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LAUNCH AQUACULTURE SCIENTIFIC LITERATURE SERVICE FOR ASIA

An outreach project which seeks to accelerate the dissemination of scientific aquaculture literature among scientists, technologists, and other research and development workers in Asia is being launched this June by the SEAFDEC Aquaculture Department. The idea behind the aquaculture scientific literature service (ASLS) is to ferret out information in this field and bring them quickly to the attention of numerous workers in aquaculture many of whom are working in distant stations or in organizations with scarce library resources and therefore not very well served by or endowed with an adequate and up-to-date body of literature.

It is a well-recognised fact among R & D organizations that one of the most vital requisites they need to turn up quality and relevant studies and to develop the capabilities of the scientific and technological staff is an up-to-date and extensive storehouse of scientific information. With the present surge in research on aquaculture and related fields, the build up of research output is going to make the organisation and exchange of research information a more complex job. Aquaculture researchers shall be facing more difficulties in assimilating information and keeping abreast with the developments in their areas of work.

The SEAFDEC Library contains some 4,000 titles (6,000 volumes), 250 journal titles, 300 titles in microfiche, and 6,000 reprints of articles. It will be the center for the aquaculture scientific literature service.

The service will initially cater to institutions in the Philippines which shall be accordingly enrolled in the system. Trial runs however shall at the same time be made for selected institutions in Asia. Eventually, too, a double-barrelled approach shall be adopted to serve both institutions and individuals. But, for a start, only institutions shall be enrolled in the service.

Aquaculture Documentation

Meanwhile, the Asian Institute of Aquaculture, which manages the SEAFDEC library, documentation and technical services, and the aquaculture scientific literature service, has started to source out available aquaculture information from the holdings of institutions and private individuals. The initial effort, which concentrated on the Panay region and covered eight schools, yielded 900

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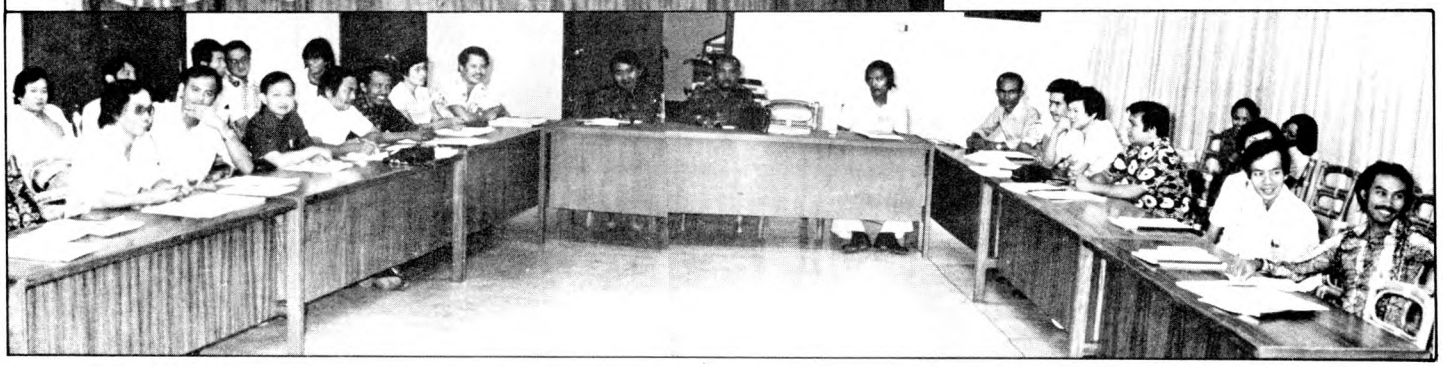
The latest batch of trainees in small-scale prawn hatchery operations receive certificates from AIA deputy director for training and technology verification H. Chaudhuri. To date, 27 individuals in four batches have been trained in this skill. Meanwhile, a 4-week international training on prawn hatchery management started last April 30. This will be followed in June by another short course in barangay (village) hatchery designed for technicians of the Bureau of Fisheries and Aquatic Resources.



