



Asian Aquaculture

VOL. 2 NO. 3

TIGBAUAN, ILOILO, PHILIPPINES

MARCH 1979

AIA Becomes a Member of the Aquatic Sciences & Fisheries Information System

The Asian Region is now represented in the Aquatic Sciences and Fisheries Information System (ASFIS), an FAO-coordinated global documentation system. This became possible with the designation recently of the Asian Institute of Aquaculture of the SEAFDEC Aquaculture Department as the Asian input center in the System. The 12 other participants of ASFIS are located in the developed regions, nine in Europe, two

in North America, one in Mexico.

In this connection, a \$5000 grant has been made available to AIA for the training of two documentalists from the Philippines, one from SEAFDEC and the other, possibly from the Philippine Council for Agriculture and Resources Research on the mechanics of ASFIS. The two-month orientation course for the grantees will be in Rome and the United Kingdom.

This marks the first time that aquaculture as a subject becomes more detailed in the ASFIS classification system. The AIA proposal which led to its designation as a participating center, suggested that aquaculture be broken down in freshwater, brackishwater and marine environments, crustacean culture, mollusk culture, culture of other aquatic species, engineering, aquatic ecology, ecosystem and pollution, integrated fish farming, and aquario management.



Some of the 53 participants, representing 15 countries, to the International Workshop on Cage and Pen Culture held from 13 to 21 February at the SEAFDEC Aquaculture Department main station at Tigbauan, Iloilo, Philippines. Among those in photo, facing camera, are J.A. Eusebio, SEAFDEC research director; F. Brian Davy, IDRC fisheries program officer; J. C. Madamba, AIA director; Teodoro Baguilat, acting general manager of the Laguna Lake (Phil) Development Authority and workshop keynote speaker; Q. F. Miravite, SEAFDEC executive director; and W.H.L. Allsopp, IDRC associate director for fisheries. **Workshop summary report on page 2.**

The participation of the SEAFDEC Aquaculture Department in ASFIS signals the increased awareness of relevant information on aquaculture as practised in the countries of the Asian Region for the benefit not only of the participants of the System but, of greater importance, among the workers in the various Asian countries. Information on aquaculture and fisheries practices in Pakistan, Nepal, Bangladesh or Indonesia, for instance, will become better known in the other countries, vice versa. This should greatly help in the effort at mutual reinforcement of each country's development programs in fisheries and aquaculture through the speedy and purposive circulation of well-processed and analysed research and development as well as industry information.

(Continued on page 6)

Cage and Pen Culture Workshop

The workshop was designed to be practical; it aimed to generate sharing of experiences among practitioners from the different countries, provide practical guidance on the art and techniques of cage and pen culture, and stimulate projects on this field in different countries.

Fifty-three participants from 15 countries — Bangladesh, Egypt, Hungary, India, Indonesia, Malaysia, Nepal, Nigeria, Philippines, Sierra Leone, Singapore, Sri Lanka, Sudan, Thailand and Turkey — discussed problems, concepts and techniques related to engineering design as well as bio-ecological, socio-economic and legal considerations to cage and pen fish culture at the Southeast Asian Fisheries Development Center (SEAFDEC) Aquaculture Department main station in Tigbauan, Iloilo, Philippines, from February 13 to 21.

Sponsors of the workshop were the International Development Research Centre of Canada, represented by three of its officers, and the SEAFDEC Aquaculture Department.

Agencies of international character represented in the workshop were IDRC, SEAFDEC, the International Center for Living Aquatic Resources Management (ICLARM), and the FAO/UNDP South China Sea Programme. Also attending were some 30 observers mostly from the Philippines.

