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Aquabusiness course graduates 35

APDEM, the first ever aquaculture business project development and management seminar-workshop at the SEAFDEC Aquaculture Department was attended by 35 participants having different aquaculture-related interests, diverse educational and work backgrounds, and representing different sectors of the aquaculture industry, but with a common problem: the need for technical information on the production, processing and marketing of prawn and milkfish, and other species as well, that is embodied in the context of *workable management and economic recommendations.*

APDEM was designed to fill this need. Sponsored by the SEAFDEC Institute of Aquaculture and SEARCA (Southeast Asian Regional Center for Graduate Study and Research in Agriculture), the course, which ran from March 3 to 16, covered the technical (biological and engineering) aspects of aquaculture production with the research and development information worked into the context of project management. As conceived, it was meant to provide managers and key members in aquabusiness companies, fishpond owners and operators, the financial community and other aquaculture-related enterprises the management tools that would sharpen their effectiveness in identifying, evaluating or implementing projects in the aquabusiness sector.

The project study component involved three major areas: market, technical and financial. Management aspect was covered by such topics as the overview of the project cycle, identification of business opportunities, market feasibility, decision analysis and planning, staffing an aquaculture project, concept of aquabusiness, strategies for marketing, problem analysis, and the discussion of cases illustrating various problem and decision situations in different types of aquaculture and related (i.e. fish processing and exportation) enterprises.

Participants and resource speakers of the first Aquaculture Project Development and Management seminar-workshop. Of fifty-four who made reservations for the course, 35 were able to attend. A second APDEM course is being planned to be held this July.

Management Game

In addition, a management game tailored for aquabusiness was played by the participants. The game itself was one of the firsts in the APDEM course. It was developed by Professors Edward Tayengco of SEARCA and Rafael Rodriguez of the University of the Philippines College of Business Administration from information furnished by some of the Philippine's aquaculture leaders and progressive fishfarmers and background materials provided by SEAFDEC Aquaculture Department researchers.

Project Studies

The participants themselves developed three feasibility studies, two on prawns and one on milkfish, which they had to

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Research News from Latin America

Laboratory Trials on *Penaeus* spp. in Peru*

The laboratory reproduction of some species of penaeid shrimps has been emphasized among the various studies being done on the culture of shrimp at the Laboratory of Tumbes of the Oceanic Institute of Peru.

While equipment for the production of microalgae and artemia is being set up, the capture of gravid females along the shoreline has been going on after the areas, seasons and methods of capture applicable for *P. vannamei, P. stylirostris* and *P. occidentalis* had been identified.

P. occidentalis has been made to spawn and larval development has been achieved with a 55% survival rate. ●

* Translated by C.V. Recio of the Institute of Aquaculture, SEAFDEC from Revista Latino Americana de Acuicultura, Sistema Economico Latino Americano; Comite de Accion de Productos del Mar y de Agua Dulce, San Luis, Lima Peru, September, 1979.

Culture of "Caracidae" in the Peruvian Amazon*

Since 1971 the research unit on ichthyology and fish culture, Estacion Principal del Tropico of IVITA (Institute Veterinario de Investigaciones Tropicales y de Altura), Universidad Nacional Mayor de San Marcos (Lima, Peru) has been undertaking taxonomic and bio-ecological studies on Amazonian caracidae as an essential prerequisite for its successful culture. At the same time, preliminary studies have been done on its culture using juveniles caught from its natural spawning grounds and acclimatized in ponds. These preliminary trials have indicated the suitability of culturing caracidae species with better results obtained from the culture of *Brycon erytropterum, Colossoma macropomum*, and *C. brachypomum.*

Experiments on stocking density, supplemental feeding and fertilization showed encouraging results: yields of more than 3,500 kg per ha per year of commercial sizes, distributed in 16% protein and 2,800 calories of metabolized energy, since this fish is omnivorous with herbivorous tendency.

The species *C. macropomum* and *C. brachypomum* are resistant to handling and can withstand critical oxygen levels (up to 3 mg/l) for sometime. Polyculture of these species with other local or tropical species like *Sarotherodon niloticus* is possible.

At present however extensive culture is prevented by lack of seeds since they are migratory and do not reproduce in captivity. Fry found in rivers are not enough to supply the needs of the region's fishfarmers.