Two international training courses started on May 1, the 4-week prawn hatchery management course and the 3-month aquaculture management program. Participants come from Indonesia, Malaysia, Singapore, Thailand, Philippines and Cuba. Photos show trainees at opening session being welcomed and briefed by Aquaculture Department chief D.K. Villaluz (left), AIA deputy director H. Chaudhuri, and AIA director J.C. Madamba.

Aquaculture Scientific Literature *(from p, 1)*

titles 70 percent of which are not in the SEAFDEC library. Spade work on the holdings of nine scientists and the libraries of two other research centers has so far yielded some 5,623 titles. The aquaculture documentation team will shortly move out to other regions of the Philippines and the project expects to cover within this year all the possible institutions in the country. This documentation effort will eventually expand throughout Asia with the assistance of librarians and documentalists in the other countries. The output of the documentation project, aside from getting into the aquaculture scientific literature service, will be fed to the Aquatic Sciences and Fisheries Information System (ASFIS) based in Rome in line with SEAFDEC's commitment to furnish ASFIS with an agreed upon number of titles a year. SEAFDEC, through AIA, has been made the Southeast Asian input center for ASFIS.

The SEAFDEC library contains at present 6000 volumes (4000 titles), 250 journal titles, 300 titles in microfiche, and 6000 reprints of articles. It is equipped with a microfiche printer-reader. The professional staff consists of 3 senior librarians and three junior librarians two of whom, one senior and one junior, are trained in documentation. The documentation team includes three research assistants whose college training are in aquaculture or fisheries.

Procedures

The aquaculture literature service will send to a station or an institution a list

(Continued on p. 7)

Available Technology, Technology Gaps, and Production Potentials in Mollusc Aquaculture

Larval rearing of bivalve molluscs

Available methods and techniques are adaptations for tropical species of larval rearing experiences by aquaculturists in many countries. Probably no more than two species of commercially important marine bivalves in the Philippines have been cultured throughout their life cycle. Success in rearing larval stages of *Perna viridis (Mytilus smaragdinus)* has been described, with particular emphasis on larval density and feed composition. Although occurring naturally all over the country, spatfall may be predicted by monitoring larval appearance, and incidentally identify larvae of each species. Broodstock could be kept alive for 3 months in cold water at about 20°C if well fed. When ready to spawn, stock should be placed in warm water and fertilized eggs could be cultured in sea water.

Technological gaps

Whenever possible, attempts should be made to utilize larvae of mulluscs as feed for larvae of other commercially important aquatic species. The freshwater *Cristeria,* formerly known as *Anodonta,* is being studied for possible harmful effects of the larval glochida on the host fishes. Being determined is whether its culture could be offset by its economic potentials.

Mussel and oyster farming

Various culture approaches involving growing in spatfall areas, fixing structures to the bottom, and no thinning done are being undertaken. Farming of green mussel is more lucrative than brown mussel because it has greater weight, it tastes better, can be transferred to other areas, and can be found where the brown mussel is also found. Greater mussel production can be obtained in areas of upwelling. A good indicator of a good feeding area is the presence of a large population of filter feeders. Research is ongoing in identified mussel farming areas. Farming methods (any of which must be above the bottom) for oysters include: hanging or 'bitin', stake, broadcast, stone, log, tray, long line, raft, monofilament, oyster sheets, and old rubber tires. Methods for farming mussels include the stake, hanging (preferred), and bamboo stationary plot from which synthetic rope netting measuring 2 x 5 m are tied. Molluscs must be conserved. Dwindling supply, especially the commercial ones like *kapis,* they must be revived by regulatory measures for gathering such shells.

Technological gaps

More studies are needed in the following areas: comparison of growth rate differences between *Crassostrea iredalei* and *C. malabonensis;* seasonal occurence of oyster spats in certain areas; spat collection; spatfall; handling and harvesting (cutting of byssus instead of pulling); distancing between stake posts; salinity tolerance for mussels; biology; age determination of *kapis* (Placuna placeuta) shells; total area for oyster and mussel farming; and hydrobiological studies in natural beds of oysters.