Status of cage and pen culture in countries represented is in varying stages of development i.e. planning, initial and operational. Countries where cage culture is generally at the planning stage are Bangladesh, Nigeria, Indonesia (for pen culture in marine waters), Sierra Leone, Sri Lanka, Sudan, and Turkey. Some have identified the potential for cage and pen culture while others have programs prepared for implementation. Initial operations have been started in Egypt, Indonesia, Malaysia, Nepal. The Philippines is starting cage and pen culture in marine

waters. At the operational stage in freshwater environments are Canada (cage), Hungary and East Europe, India, Indonesia, the Philippines, Singapore, and Thailand. Malaysia, Canada, India, Singapore and Thailand are already at the operational stage in cage or pen culture in marine waters.

For cages, a variety of materials are used ranging from bamboo and wood to metal frames, rubber tires filled with styrofoam, styrofoam and plastic floats, and nettings. Pens are commonly of bamboo and wood or bamboo and nets. Hungary reported using zinc coated steel frames and long-lasting aluminum cylinder floats.

Fry availability is the main constraint to increased production although induced breeding and improvement in hatchery and nursery operations have enhanced intensive culture.

Floatation Systems for Netpens

Floatation materials include bamboo, plastic drums, PVC, steel drums, styrofoam, aluminum floats, logs, plastic containers, oil drums coated or not coated with fiberglass, and painted metal drums. Rubber tires filled with styrofoam are also in use in tropical and temperate regions. Ferrocement is at the experimental stage in some countries but cited as already in the operational stage in such countries as Japan and Canada. Hungary has, with its newer cages, been using aluminum cylinder floats and impregnated perlon nets.

Life span of these materials vary from one-half or one year with metal drums and bamboos to as long as 10 years with ferrocement, aluminum buoys, and aluminum cylinders. Rubber tires, PVC pipes, covered styrofoam and plastic spherical buoys normally last 5 years; steel and plastic drums, 1-1/2 years; and bamboo and logs, 1-2 years.

Rigging of netpens and cages

Five types of rigging pens and cages were described. Inspected were three types of floating cages at SEAFDEC and demonstrations were held on the types of rigging employed for these types of cages.

Of particular interest for its novelty is the SEAFDEC-designed circular floating platform supported by steel drums as floats and with a cylindrical shaped net. This contains milkfish broodstock and has the advantage of allowing movement of fish without injury.

Fish jumping over the cages was noted. A proposed solution is to have cages so designed as to have 0.3 m to 0.6 m (as in Hungary) above the water.

Materials for, size and shape of, and anchoring netpens

Use of polyethylene and nylon monofilament twine to make cages and netpens was expressed unanimously. Experiences show that knotless twines eliminate injury to certain species and reduced greatly fouling. Knotless twines however are not easy to mend. Wire mesh is commonly used. It is recommended that plasticised wire mesh or plastic webbing be used where economical.

Ropes of synthetic fibers in cages and pens was recommended by all. Bamboo and wood coated with asphalt are also used for cage and pen construction.

Size of netpens had been recommended not to be more than 8 x 8 m for proper management. For commercial operation, especially for freshwater culture, cage sizes may be larger. For milkfish pen culture, between 1 and 5 ha is recommended for profitable production.

Cages are circular or rectangular/square. Rectangular cages are preferred for easy operation and management. Circular cages were found suitable for the culture of certain species like milkfish and yellowtail but they need special skills to build.

For anchoring netpens, driving piles maybe suitable in muddy bottom. Concrete slabs, sandbags and iron anchors are in wide use. For muddy bottom, concave type concrete slabs are suggested.

(Continued on page 5)

Technology Now Available in RP on the Culture of Milkfish, Prawns, Molluscs, Tilapia

Background

Seventy-nine of the Philippines' outstanding fishery/aquaculture researchers, technologists, educators, extensionists, policy-makers and fish producers met at the main station in Tigbauan, Iloilo of the SEAFDEC Aquaculture Department in a 4-day (8-11 Feb) technical consultation on available aquaculture technology in the country.

The participants determined and evaluated currently available technology on 4 of RP's more important aquaculture commodities, established the production potentials of these technology, pinpointed gaps in the technology and worked out a mechanism for transferring appropriate aquaculture technology to the industry.