Studies have been started on artificial reproduction from a group of broodstock and a seed bank. Experiments on hypophysation was started in late 1979.

IVITA announces the availability of the information from these studies. It is also preparing a publication on the biology of important Amazonian species. ●

Aquabusiness course . . . *(From page 1)*

work out from information gathered from eleven fishponds and aquaculture projects on the island of Panay.

Technical Topics

On the biological and engineering aspects of aquabusiness, the course covered the subjects on site selection, design and construction of ponds, management of problem i.e. acid sulfate soils, artificial propagation of milkfish fry, seed collection, fry handling and storage, management of nursery and rearing ponds, harvest and post-harvest operations, design, layout and construction of prawn hatcheries, prawn broodstock development, larval rearing of prawn, management and operation of prawn ponds, intensive prawn culture systems, post-harvest handling and processing of prawns, feeds and feeding, machinery and equipment for prawn production, mussel and oyster culture, farm operations, harvesting and marketing of molluscs, and project planning and scheduling (PERT/CPM).

Economics

The economic side was covered by the sessions on aquaculture credit schemes, overviews of the milkfish and prawn industries, comparative analysis of different prawn production systems, financial analysis, and by a case study of a shrimp processing business concern.

Profile

Four of the 35 participants are from other countries: a manager of a shipping concern from Hongkong with keen interest on prawn culture; a fishery officer of the Tarawa, Gilbert Islands ministry of natural resources and development whose main interest is stock management of food and baitfish (they raise milkfish for tuna bait); and two fishery officers from the fisheries department of the federal government of Nigeria whose varied interests include hatchery management, pond construction and management, and fish nutrition.

The Filipino course members have diverse work backgrounds -- owner-managers of small to medium to large aquaculture projects; researchers, development staffers and project analysts of private and government agencies; research managers of colleges and universities; and technicians, administrators, and general managers of aquaculture and related concerns.

As to their educational backgrounds, nine have bachelors or masters degree in business administration, management, economics or commerce and eight are fisheries or marine biology graduates. Two medical doctors, an engineer, a lawyer, a Ph.D. in the agricultural sciences, and several others with bachelors degrees in liberal arts or technical courses complete the cast. Most said they would like to concentrate on prawn with milkfish as second priority.

Average size for individually-owned ponds was 25.6 ha while that for company-owned holdings was 50 ha.

APDEM II

This early, the organizers of the course are already planning for a second course which, according to SIA director J.C. Madamba, could be held at the SEARCA headquarters in Los Banos, Laguna.

Planning and management for APDEM was provided by Dr. Madamba for SEAFDEC and Prof. Edward Tayengco for SEARCA. They were assisted by an all-SEAFDEC support staff and secretariat. ●

When is fish production considered as the major enterprise in an integrated system? A number of conditions could justify fish as the major enterprise: (1) when fish contributes the greatest production or profit in the system; (2) when fishponds exist ahead of the commodities that are to be added and adopted into the system; (3) when the area is most suitable for fish production such as swamplands or floodplains, whereby conversion into fishponds would lend itself into integration with other commodities due to the existence of dikes; (4) when the area occupied by fishponds is greater than the space occupied by other commodities of comparable importance; and (5) when conversion of some area such as ricefields

Integrated farming with fish as the major enterprise

is done in favor of fish where the area it would occupy is equal to or greater than the remaining portion.

As point of reference, I consider all conditions except the first as the defining scope of this article. This is geared toward the efficient utilization of fishpond resource which has available space that otherwise will just be wasted if fish farming enterprises continued to exist independently.

INTEGRATED SYSTEMS

Fish integration with agricultural crops. Two schemes of fish culture in paddy fields are practised – the combined fish and rice culture in one area and the rotational cropping of rice and fish. Modification have also been done by introducing a number of more appropriate agricultural crops in either of these basic schemes. Terrestial crops such as beans, onions, *Brassica* sp. sweet potato, etc. are grown in paddy dikes while aquatic crops such as *Ipomoea aquatica, Colocasia* sp., etc. are grown in water.

The extent of the area covered by irrigated ricefields in some Asian countries is more than 35 million ha. The leading countries that are taking advantage of the importance of this resource, as far as fish supply is concerned, are Indonesia, Thailand, Malaysia, Japan, India, Vietnam and Hongkong. The Philippines is just beginning its rice-fish culture program.