Post-harvest processing and handling.

The three-fold problem of rapid spoilage, bacterial contamination causing food poisoning, and expensive transport has been identified. Detoxification and depuration procedures along with the prolonging of keeping time and quality have been described.

Technological gaps

Studies are needed in processing technology and marketing.

Socio-economic survey of molluscs farming

A study has been made of the mollusc farm operator, his farming practices, farm production levels, product disposal and marketing practices, and prices.

Technological gaps

More information on the existence and activities of farmers' organizations and on marketing practices will be useful.

PRODUCTION POTENTIALS USING DIFFERENT TECHNIQUES CLASSIFIED ACCORDING TO INPUT LEVELS (tons/hectare/year)

	Production	Input Level
A. OYSTERS		
1. Broadcast	0.5-1.0	Low
2. Stake	4.0-8.0	Medium
3. Tray	2.0-5.0	High
4. Hanging		
fixed	10.0-15.0	High
raft	40.0-60.0	High
long line	25.0-50.0	High
5. Rubber Tires	5.0-10.0	Medium
B. MUSSELS		
1. Stake	30-100	Medium
2. Rope web	200-300	High
3. Hanging		
raft	500-1500	High
long line	500-1000	High

It has been reported that best production potential would come from culture methods above the bottom where siltation cannot affect the spats and there is less predation. ●

Development of Aquaculture in Sierra Leone with a Brief Reference to Oyster Research*

The need for increasing aquaculture products is becoming a necessity as they are popular diets to many Sierra Leoneans. Oysters in particular are an important source of protein in the country, especially for the poor. This is also true in many West African countries.

In Sierra Leone oysters are commonly called mangrove oysters, mud oysters, or rock oysters depending on the substrate. At present, mangrove roots to which oysters are attached are cut by men using dug-out canoes and machetes. A very small amount is gathered by women mostly from mud banks and rocks. Since they are so small, collection and processing are very laborious, production is limited, and distribution is localised.

In 1974, the present oyster culture project, jointly funded by the International Development Research Centre (IDRC) of Canada and the Sierra Leone Government's Fisheries Division, was started.

The project aims to increase the yield of mangrove oysters and established a practical and economic system for their cultivation through various culture systems, biological, investigations, processing studies and sanitary and bacteriological surveys.

Since the project started, various culture systems have been tried and further work is actively being pursued in: rack and raft culture in the estab lished sites even as the search for new sites continues; seasonal gonad changes of mangrove oysters; seasonal settlement of principal fouling organisms; study of major predators; plankton studies with emphasis on the seasonal settlement of young oysters; and preliminary studies on traditional harvesting, processing and marketing of oysters.

Culture trials. Work has been concentrated in and around the Sierra Leone river near Freetown. Five stations have been established. Using oysters still on the root, tests have been made of rack culture or stick culture by building small frames above and below low tide, as well as suspended culture using mangrove roots strung from floats made of a small log or bamboos.t. Experiments have been also made with tarred sticks, veneers dipped in cement, mangrove roots, mangrove aerials, and oyster shells as cultch. Most of the above methods and materials failed to show any success.

Raft or suspended culture method has been found to be most promising followed by subtidal rack culture. A raft is made of 44-gallon oil drum floats coated with tar or pitch and connected by a bamboo frame. It measures about 5 m x 6 m and lasts for about a year, but some of the materials could be re-used. The cost of a raft is about US$55-60.

Cultch. Mangrove oyster shells and cultured oyster shells are so far the best as they are light, abundant, easy to punch, cheap, and can catch spats very well. Other cultch which have been used but are not suitable are cement dipped veneers, tarred boards, mangrove roots, cockle shells, dock oyster shells and bamboo.

Predation. Predation on the raft has been minimal. Drills, crabs and fish are considered as predators. The spider crab or shore crab and porcupine fish which are found on the raft or among the strings are also suspected to prey on the oysters.