Sponsored by the SEAFDEC Aquaculture Department in collaboration with the Philippine Council for Agriculture and Resources Research (PCARR), the consultation was attended by representatives of some 14 institutions. These are SEAFDEC, PCARR, SEARCA, Bureau of Fisheries and Aquatic Resources, Fishery Industry Development Council, Philippine Federation of Fishfarm Producers, Western Visayas Federation of Fish Producers, National Institute of Science and Technology, Association of Negros Occidental Fishpond Operators, Central Luzon State University, the University of the Philippines' College of Fisheries and Brackishwater Aquaculture Center, Capiz Pondowners' Association, and the mass media as well as four trainee-scientists from the Indian Council for Agricultural Research.

AVAILABLE TECHNOLOGY ON MILKFISH FARMING

Broodstock development and reproduction. Information on cage, migration



Participants to the Technical Consultation on Available Aquaculture Technology in the Philippines share a light moment before buckling down to serious work. Seventy-nine of RP's topnotch workers in aquaculture research, development, extension, education, policy and production attended the 4-day consultation.

pattern, and food habit of mature *sabalo* is still limited. Some environmental factors influencing gonadal development and migration of maturing milkfish have been identified. Possible spawning areas have been identified. Induced spawning has been achieved. Sex determination of *sabalo* based on external characteristics has been achieved.

Larval rearing. Following induced spawning, modest successes have been achieved in rearing larvae to fry stage. Rotifer was found most effective as food in the early stage.

Nutrition. No clearcut technology available in RP. Present practices use single-ingredient materials as supplements for fry and fingerlings. Feeding techniques not standardized. Preliminary studies indicate that dietary level of 40-50 percent protein is acquired by fry for maximum growth, efficient feed conversion, and high survival rate. Trials show feasibility of high density rearing and fry

fingerlings in indoor systems using purified diet with prophylactic treatment.

Culture. Farming has moved out of the traditional level to that of fertilization. Benthic type of organism is the main feed for the fry and adult milkfish. Supplemental feeding techniques are practised to some extent. Chemical poisons are usually applied against pond pests and predators. Some fishpond operators practice stock manipulation. Polyculture remains traditional using prawns and crabs. Deep-water plankton method is a recent innovation.

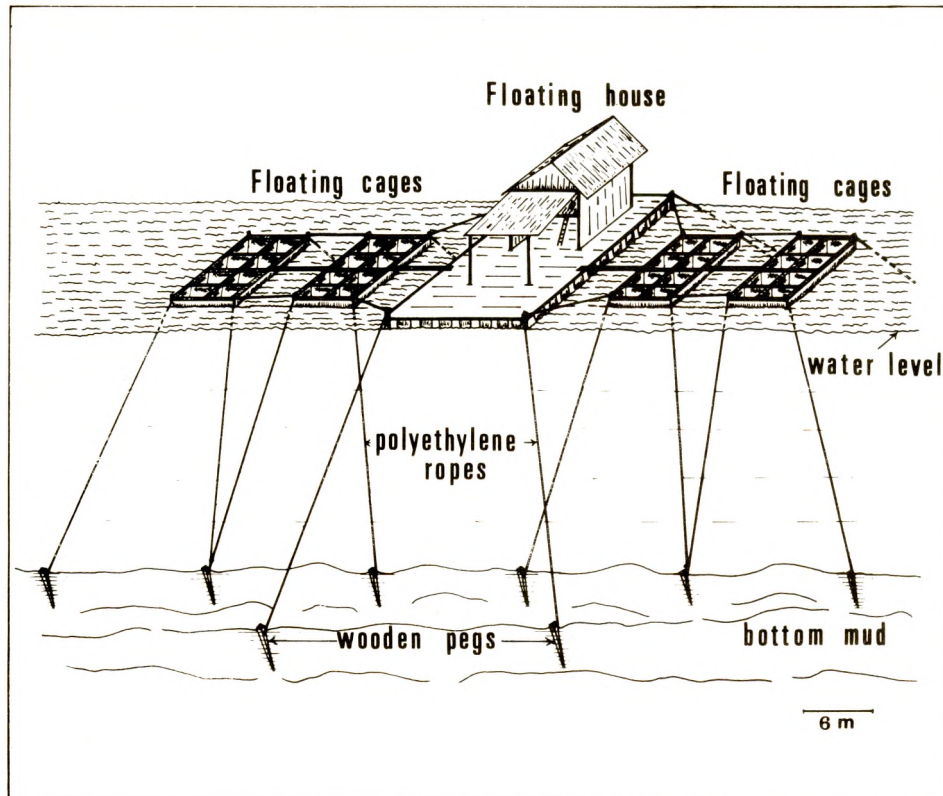
Parasites & diseases. Some parasites and pathogens have been identified. Prophylactic treatments are known but only adaptable in small confined areas.

