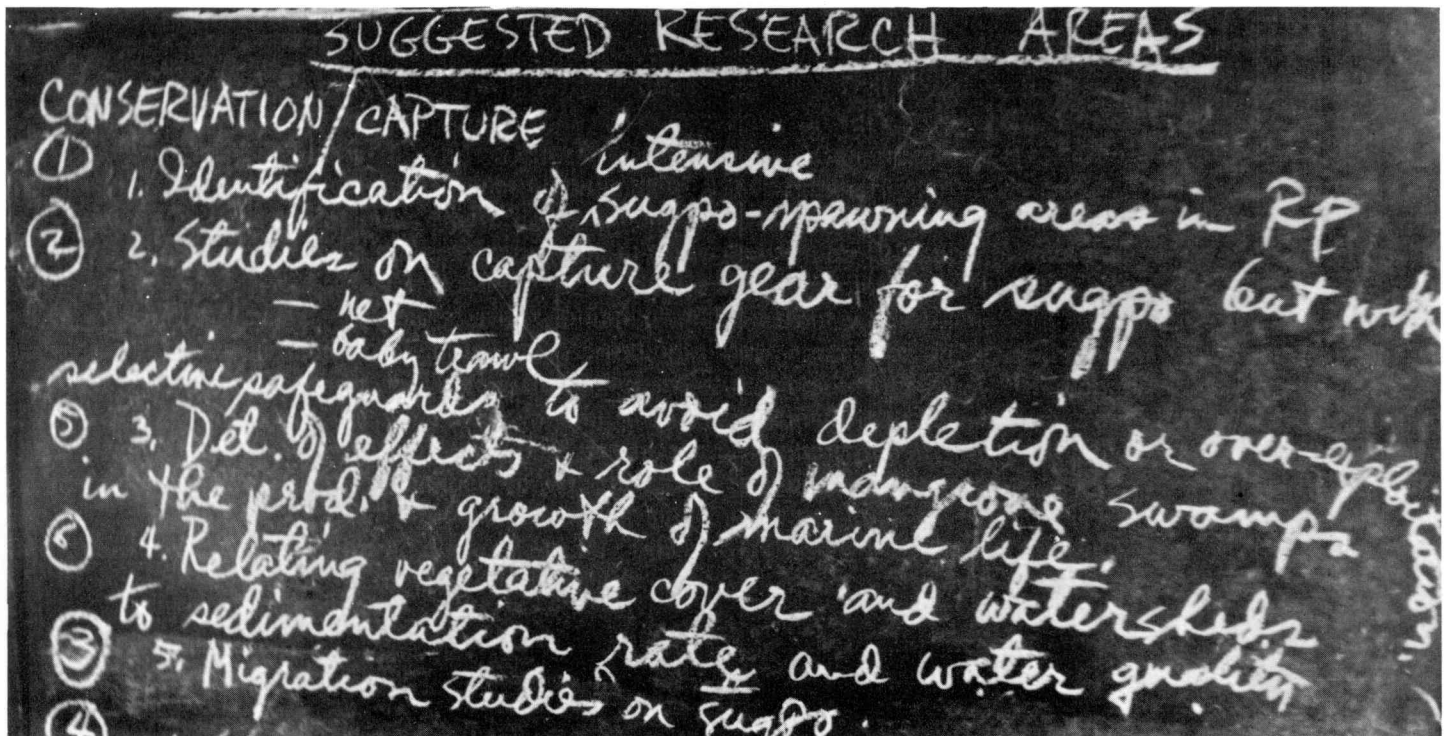
Dean Villaluz and Dr. Miravite also attended a workshop of the South China Sea Fisheries Development and Coordinating Program held in Manila from August 28 to September 4, 1974.

As member of the Philippine Delegation, Dr. Miravite attended the Senior Economic Officials' Meeting of the Ministerial Conference for the Economic Development of Southeast Asia held in Manila in October.

As advisers to the Philippine Delegation, Dean Villaluz and Dr. Miravite attended the Ninth Ministerial Conference held in Manila mid-November.

Several conferences were conducted by the Department to identify the problems of the aquaculture industry, provide baseline data on the problems identified, and develop capsulized designs for each specific research project.

a. First Aquaculture Research Conference. The first conference on aquaculture research was held in Naawan, Misamis Oriental and Iloilo on April 19 - 21, 1974. Some 30 participants which included scientists and SEAFDEC staff were able to identify certain problems in aquaculture development, specifically on prawns.