Fouling. Most important of the fouling organisms are the hydroids and the barnacles, Chthanalus and Balanus. The hydroids form a layer over the shell surface and inhibit spat settlement. Other fouling organisms include the sea squirts, mussels, fanworms, sponges, sea anemones, brittle stars and algae. Fouling of all types is heaviest during the dry season, especially from December to July.

Salinity and temperature. The optimum salinity is not known, and therefore different sites have been established to test the effects of various salinities. The temperature at most of the stations is usually 26° – 28°C during the rainy season and 28° – 30°C during the dry season.

Pen and Cage Culture. For now, the above system is only applicable to oyster culture. This system however attracts much fish in Sierra Leone and therefore floating cage culture is possible.

Among the many species suitable for the system are *Tilapia nilotica,* mullets, catfish, alestes macrolepidotus, etc.

The Guma dam and the mining pools in Kono district and other mining areas are very suitable for pen and cage culture. Also, many up rivers like the Mao, Sewa, Jong, Wanjai and the River Bokel, etc. are suitable for the system. Cage

(Continued on p. 5)

*From the paper "Development and Progress of Aquaculture in Sierra Leone with a brief reference to oyster culture" submitted by Kamorba K. Dabo, Sierra Leone Fisheries Division, to the International Cage and Pen Culture Workshop, SEAFDEC Aquaculture Department, Tigbauan, Iloilo, Phil., 13-21 February 1979.

ABSTRACT

The effect of various ratios of protein and carbohydrate sources on growth and survival of the juvenile *P. monodon* reared under laboratory conditions.

Pascual, F., 1978

Fifteen *P. monodon* Fabricius juveniles were stocked in fiberglass aquarium in a controlled environment for a period of 4 weeks. They were given feed containing various ratios of fish meal and shrimp head meal. The amount of fish meal varied inversely (50-10%) as the fish meal in the diet. Rice bran, wheat flour, sago palm starch, cholesterol, fish oil, corn oil and vitamin mineral mix were constant for all the diets. There were no significant differences in treatment means in weight gain and survival rate. However, a trend was discerned in the values obtained for weight increments. Those groups fed 40 and 50% fish meal had a mean weight gain of 37 and 46% respectively while those fed 40 and 50% shrimp head meal gained 46 and 51% respectively. The group fed equal amounts of fish meal and shrimp head meal (98%) gained 57.9%. Survival rate was highest (although not significantly different) for those fed 10% fish meal, .50% shrimp head meal and lowest for those fed equal amounts of fish meal and shrimp head meal, 87%. The animals fed 20% fish meal, 40% shrimp head meal or vice versa had similar survival rates, 91%. Mean survival rate of prawns fed 50% fish meal and 10% shrimp head meal was 92%.

Edible Crustaceans in the Philippines*

6. *Metapenaeus ensis* (de Haan)
English name: Greasy back shrimp.
Philippine dialect: Suaje, Hipon suaje, Pasayan.

Maximum size is about 13 cm body length. The body has irregular mats bearing fine hairs. Carapace has well developed antennal, orbital and hepatic spines. Rostrum is straight in shape bearing 9 to 10 dorsal teeth on back but none ventral. The telson has a medium dorsal groove bearing no lateral spine.

Color in life is light gray, covered with speckles or dark brown pigments. Pereiopods and pleopods are light yellow or red.

M. ensis is the most ubiquitous species in the Philippines, abundant in both shallow and open sea waters and in brackish fishponds, too. The species was sometimes given in some books under the name of *M. monoceros* in the Philippines.

This species distributes in Japan, Taiwan, Philippines, Malaysia, Singapore and Australia.

The middle-sized shrimp is suitable for rural consumption with the price of about P15/kg.

*by H. Motoh; 6th in a series.

Aquaculture in Sierra Leone *(from p. 4)*

and pen culture can go on in some areas of the country throughout the year.