Post harvest. Technology is available for pre-chilling, handling and transport of fish from pond to market. Thermal processing like canning and by-product
(Continued on page 7)



Malaysian Experiment:

Family Unit-Cages



A schematic diagram of a family unit cage system showing the anchoring facilities.

The idea of family unit net-cages had been proposed by Drs. Chua Thia-Eng and Teng Seng-Keh of the Universiti Sains School of Biological Sciences to extend the cage culture technology to the fishermen in Malaysia and whose economy are badly affected by the dwindling catch of the inshore water and to train future generations of fish farmers through participation in the culture practices by the family members.

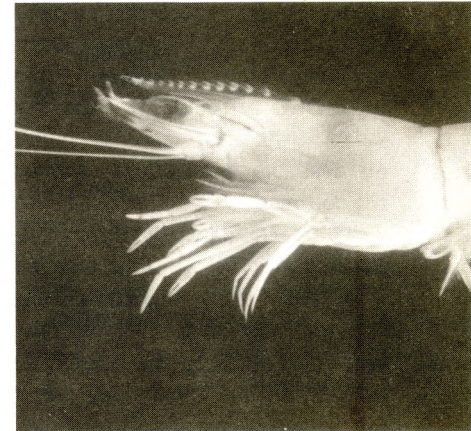
For such unit, a total of four unit rafts, each with eight unit net-cages were employed.

A floating house is built in addition to the unit cages and the floating units.

The house accommodates the family living or working at the farm. The area of the floating house is twice that of a floating unit, i.e. 9.6 m x 15.6 m floated on used plastic barrels. The house enables at least a family of four working in it and has a working platform for cleaning, drying or mending of nets as well as a space for preparing feeds.

The house is furnished with cooking facilities and a small room for accommodation. A family unit therefore consists of four floating cage units of size 5.4 m x 8.4 m each and a floating house. Both the house and floating cage unit are anchored to the sea bed by wooden

Edible Crustaceans in the Philippines



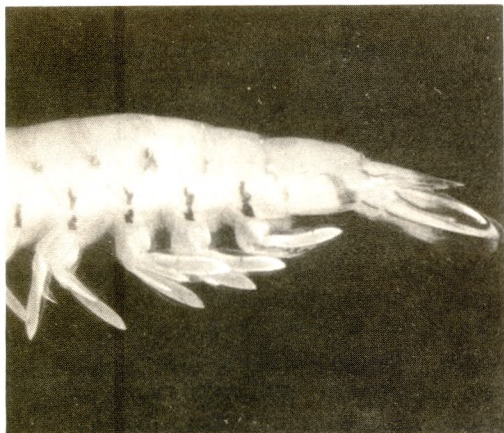
Penaeus latisulcatus Kishinouye
English name: Western king prawn, Blue-leg king prawn, Furrowed prawn
Philippine dialect: Bulik

Maximum body length is about 16 cm with body weight of about 60 g. Ca-

pegs. The whole family unit could be moved and towed away at will if the environment becomes unfavourable.