Research conferences are conducted to identify the major problems of the aquaculture industry

b. **Second Aquaculture Research Conference.** The second conference was held in Caliraya, Laguna, on August 2 - 4, 1974. Attended by the same participants, this was actually a sequel to the first conference. A total of 40 research projects were finalized, and capsulized proposals were submitted.

c. **Joint Filipino-Japanese Research Conference.** Joint conferences have been held among Filipino and Japanese senior research staffs of the SEAFDEC, to delineate the research objectives of the Department and designate research teams which will work on identified research problems. The research areas were delineated into those of propagation

and seed production, cultivation, conservation and capture, and socio-economic aspects of the prawn industry.

d. **Training Conferences.** The Department has participated in a series of conferences with a consortium of 3 state universities and some 8 government agencies and international organizations in the effort to develop training programs for the fishing industry, particularly the prawn industry. As a result of these conferences, the state universities as well as the other participating agencies agreed to launch 3-month programs in fisheries technician training; 2-year post high-school training program in fisheries; and 2-year graduate program leading to M.S. in Aquaculture.

D. SEVENTH SEAFDEC COUNCIL MEETING

Hosted by the Republic of the Philippines, the Seventh SEAFDEC Council Meeting was convened in the Coral Ballroom of the Manila Hilton on December 16 - 20, 1974.

Among the more significant events was the election of Director Felix Gonzales, council director for the Philippines, as chairman of the SEAFDEC Council of Directors. The Council unanimously approved the reappointment of Dean Domiciano K. Villaluz as chief of the Aquaculture Department for another 2-year term effective upon the expiration of his first 2-year term in July 1975.

The Council approved the revised budget of the Department as well as its proposed program of activities for Calendar Year 1975.



Director Felix Gonzales (second from right), newly elected chairman of the Council of Directors, chats with delegates to the Seventh Council Meeting

Program of activities for 1975

A. RESEARCH PROJECTS

The year 1975 will usher in the expansion of various research projects with the completion of the research laboratories and hatcheries in Tigbauan, Iloilo, and the establishment of some 5 satellite research and spawner collection stations throughout the country. The research activities will include not only the various species of commercial shrimps and prawns but also the milkfish **Chanos chanos** Forskal, which is the most extensively cultured fish in Southeast Asia.

The research projects scheduled for implementation during Calendar Year 1975 are as follows:

1. Shrimps and prawns

a. Further studies in the refinement of the techniques of

mass production of **P. monodon**. This is designed to increase the survival rate of fry per spawner.

b. Studies on the mass production of the white shrimp **P. indicus**, the giant prawn **M. rosenbergii**, and other commercial shrimps. Preliminary techniques developed in the experimental production of the fry of these species of shrimps and prawns will be further improved for mass production to supply the increasing demand of the 175,000-ha of brackishwater fishponds and freshwater bodies in the country.

c. Continued studies on the gonadal development of **P. monodon** in shrimp pens at Igang, Guimaras. Some 20,000 juveniles of this species are presently



Dr. O. F. Miravite, director for General Affairs, explains the program of activities for 1975

under observation for gonadal development and maturation for eventual supply of gravid spawners to the Tigbauan hatchery complex.

d. **Further studies on the combination-rearing of *C. chanos* and *P. monodon*.** This is to determine the maximum production per unit area in rearing these two compatible species in the same pond-rearing system.

e. **Studies on the efficiency of various designs of rearing-pond systems for *C. chanos* and *P. monodon*.** This is to determine the most efficient and economical design of a rearing-pond system for these two species.

f. **Socio-economic survey of the aquaculture industry of the Philippines.** This is a 2-yr study to be undertaken jointly by SEAFDEC and PCAR with funding amounting to ₱700,000.

g. **Acclimatization of *P. monodon* and other commercial species.** This project is designed to study acclimatization problems of shrimps and prawns during transfer from salt water to freshwater and vice-versa.

2. *Chanos chanos*

a. **Survey of the spawning and fry grounds of *C. chanos* in different target centers in the country.** This project will be jointly undertaken by the Bureau of Fisheries and Aquatic Resources (BFAR) and the SEAFDEC Aquaculture Department.

b. **Study of the ecology of the spawning and nursery grounds of *C. chanos* in the coastal areas of Antique and Iloilo provinces.** This project is to determine the specific spawning and nursery areas of

***C. chanos* in these two leading provinces in fry production.**

c. **Improvement in the catching of *C. chanos* fry.** In this study various kinds of fishing gear such as the bulldozer, traditional seine, scissor nets, and the newly-devised SEAFDEC shrimp trawl will be tested for catching efficiency.

d. **Improvement in the collection, handling, and holding of *C. chanos* breeders.** Such facilities as fish corals, ring nets, hand lines, floating cages, tanks, and earthponds will be tested. For effective handling, various types and procedures with the use of chemical and electrical tranquilizers will be tested.

f. **Histological study of the gonads of *C. chanos*.** This study will involve the collection and preservation of the various stages of gonadal development of *C. chanos*. Microtome sections of the various stages of gametogenesis will be prepared.

g. **Tagging and telemetry.** This study is designed to determine the migration patterns of the breeders in different parts of the country including the Southeast Asian region.