In the above scheme of producing fish, the combined rice-fish culture together with other crops, consider crops as the major enterprise. The rotational cropping of rice and fish is the scheme that would fit the considered criteria of having fish as a major enterprise. In a regular rice and fish rotation scheme where an original rice land area is seeded with fish instead of rice, it is expected that the income from rice can be equaled or exceeded by the income from fish. Similarly, the conversion of a larger portion of a farm area into fish production units whould show a shift of emphasis from agricultural crops to fish production. This is what happened when most of Taiwan's integrated fish farms were converted from rice paddies into aquaculture units, despite government regulation against conversion of high-yielding rice fields into fish ponds.

Analysis of the additional net profit obtainable from fish in combined rice-fish culture shows that it may vary from $60 to $90 per cropping under Philippine condition. Cost and return comparing income from rice with fish produced in an area originally planted with rice indicated promising results in favor of fish. Consideration of other benefits from rotational cropping of rice and fish will make the system more attractive.

Fish animal integration. Available information show that most of the integrated farm under this category have fish as the major enterprises. The spaces utilized by the animals confined in pens were very small varying from negligible to less than 10%. The sheds or pens, may be constructed alongside ponds or directly above the pondwater. The animals may also be put in one roof such as a chicken cage constructed above the pig space.

Costs and Returns. Tables 1, 2, & 3 which were derived from the case studies presented during the ICLARM-SEARCA conference on integrated Agriculture-Aquaculture Farming Systems (Aug. 6-9,

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* From the paper of the same title presented at the Workshop on Agribusiness Systems for Integrated Crop-Livestock-Fish Farming held at PCARR, Los Banos, Laguna, Philippines, November 19-25, 1979 by Dr. C.R. de la Cruz, associate professor and director, Freshwater Aquaculture Center, Central Luzon University, Philippines.

Prospects of cage and pen culture

Sri Lanka, with an area of 25,000 sq. miles, has about 300,000 acres of fresh water bodies in the form of irrigation tanks, hydropower reservoirs and flood lakes or "villus," and about 300,000 acres of brackishwater areas consisting of lagoons, estuaries and tidal flats.

There are no natural lakes in the Island. Irrigation tanks or reservoirs numbering about 10,000 were built in ancient times dating back to 2000 years. Most of these tanks had been in disrepair and disuse until the beginning of the century, when a large number of tanks were restored. Restoration of these tanks has since been regularly done by the Department of Irrigation.

In the second half of the century, a concerted effort for the development of inland fisheries was made by the State. Preliminary surveys had revealed that the indigenous species had made hardly any impact on the fish catches. Therefore, *Tilapia mossambica, Osphroneumus gourami* and *Cyprinus carpio* were introduced into the inland water bodies. Tilapia was an immediate success. Gourami and common carp composed only a fraction of the total catch.

Freshwater fisheries had made steady progress during the last 25 years. The total production in 1977 was 20,275 tons and with the accelerated program for the development of Freshwater Fisheries, it is envisaged to step up production up to about 50,000 tons by 1982. The majority of the production could be from existing man-made lakes.

Experimental work on the economics of pond fish culture in respect to different regions of the Island are also carried out at these stations. Bighead carp and grass carp which were introduced into the country in 1975 have been propagated artificially at the Freshwater Breeding and Experimental Station at Uda Walawo.

The diversion of one of the largest rivers in the country -- The Mahaweli -- would generate more water areas and a vast network of canals.

Of the 300,000 acres of brackishwater areas, 200,000 acres are deep lagoons and estuaries and 100,000 acres are shallow lagoons and tidal flats. The production from Brackishwater Fisheries will be stepped up from 1,823 tons in 1978 to 3,225 tons in 1982.

Brackishwater pond fish culture has been fairly well established but purely on a subsistence level. Ponds are either stocked with the fry of milkfish (*Chanos chanos*), *Mugil* spp. *Etroplus suratensis, Tilapia mossambica,* or the fry is let into the pond by natural recruitment. *Penaeus indicus* and *P. monodon* are also captured from these ponds.

A brackishwater fisheries station was set up at Pitipana in late 1950 and another is nearing completion at Pambala. *Mugil* spp., *Etroplus suratensis, Tilapia mossambica,* and experimental work on developing brackishwater fisheries is being carried out at Pitipana.

Proposals have been made to set up a number of experimental cages in some of the freshwater and brackishwater bodies in Sri Lanka.