From the paper, "Site selection, structural design, construction, management and production of floating cage culture system in Malaysia," submitted by Dr. Chua Thia-Eng to the International Cage and Pen Culture Workshop, SEAFDEC Aquaculture Department, Tigbauan, Iloilo, Philippines, 13 - 21 February, 1979.

ustaceans lippines*



rapace and abdomen are uniformly glabrous; carapace with well-developed orbital, antennal and hepatic spines. Rostrum is armed with 10 to 12 teeth dorsally and 1 ventrally. Telson has median groove and bears three pairs of lateral spines which are fairly long and easily visible.

The color in life is light yellowish brown with blue-yellow tinge pereopods and pleopods. The abdominal segments show laterally a faint transverse pattern of dark brown bands. Antennae are white. Telson is tipped with dark blue color and fringed with crimson hairs.

The species is mostly dwelling in open sea where bottom consists of sand or muddy sand, and is mainly caught by commercial trawlers.

Geographical distribution is Indo-West Pacific region extending to the Red Sea, and Australia.

The commercial value is great; its retail price is P20 to P25 per kg.

Contributed by H. Motoh: fourth in a series

Cage & Pen...

(From page 2)

Due attention should be paid to anchoring lines. Normally, length of anchor ropes is three times the depth of water. Ropes of synthetic fibers and iron chain coated with tar are widely used.

Dealing with Fouling on Netpens

North America and Europe try some chemicals to prevent fouling organisms but none has proved worthwhile. Changing net in short time intervals is a proven solution. Washing once a week eliminates most freshwater algae. In Nepal, *Labeo rohita* is a biological control (5 fish per 25 m³ water) for freshwater algal fouling.

To eliminate foulers, net cages painted with some chemicals is done in Thailand; these chemicals also prevent rust. Rotating cages to expose the part blocked by foulers was mentioned as being done in Europe. Changing the net and periodic cleaning as well as biological measures seem to be the most practical method so far for dealing with foulers.

To protect netpens from floating objects, planks are placed and occasionally removed (Indonesia), bamboo rods are placed horizontally around cages (Malaysia). In North America, logs, connected together with chains end to end serve as a log boom surrounding netpens. In Singapore, an outer net is installed.

Diseases and parasitism

Onset of diseases and parasites is an effect of poor management and poor water quality, it was agreed. Prevention rather than treatment should be the attitude towards diseases and parasites.

Feeds and Feeding

Cage culture — characterized by high stock density — necessitates artificial feeding. Developing countries commonly

use simple diets, made of single ingredient or formulated out of locally available materials. The trend in developed countries is towards the use of pelleted feeds. The economics of feeding must be closely studied, it was suggested. At a certain density artificial feed may not really be necessary, as in the case of tilapia culture in one Philippine lake.

It was also suggested that the exact requirement of the species be studied; appropriate feeding frequency should reduce cost of operation. On this account Hungary has been experimenting on the use of demand feeders and feeding trays which have reportedly helped minimize loss of feed. Groupers in Malaysia reportedly have the best feed intake from 6-7 am and 6-7 pm. Frequency of feeding depends on the growth stage of the fish. Cage culture must also consider the market-orientation of the fish i.e. high priced fish may justify the use of high protein feeds.

With highly carnivorous species that prefer live feeds, it may be possible to train them to accept artificial diets; they could be subjected to a starvation stress before they are offered other feed types.

On feed distribution, it was stressed that manual feeding is needed to observe the status of the fish. Feeding trays placed at various depths according to the feeding habits of different carp species in polyculture seem to make for a more efficient utilization of feeds in ponds.

To eliminate detritus and particulate wastes, it was noted that constructing cages two feet above the bottom and where there is sufficient water current prevents accumulation of wastes. Species which could browse on uneaten feeds and other wastes should be identified.