3. Hatchery management procedures

a. **Studies on the conditioning of the concrete hatchery and rearing tanks in Tigbauan.** This study will determine the various approaches in conditioning the newly constructed concrete hatchery and rearing tanks for immediate use in the mass production of the fry of *P. monodon* and other commercial shrimps and prawns.

b. **Studies on water quality control.** This will involve the determination of conditions for optimal water quality in the hatchery tanks to insure high survival rates.

c. **Feeds and feeding study.** This is to determine the different kinds and combinations of natural and artificial feeds for different larval stages of shrimps, including food preferences and nutritional requirements.

d. **Studies on predators and parasites in the pond and in the hatchery.** This will involve the study and identification of the various predators and parasites of the fry in the hatchery as well as in the rearing-pond system. This will include effective control measures against these undesirable species.

4. Cultivation

a. **Studies on pond management.** This will involve the determination of the optimum depth of water and frequency of natural freshening by tidal movement.

b. **Studies on pond preparation and fertilization.** This will involve various schemes of pond preparation, including the optimum application of various kinds and quantities of organic and inorganic fertilizers in the nursery and rearing-pond system.

c. **Improvements in the intensified rearing of the stocking fry and/or fingerlings of *C. chanos* and *P. monodon*.** This is designed to develop efficient procedures for intensive rearing of the stocking fry and fingerlings under an enclosed system as compared with the traditional earthpond nursery system. The objective is to establish seed



Japanese expert examines gonadal development of giant freshwater prawn *M. rosenbergii*

bank centers in various parts of the country not subject to recurrent weather changes, typhoons, rain and flood.

5. Establishment of a freshwater fisheries station

Plans are underway to establish a number of substations along the coast of Laguna de Bay to promote and coordinate research for the development of the freshwater fisheries industry in the region as well as train researchers and technicians in freshwater fisheries.

The research activities of the freshwater fisheries station shall include the following:

- a. Promoting the collection of quality seedling of desired freshwater fish species from natural sources or by induced breeding.
- b. Increasing production through improved design and construction of ponds, pens, and cages as well as improved management and maintenance of pond and water conditions as required by species concerned.
- c. Improvement of natural and artificial fish food; biological manipulation of stocks; and control of diseases, parasites and predators.
- d. Prevention and control of pollution affecting freshwater fisheries operation.

B. TRAINING & EXTENSION

1. A 10-mo fishpond management program beginning August 1975. The program is open to 20 participants from member countries and expenses are borne by funds received from member governments, including the Government of Japan. The training program will be based primarily in Tigbauan and Leganes.

Details of this program will soon be circulated to member governments so that nominations can be received and applications processed before the opening of the program in August 1975.

2. A 2-yr graduate program leading to the M.S. in Fisheries, major in Aquaculture, will be conducted at the Department's project sites under consortium arrangements with major state universities in the Philippines, and a number of government agencies involved in fisheries development. Funds for this purpose will come from the Philippine Government and from consortium member institutions. Details of this program, which will commence November 1975 with an initial freshman group of some 30 graduate students, are at present being worked out.

3. Short-term technician training programs (1-6 months) primarily for local participants on various aspects of seed production, cultivation, conservation, and fisheries economics. Funds for this purpose will come from the Republic of the Philippines.

4. The Cooperators' Training Program launched June 1974 will be continued and intensified. The projected increase of fry production in the Tigbauan hatcheries will necessitate the training of more pond cooperators. This research-production scheme will involve more pond owners as partners in the search for improved techniques in prawn cultivation and facilitate the transfer of technology from the researchers to the end-users.

5. A Staff Development Program will be designed to upgrade the competence of the research and management staff. This fellowship program will include short-term training programs and a formal graduate program for studies in selected local institutions as well as abroad.

During the year 3 researchers and 4 research assistants are scheduled for short-term (1-3 months) observation studies in Taiwan, Japan and Hawaii on various aspects of aquaculture including fishery statistics.

Two researchers are scheduled to undertake post-graduate study on aquaculture at Auburn University, Alabama, U.S.A.

The Department will sponsor an international workshop in September 1975 at Tigbauan, Iloilo, on the breeding and artificial propagation of **Chanos chanos**, involving western and Asian countries with expertise in this field. A national seminar on the same subject will be held July 1975 to assess the extent of completed as well as ongoing studies in the Philippines on this species.

C. INSTITUTIONAL LINKAGES

1. The Department will continue to implement the existing Agreement with the National Science Development Board (NSDB) for a research project on the spawning and cultivation of **P. monodon**.