CAGE CULTURE

Fish cage culture has not been tried out extensively in Sri Lanka. Experimental cages however have been set up in the Negombo Lagoon and available types of fish were introduced. Cages of different sizes and shapes with different materials would be used to study growth under different stocking densities, depths and feeds.

A preliminary experiment employed the following cage type and dimensions: one cyclindrical cage made of rigid copper wire frame covered with a 1/8 inch mesh size nylon net; one cylindrical cage made of rigid copper wire frame covered with a closely knit bamboo tat; one wooden frame covered with a nylon net of 1/8 inch mesh size; one wooden frame covered with finely knit bamboo tats; one 1.5 m x 1.5 m cage made of galvanized mesh, anchored to the lagoon bed with wooden poles and covered with cadjan tats.

Sri Lanka is geographically divided into two zones, the wet zone which receives more than 75 inches of rain, and the dry zone. Locations for setting up of experimental cages have been selected to cover a wide range of conditions prevalent in the country.

The following sites have been selected for preliminary experiments on cage culture:

Parakrama Samudra. This is one of the largest tanks in Sri Lanka with an area of 6,250 acres. There are a number of small fishing units and colonies situated along the perimeter of the tank. Cages would be set up with the collaboration of the residents who could be persuaded to be in charge of the security and maintenance of the cages. The catch from the harvest would be given to those who actively participate in the project.

Uda Walawe Tank/Left Bank Channel. The channel flows close to the Uda Walawe Freshwater Fish Breeding and Experimental Station. Bighead carp and grass carp propagated at this station would be extensively cultured in cages in the channel.

Beira Lake. This lake winds around a part of Colombo and opens into the Colombo harbour. It has an abundance of plankton. Certain parts of the lake is polluted, but to no lethal levels. Cages could be erected close to large firms which would be requested to participate in the project.

* From the paper "Cage and Pen Culture in Sri Lanka" by D.E.S. Jayamaha of the Research Division of Sri Lanka's Ministry of Fisheries, presented at the International Symposium on Cage and Pen Culture sponsored by IDRC & SEAFDEC Aquaculture Department, 11-22 February 1979, Iloilo, Philippines.

in Sri Lanka

Wennappuwa Tank. It is a medium size tank close to the Brackishwater Fisheries Station in Pitipana and the Brackishwater Fisheries Station at Pambala. Milkfish and indigenous species which are caught in abundance from this tank could be cultured in cages.

Negombo Lagoon. This is a fairly productive lagoon with an area of 6,900 acres. Salinity range is 0.5-33 ppm. Average salinity is 24 ppm. The Brackishwater Fisheries Station at Pitipana is close to this lagoon. Milkfish, *Etroplus suratensis, Mugil* species could be reared in cages after preliminary studies.

Construction of Cages

Cages were to be constructed along the designs presently in use in most parts of the Indo-Pacific Region. Rattan and bamboo are cheap and easily available in the country. Synthetic netting however has to be imported and is expensive. A firm dealing in plastics offered to assist the Fisheries Department in the construction of an experimental cage made of rigid P.V.C. The cage consists of two perforated plastic sheets (top and bottom) supported by rigid plastic pipes placed at short intervals.

Pen Culture

This method of culture is also new. Trial pen culture projects will be carried out in certain fertile irrigation tanks. Besides trying out the usual types of pens currently in use in most countries, pens in the form of earth bunds with 2-3 openings could be constructed in shallow coves of irrigation tanks. The barricaded area could then be cleared of all extraneous fish. Fingerlings or fry of a fast growing species could be stocked in the enclosure. This barricaded area could serve either as a nurturing ground for fingerlings/fry prior to release into the main tank or as a pen for adult fish culture.