Conclusion. Sierra Leone with her numerous fresh water bodies and a long coastal marine belt has great potentials in aquaculture. Oyster culture has so far shown great success as it is now possible in 9 months to produce oyster of an average weight of 9 grams, or four times the size of wild mangrove oysters. Also, studies on plankton tows, cultch exposures and condition factors indicate that the oysters may spawn all year round in some areas. ●

Net Cage Culture of *Lates calcarifer* Bloch and Other Marine Animals in Thailand

Aquaculture has quite an important role in the economy of Southeast Asian countries by being a major source of protein and by providing employment. In 1976, the aquaculture production of the ASEAN countries was 555,957 MT or 11% of the total fishery production. Inland aquaculture produced 169,420 MT or 30% and mariculture or brackish water contributed 386,537 MT or 69%. Indonesia contributed the biggest production from inland aquaculture while Thailand had the largest marine and brackish water production.

Table 1. 1976 fresh water and brackish water aquaculture production of the ASEAN countries*

Countries	Inland (MT)	Brackish Water (MT)	Total (MT)
Malaysia	1,603	31,642	33,245
Philippines	47,042	112,761	159,803
Indonesia	85,871	78,776	164,647
Thailand	34,301	163,283	197,584
Singapore	603	75	678
Grand Total	169,420	386,537	555,957

**From Fish. Stat. Bul. for South China Sea Area 1976.*

Net cages have been used for culture of sea bass *(Lates calcarifer* Bloch) since the last decade. Most of the culture activities were conducted in Songkhla Lake, the largest brackish and fresh water lake in Thailand. Several experiments on feed and feeding, high density culture, and cost of investment were carried out and it was shown that sea bass could be successfully cultured in net cage.

EXPERIMENTS ON SEABASS CAGE CULTURE

Feeding experiments of sea bass in nylon net cages have been conducted since 1971 to obtain information on growth rates, survival rates, food conversion rates, and some environmental conditions that affect the fish.

The net cage was made of nylon net (no. 18) 5 x 6 x 3m^3 in diameter, and 3.5 cm in mesh size. The pieces of net already cut were sewed together to a rectangular shape without frame. Floated, the depth of water varied from 1 to 2 meters depending on the tide. For the experiment, five net cages were used and each of them contained 90 fish of almost the same size and length.

The first and second cages were stocked with 21.4 cm long sea bass, while the 3rd, 4th, and 5th cages contained fish measuring 23.4, 24.1 and 26.2 cm, respectively.

Trash fish (costing 1 bht/kg) were used as food. They were cut into pieces and given at 10.0% of total body weight. After the fish finished their daily feeding the remaining foods were weighed again to find out the exact consumption.

The fish were caught from each cage every two months to get the survival and growth data. The environmental factors such as chemical and physical properties of the water were checked daily. The experiment was conducted for one year.

RESULTS

Very favourable growth and survival rates were obtained. The average weight increased to 1596.25 gm from an initial 236.95 gm; survival percentage was 94 percent; Food Conversion Ratio (FCR) was 7.20.

PROBLEMS

Water current. Fish would swim against a strong current and stop feeding.

Parasite. Aega sp. was always observed when the salinity decreased, but only a few were found at high salinity.

Turbidity. Generally, sea bass will come up to the water surface to feed, but it becomes rather difficult for them to see the food in turbid water. The water becames turbid during September and December by the run-off of fresh water from the upper part of the lake to the sea. The rainy season of the Southern part of Thailand where Songkhla Lake is situated is May to October.

Salinity. Sudden change in salinity causes the fish to stop feeding. Salinity changes occurred with the tides as the cages were placed near the mouth of the lake.

COST OF INVESTMENT AND RETURNS

It cannot be said that to raise sea bass in net cages is expensive if we consider labour. One person can take care of at least 5 cages of 30 m^3 each. Further study was done by carrying out the culture of sea bass in 10 net cages of 10 x 10 x 2 m in dimension and the results are promising (See Tables 3 and 4).

NURSING SEABASS IN NET CAGES

Net cage can also be used for nursing young and fry. This has been conducted since 1975.