2. A Memorandum of Agreement has been signed between the Department and the Philippine Council for Agricultural Research (PCAR) for a joint research project on the socio-economic aspects of aquaculture, exchange of experts, joint training, etc.

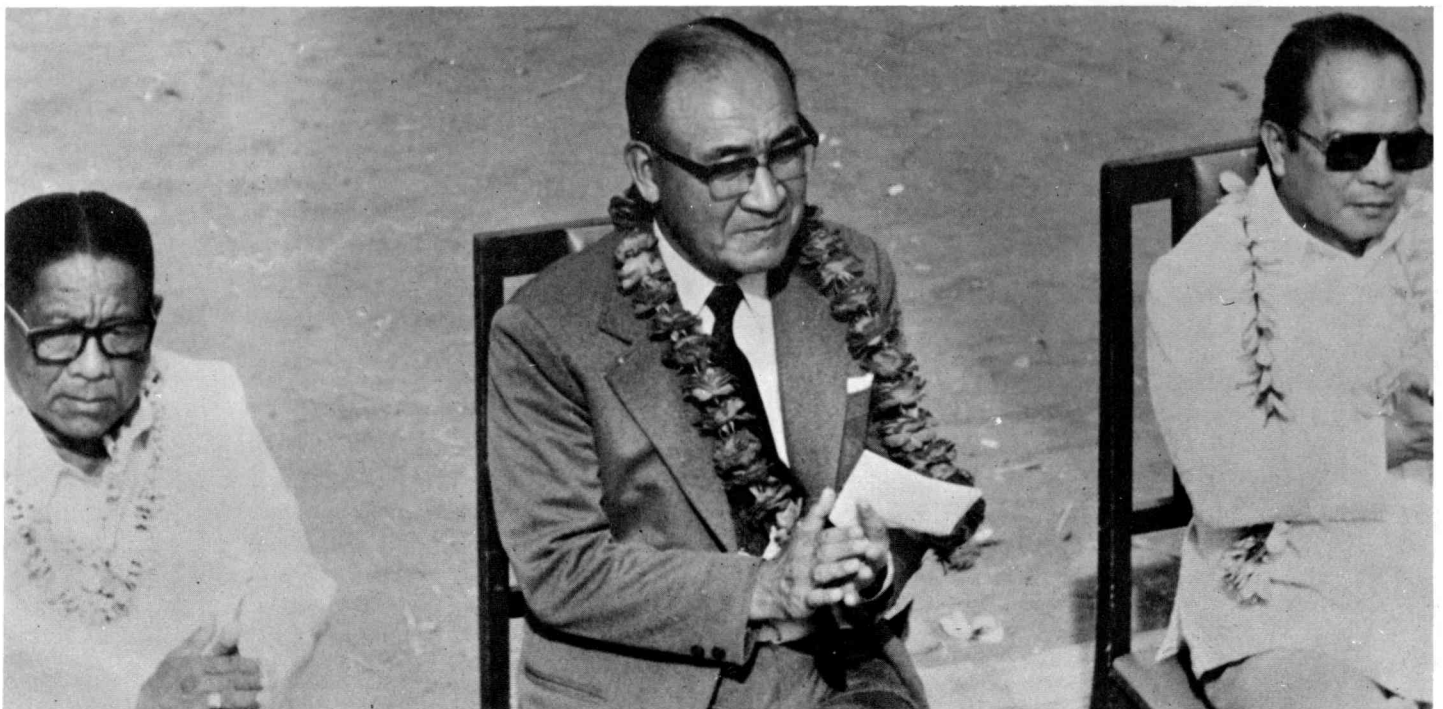
3. A Memorandum of Agreement was signed with Mindanao State University involving cooperative research on seed production of prawns in the MSU hatcheries at Naawan, Misamis Oriental.

4. The Department is working closely with the BFAR and the DNR on national programs related to fisheries development.

5. A proposal for an integrated research and development project for milkfish seed production and cultivation has been approved for funding support by the International Development Research Center (IDRC) of Canada. This project aims to establish hatchery stations for seed production and improved techniques to increase pond production.

6. Negotiations are underway for the New Zealand government to support the Department's research plan to study and develop techniques for the culture of mussels and eels.

7. The Oceanic Foundation of Hawaii has agreed to assist the Department in a study on the artificial breeding of the grey mullet **Mugil cephalus**. It has already committed to support a grant for 2 researchers from the Department to undertake short-term training on the breeding of grey mullets at the Oceanic Foundation.



Top local officials of Iloilo honor Ambassador Toshio Urabe of Japan during his visit to Leganes



Rural folks are the ultimate beneficiaries of the Department's manifold programs