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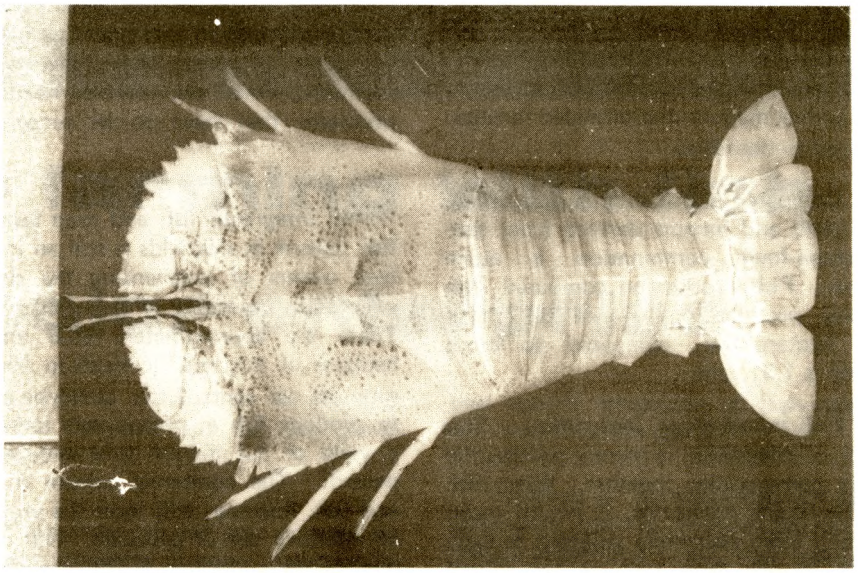
Edible Crustaceans in the Philippines*



16. *THENUS ORIENTALS (LUND)*

English name: Sand lobster, Sand crayfish, Shovel-nosed lobster, or Slipper lobster.

Philippine name: Pitik-pitik (Ilongo and Cebuano) or Cupapa (Surigaonon).

The body usually attains 13 cm in length. The common name shovel-nosed lobster is derived from the extremely flattened antennal plates. The shovel-nosed lobster closely resembles the spiny lobster phylogenetically, but differs in the shape of the antenna and carapace and in the mode of eye protection. The carapace is obviously flattened in the horizontal plane unlike the spiny lobster. Furthermore, the eyes, which are located on the outer angles anteriorly on the carapace, are surrounded by definitely formed sockets which serve as protection. In the spiny lobster, it is the supra-orbital spines that serve to protect the eyes. Like the spiny lobster, the female carries the eggs underneath the abdomen. The body is dark brown in ground color and covered with tubercles. *Thenus orientalis* is picked by commercial trawls on muddy or sandy bottoms as deep as 100 m.

This species is distributed in the Indo-West Pacific from Japan, through the Philippines to the Arabian Gulf and Australia.

It is cheaper than spiny lobster, fetching a market price of P15/kg in the local market.

* by H. Motoh, 16th in a series

ERRATUM: The scientific name of shore crab, which appeared as the 14th in Mr. Motoh's series (AA Jan, 1980) is Varuna litterata not Veruna litterata.

Integrated farming with fish *(From page 3)*

1979), show the cost and return figures from various types of integrated fish and animal farming. Note that the production cost of animals in the systems are much higher than the fish.

Although the profit for fish is lower in most of the systems, the benefit-cost ratios have largely favored it. In all cases studied, the management input for fish production component is minimal, with only fry and labor comprising production cost. The low production cost is due to the animal manure that provided fertilizer or feed to the fishes.

Compared with fish-crop integration, the yield and income derived from fish-livestock-fowl combination is much higher. Fish production combined with animal production averaged 6.22 tons per hectare/year, compared to crops which is 1.31 tons.

Fish-animal-crops integration. This kind of integration is merely putting the three commodities together. When fish is the major enterprise, it would mean putting them separately adjacent to each other in one farm unit or the animal may just use a space above the pond water while the plants are grown on top of dikes and slope of ditches.

The management techniques for these combinations need modification in order to adjust to the requirements of the new commodities (crops and livestock) to the system. As an example in the case of fish-pig-vegetables combination, with pig and vegetables as additions, the number of pigs must be able to supply adequately the manure requirements of the fish and vegetables. Another alternative in the management, however, is for the vegetables to exist independently and just occupy the space available in the fishpond dikes. Further still, the vegetables aside from being a human food, may also be fed to pigs and fish. A second example is the fish-goat-vegetables combination. In this combination, goat would serve as biological control for grasses growing on dikes. With the addition of vegetable for human food the grazing area of goat will be reduced, hence its number will correspondingly decrease to match the availability of grasses.

PROSPECTS, NEEDS AND PROBLEMS

The vast resources of developed irrigated ricelands, existing fishponds, and swamplands that await development offer great potential to which integration of fish to the former (ricelands) and livestock for the latter may be done without much need for additional space. The years of experience gained provide useful information that could be used to formulate acceptable management methods. There are, however, needs and problems that have to be recognized.