Net cage for this purpose is 1 x 2 x 0.9 m. They were floated in a concrete pond of 6 x 15 x 1 m filled with water to a depth of 0.9 m. These net cages were very useful in rearing fry of about 1−1.5 cm in length. Generally, young sea bass is a strongly cannibalistic type, the larger fry eat the smaller ones. Therefore, they were separated by size and

Table 2. Growth in length and weight, and survival of seabass reared in nylon net cages.

Cage no.	Initial no.	Initial length ($\bar{x}$-cm)	Initial weight (x-gm)	Final no.	Survival (%)	Final length ($\bar{x}$-cm)	Final weight (x-gm)	Total wt. gain (kg)	FCR
1	90	21.4	171.1						
				156	86.66	42.0	1219.6	80.285 x 2	6.39
2	90	21.4	171.1						
3	90	23.0	210.8	88	99.77	43.8	1465.8	109.09	8.25
4	90	24.1	244.6	90	100.00	45.5	1620.9	123.375	7.61
5	90	26.2	321.3	89	98.88	48.0	2002.2	149.780	6.63
$\bar{x}$	90	23.68	236.95		94.00	44.83		1596.25	7.22

Paper contributed by Yodying Dhebtaranon, Sujin Maneewongsa and Swad Wongsomnuk, Department of Fisheries, Ministry of Agriculture and cooperatives.

reared in separate net cages until they reached the fingerling stage when they were transferred to larger cages.

The open water system was employed; the water supply ran from the tap and flowed to the drainage tube set at another side of the pond. The survival rate appeared very high with this method.

NET CAGE CULTURE FOR OTHER MARINE ANIMALS

In 1978, the mariculture and seed production staff of the Marine Fisheries Division succeeded in mass producing several economic invertebrate species such as large cuttle fish *(Sepia pharaonis),* mud crab *(Scylla serrata,),* blue swimmer *(Portunus pelagicus),* striped crab (*Charybdis* sp.), giant oyster *(Crassostrea gigas),* and two other species of oyster.

Among these marine invertebrates however only the cuttle fish (*Sepia* sp.) showed the best potential for culture in net cage. Oyster appeared to be also suited for floating cage culture.

SPECIAL CONSIDERATIONS

The change in the ocean regime seriously affects Thai marine fisheries. The country faces decline in the production of fish and other marine species. This decline can be conceivably offset by immediately conducting large-scale mariculture in which the net cage culture will become the most important system after the mangrove area is completely utilized.

PROBLEMS

Among the problems that at present retard the development of net cage culture in Thailand are: insufficient supply of necessary facilities and equipment; inadequate modern techniques; lack of lead training center to train farmers who can carry out net cage culture by themselves; and inadequate supply of marine seeds. ●

Table 3. Cost of investment of raising sea bass in 30 m^3 net cage (duration of one year)

Items	Expenditure (Bht)
Net cage (one year)	700
Feeds	1,890
Labour (one person)	14,400
Young sea bass and net cage for nursing	300
Net cage frame (rope) and others	2,000
Total	19,290
Receipts from fish sold at the market @ 50 bht/kg *13,500* bht	

Table 4. Cost of investment of raising sea bass in five 10 x 10 x 2 m^3 net cages (duration of one year)

Items	Expenditure (Bht)
Five net cages (one year)	7,000
Feeds	18,900
Labour (2 persons)	28,800
Young sea bass and nursing cage	3,000
Net cage frame (rope) and others	20,000
Total	77,700
Receipts from fish sold at the market @ 50 Bht/kg *135,000* Bht	
Net Gain	57,300 Bht

Aquaculture Scientific Literature *(from p. 2)*

of serial titles available in SEAFDEC library system. After consultation with the research personnel, the librarian in the station marks the titles likely to contain materials of interest to the station but which are not in the station's library. The list where titles have been selected and marked is sent back to SEAFDEC. Shortly thereafter, the station will begin to receive batches of the content pages of requested titles. The librarian again consults the staff to decide which articles are likely to be of interest or use. These articles are then marked and the marked content pages are returned to SEAFDEC.