(Continued on page 6)

Mechanism to Transfer aquaculture technology in RP drawn up

A linkage mechanism to transfer aquaculture technology from the researcher to the fishfarmer was drawn up during the Technical Consultation on Available Aquaculture Technology in the Philippines held at the SEAFDEC Aquaculture Department, Tigbauan, Iloilo from February 8 to 11, 1979.

The Consultation was participated in by some 79 top aquaculture experts from 14 agencies representing research, extension, education and policy as well as the private sector.

For technology generation, the lead agencies are the SEAFDEC Aquaculture Department, University of the Philippines, and Central Luzon State University. Support will be provided by the Philippine Council for Agriculture and Resources Research (PCARR), Bureau of Fisheries and Aquatic Resources (BFAR), Mindanao State University (MSU), Bicol University (BU), and Mindanao Regional School of Fisheries (MRSF).

In verifying and packaging the technology developed by the researchers, the BFAR will be responsible together with the private sector, regional research and educational institutions, and PCARR. To provide them the necessary support are the Asian Institute of Aquaculture (AIA) of SEAFDEC, and the National Food and Agriculture Council (NFAC).

The BFAR will also be the lead agency, together with the private sector, in disseminating and applying the technology. Support will come from action programs, regional educational institutions, the mass media and AIA-SEAFDEC.

The Consultation also came up with a listing of available technology, technology gaps, and research programs and proposals for aquaculture.

Cage & Pen...

(From page 5)

Legal, Environmental, Socio-economic Considerations

Poaching and predators are a common problem. Night watching and dogs and siting of pens near the house have been recommended. But the most effective way to prevent poaching, it was observed, is the maintenance of good relations with people.

Legal constraints and requirements vary among countries; licensing is normally required.

Pens and cages indiscriminately placed pose navigational hazards. Placement of cages is restricted in one city in Indonesia because it abets flooding. In Egypt, permission of irrigation authorities is needed to set up cages in canals because of possible restriction to water flow, siltation and pollution.

It was urged that technology must be adaptable and lend itself to translation for artisanal fish farmers. Costs must be reduced to keep the products within the range of low income groups. Malaysia has developed a family unit type floating cage.

It was shown in a comparative cost/benefit analysis of different species cultured in different systems that the most favorable cost/benefit ratio is derived from one which gives no unexpected mass mortality and recovers investment costs in one year (3 years for traditional system under equivalent conditions).

Ecological aspects

The following criteria are considered vital for the selection of fish for culture in pens or cages: (1) value of the fish and market demand (2) hardiness (3) ready source of seed (4) ability to grow fast (5) ability to take supplementary feed.

Species of demonstrated potential in freshwater habitats with high natural productivity include milkfish, Chinese carp, Indian carp, mullets, *T. mossambica*, *T. nilotica*, *Puntius gemonetus*, *Cyprinus carpio*, eel and catfish.

For freshwater bodies with low productivity, potential species include those that are not able to survive on natural productivity alone and grow well with supplementary feeding i.e. *Penaeus spp.*,

AIA Becomes...

(From page 1)

The inclusion of Asia in ASFIS should also greatly benefit the System itself by making available to the other participating centers literature in tropical developing countries particularly of Asia. An examination of the 4000 or more journals being abstracted in the Aquatic Sciences and Fisheries Abstract (ASFA) shows that less than 200 titles or a mere five percent come from Asia.

ASFIS Services

Abstracts of literature that get into the pages of ASFA become easily available and widely circulated in the region. Aside from ASFA, the services of the System include selective dissemination of information (SDI), specialized bibliographies, current awareness which include a marine science contents tables, a newsletter, and a list of scheduled meetings, registers of experts and institutions, directories of marine scientists, institutions, and marine affairs projects in preparation, an authorities thesaurus, a list of aquatic sciences and fisheries serial titles, and a list of aquatic science institutions.

The 12 other participating centers are: All Union Research Institute of Marine Fisheries and Oceanography in Moscow; Bundesforschungsanstalt fur

Macrobrachium, *Leptobarbus*, *Pangasius*, *Clarias batrachus*, *Etrophus*, marble goby.