In integrated fish and crop farming, fish culture in ricefields is still an important means of augmenting the supply of protein especially in Asian countries. There are approximately 35.6 million hectares of irrigated ricefields in Asia. If only 30 per cent of this could be made to produce fish at even a very low rate, a yield of 2.2 million tons can be expected. The combined culture of rice and fish, however, still faces the problem of intensive use of pesticide. This problem causes a decline in fish production from paddies in some Asian countries. Tan and Khoo in 1979 reported that Indonesia, the country with the largest area devoted to rice-fish production, uses 2 million kg of insecticides which are applied to more than one million hectares of ricefields annually. Although some advances had been achieved on selecting the kind of chemical to use and its proper application in rice-fish culture the risk is still present when practiced in wide scale because of the danger of pesticide contamination from adjacent areas. It is also difficult to control the use of different brands of commercially available rice pesticides. Very strict enforcement of formulated policies and laws regarding the use of less toxic pesticides in rice fish culture is needed for success.

With the setback on combined rice-fish culture against uncontrolled use of pesticide the prospect of adopting rotational cropping of rice and fish will become more important. This system offers a number of advantages: (1) reduced chance of pesticide accumulation in fish tissues since rice and fish are grown in separate areas or at different times; (2) better pest control since the life cycle of insect pests is disrupted; (3) mutually beneficial interaction between fish and rice crops; (4) decreased rice production cost because of the possibility of zero tillage and (5) lower construction cost of fish paddy as compared to a regular fishpond with deeper water and higher and larger dikes.

This system requires the cyclic conversion of prescribed paddy fields into fish paddies. Overall production of rice could decrease as a result of the withdrawal of some area converted to fish production. This scheme is suitable in irrigated areas and in countries that have moonsoons or those located within the typhoon belt. While rotational cropping in adjacent areas is one method, fish production in paddies may also be done during the rainy months instead of rice which is usually faced with great climatic risk. Rice production follows during the dry months when the risk is already over. This scheme is also suitable for countries having rice surplus and marketing problem.

In the case of integrating livestock production with fish, most of the case studies show increased income from the livestock, although the investment required was high. However, two cases incurred losses. This situation demonstrates some implications.

1. Among the cases studied, there was a wide range in the stocking density of animals in relation to the area of fishpond being supplied with manure. The same is true with the stocking density of fish. Clearly the optimum relationship between fish and animals has not been established. It is necessary to establish the balanced relationship between the number of fish and animal in order to have an efficient integrated system.

2. Proper strain of animals to be included in the system should be selected.

3. It also implies that as more commodities are dealt with, the management system becomes more complicated. Unfortunately, many small farmers are knowledgeable only in producing one kind of crop.

It is important to consider that all information used in this paper were obtained in systems located in freshwater

areas. This is understandable owing to the fact that plants and animals require abundant and dependable supply of freshwater. Thus, in brackishwater fishponds, integrated system may be practised if freshwater is assured. On the other hand, integration of animals with fish may be hindered in areas where transportation problem exist. There are conditions where transport of fish product is done by using small boats.

Finally, another aspect in fish-animal integration wherein little work is being done is its possible hazard to public health. To my knowledge, no case of disease that may have been transmitted to humans through the fish-animal system has been reported. However, research on this area must be done to ascertain public safety. ●

Cage and pen culture in Sri Lanka . . . *(From page 5)*

Prospects

Most of the large tanks, reservoirs and lagoons are fertile. The Beira Lake, which has an abundance of plankton, yields about 1,000 lbs. of *Tilapia mossambica* per day. But the fish caught from this lake are small in size. This is due to overpopulation and severe competition for food. Bighead carp, which is a macroplankton feeder, could be stocked in cages placed in these bodies of water.

Fishing in tanks and reservoirs has been a problem because of the large number of tree stumps and other obstacles in the water. Cage and pen culture could supplement the loss in catches due to the constraints.

In brackishwater fisheries, a main constraint is the very low tidal amplitude. Cages could be erected in lagoons to overcome this disadvantage.

The Mahaweli River Diversion Project would involve the construction of a number of canals in which cages could be set up, and the maintenance and security of the cages could be entrusted to settlers along these waterways.