The ASLS will send the research station one copy of each article requested which then becomes the property of the research station and should be marked out in the same manner as books, periodicals or reports. The station will also receive back the content pages sent to the ASLS in which the marked titles had appeared.

Enrolment in the Service

To avail of the service, schools, experiment stations and research institutions will be asked to send a list of their current journal holdings, a list of current staff and their areas of work, and a copy of the holdings of the ASLS in which the institutions and stations have marked those journals whose contents pages they wish to receive regularly.

Those who provide the requested information are considered enrolled in the ASLS.

Advantages

A literature service provides current awareness faster than abstracts or bibliographic services. It also provides copies of the original articles when required. Members of the service will have access to a much wider range of serials than they could buy. To promote the building of collections in areas of specializations, the ASLS will service requests for articles from non-current issues of serials on the list, if available; and issues of contents pages of these serials for periods in the past. These can be useful substitutes for runs of back issues. ●

New Journal:

MARINE BIOLOGY LETTERS

The Elsevier/North-Holland Biomedical Press has announced the launching of a new journal – *Marine Biology Letters* – to provide a medium for rapid publication of essentially short, definitive articles on marine organisms, which are broadly concerned with biophysical, biochemical and physiological processes as they affect the individual or the population.

The first issue is scheduled for publication in July 1979. "Letters" aims to provide a vital forum for the rapid and constructive exchange of ideas and developments, providing researchers with a unique opportunity to keep abreast of advances in the area.

The *Marine Biology Letters* will accept articles on: sensory and motor neural mechanisms; respiratory physiology and energy metabolism; aspects of nutrition and reproduction; homeostatic mechanisms and hormonal control; biochemical and population genetics. A desirable length of contributed papers is about 6-8 *printed* pages. Articles on multidisciplinary studies will also be considered and occasional reviews will be published following invitation by the editors-in-chief.

Contributions may be sent to either of the following editors-in-chief of the journal:

D. J. Crisp
Unit of Marine Invertebrate Biology
Marine Science Laboratories
Menai Bridge, Gwynedd LL59 5EH,
U.K.

Richard K. Koehn
Department of Ecology and
Evolution
State University of New York
Stony Brook, NY 11794

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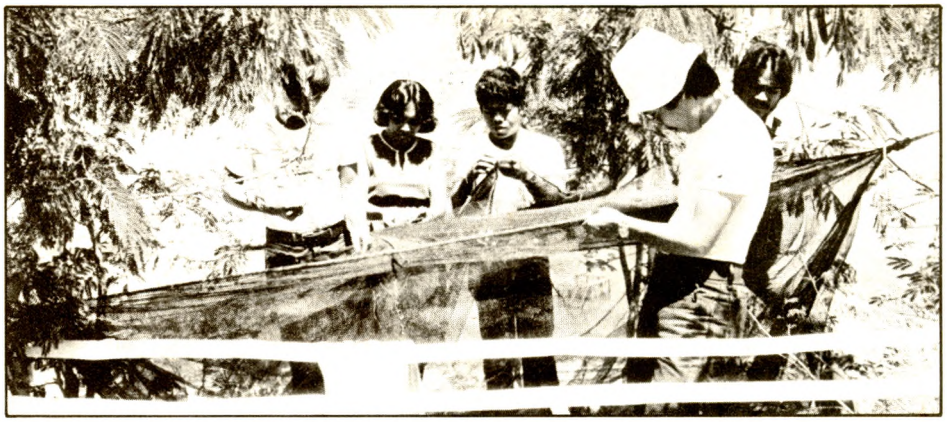
GREETINGS

To the Asian Institute of Aquaculture on the occasion of its First Anniversary on May 23.

From the staff of the SEAFDEC Aquaculture Department and friends



Filipino trainees learn to construct a net cage at the SEAFDEC freshwater fisheries station in Binangonan, Rizal along the shores of the Laguna de bay, a 93,000-ha freshwater lake.

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