Cage and pen culture is in its nascent stage in this country. The Minister of Fisheries of Sri Lanka has given his support to certain recommendations made by a Committee of Fish Culturists for the development of inland fisheries. Initiation of a program for the development of cage and pen culture is one of them. ●

Table 1. One-year economics of fish-pig farming (Jhingran and Sharma, 1979; Tan and Khoo, 1979; Chen and Li, 1979; and Delmendo, 1979)

Country	Actual Area ha	Stocking Density No./ha		Profit per ha		
		Fish	Pig	Fish	Pig	Total
India (RS8=$1)	0.1	8,500	130	$5,878.75	$1,282.50	$7,161.25
Malaysia (M$2.2 = 1)	8	788	38	5,159,10	6,909.10	12,068.19
Taiwan (NT$36=$1)	1.0	35,500	210	7,674.75	14,058.33	21,733.08
Thailand (20 Baht=$1)	0.64	23,438	70	1,445.31	3,956.17	5,401.48
Thailand	0.96	26,042	104	914.06	3,842.71	4,756.77
Thailand	1.60	125,000	63	625.00	1,046.88	1,671.88

Table 2. Ratio of profit to production cost

Country	Area ha	Production Cost/kg		Profit/kg		Profit/Prod. Cost	
		Fish	Pig	Fish	Pig	Fish	Pig
India	0.1	$0.50	$0.50	$0.80	$0.12	$8.00	$0.24
Malaysia	8.0	0.15	0.63	0.47	0.15	3.13	0.24
Taiwan	1.0	--	0.92	1.04	--	--	--
Thailand	0.6	0.03	0.43	0.37	0.47	12.33	1.09
Thailand	0.96	0.12	0.59	0.28	0.34	2.33	0.57
Thailand	1.6	0.10	0.81	0.20	0.14	2.00	0.17

Table 3. Ratio of profit to production cost (Based on actual area).

Country	Pond Area ha	Production Cost, $		Profit, $		Profit/Prod.	
		Fish	Duck	Fish	Duck	Fish	Duck
Hongkong	1.0	4,103	10,277	1,980	1,915	0.48	0.19
India	1.48	1,419	465	2,979	(-- 60)	2.10	(-- 0.13)
Indonesia (West Java)	0.2625	958	940	948	755	0.99	0.80
Nepal	0.25	376	162	243	48	0.65	0.30
Taiwan	1.0	1,666.39	--	4,140.28	--	2.48	--
	1.0	--	--	--	--	--	--

Aqua research methodology course opens

A four-month research methodology training course starts April 7 at the SEAFDEC Aquaculture Department with some 25 participants expected. Many of the trainees will be coming from the SEAFDEC member countries but some are expected to come from other developing countries in Asia as well as Africa and Latin America.

The research course is for aquaculturists who have little or no training or experience in doing research. It is not intended for those who have had advanced training or considerable research experience.

Covering research methodology and aquaculture technology, the 4-month course aims to: (1) acquaint participants on the state of technology in aquaculture and the problems that still beset the industry; (2) provide knowledge and information on both aquaculture technology and research methodology; (3) equip participants with tools and skills in the conduct of aquaculture research; and (4) help participants identify specific research problems along which they will conduct a mini-research study.

This is the fourth time the research methods program is offered. The first session was conducted for ten months from 1976-77 with 16 participants from Malaysia, Thailand, Indonesia and the Philippines; the second (October 77 to Feb 78) was attended by 15 from Indonesia, the Philippines, Thailand, Bangladesh and Australia; while the third (June to September 1979) graduated 19 participants from Nigeria, Indonesia, Thailand, Malaysia, Brunei and the Philippines for a total of 50 participants in three sessions. ●

Last year's research methodology trainees practice fry sampling techniques at the wet laboratory of the SEAFDEC Aquaculture Department.

Announcement

Fish fry cultivation proceedings available from European Mariculture Society

The European Mariculture Society has announced the availability of *EMS Special Publication No. 4* which consists of the proceedings on the conference on the cultivation of fish fry and its live food. The conference was sponsored by the Polish Hydrobiological Society. Covering 534 pages with about 140 figures and 65 tables, the proceedings should be of practical and scientific interest to all involved in fish culture, both freshwater and marine. Write to the EMS Secretary-Treasurer. Price: US $54.00 for non-members, $47 for WMS & EMS members. ●

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