Brackishwater is a fluctuating environment over time; it presents the most difficult situation of the three types for growth. Therefore species to be considered should be able to grow well in changing salinities. Species of potential include milkfish, sea bass, mullets, siganids, sea bream, grouper, snapper, crabs, threadfin, carangids, penaeids, *Hilsa spp.*, *Spirus spp.*, and eel.

Marine environments offer a great potential in many countries despite greater problems due to waves and wind. In the tropics, species of demonstrated potential are siganids, milkfish, pompano, yellow-tail, tuna, grouper, snapper, sea bass, sea bream, caranx, pomfret, and boster.

Fischerei Informations und Dokumentationstelle in Hamburg, Federal Republic of Germany; Centre National pour L'exploitation des Oceans, Bureau National des Donnes Oceaniques in Brest, France; Centro de Informacion Cientifica y Humanistica of the Universidad Nacional Autonoma de Mexico; Fisheries and Environment Canada, Fisheries and Marine Service, Scientific Information and Publications Branch in Ottawa, Canada; Gessellschaft fur Information and Documentation in Frankfurt-am-Main, Federal Republic of Germany; Information Retrieval Limited in London, National Oceanic and Atmospheric Administration, Environmental Science Information Center in Washington, D.C.; Natural Environment Research Council, Marine Biological Association of the United Kingdom in Plymouth, U.K.; Servico de Informacao a Documentacao, Secretaria de Estado das Pescas in Alges-Mar, Portugal; U.N. Food and Agriculture Organization Department of Fisheries in Rome; and the Intergovernmental Oceanographic Commission in Paris.

FAO coordinates the development and maintenance of ASFIS, prepares input to ASFA from FAO documents and publications and from fisheries literature, compiles ASFA, current awareness services, and maintains the ASFIS register of experts and institutions.

AIA Reponsibilities

As input center, AIA has been required to feed the system with 1,200 abstracts yearly. The Institute has started to organize a staff composed of abstractors and documentation workers. AIA shall be establishing linkages and mechanisms to put into action an aggressive acquisition and documentation of published and unpublished literature in the region. Linkages will be made with aquaculture R & D institutions and systems for this work.

Linkages Workshop

The Institute will organize a regional workshop on documentation to be participated in by selected librarians and documentalists in selected Asian countries. The participants will be enlisted

Technology Now Available...

(From page 3)

utilization using offals have been developed. Also developed are smoking, salting, fermenting, and drying techniques.

Lab-lab culture. Present practice induces lablab growth by systematic water management plus fertilization. The lablab complex develops without propagation of specific algal species or groups.

Pond engineering. Information on the following are available: criteria on site selection of ponds; relationship between gate size, pond water level, and design tide curve; design elevation of foundation; relationship among sizes of pond compartments according to functions; types of layout schemes; size and proportioning of dikes; control of erosion and seepage; pond construction and repair methodologies; tool and machineries.

Farming systems. The widely practised system uses shallow lab-lab ponds stocked with mono-sized fingerlings grown to marketable size. A recent innovation should lead to the modular or progression system and to the multi-sized stocking method. Plankton method is resorted only when lab-lab is prematurely grazed. Recent studies using nylon screens serving as additional substrates for

to assist in the tracking down and acquisition of literature in aquaculture and fisheries and related fields in their own countries.

Asian Documentation Center

This beginning of an Asian regional aquaculture information system could eventually evolve into an Aquaculture Documentation Center that would serve the Asian Region. It will be recalled that the first regional workshop on aquaculture development strategies for Asia recommended the development and operationalization of an Aquaculture Documentation Center "to meet the critical demand for information exchange and utilization."

lab-lab attachments indicate higher yields for small compartments. The productivity of using the so-called "kitchen" pond, a separate pond solely for lablab culture, has been demonstrated by a private fishfarmer.

Culture in freshwater. Pen culture in Laguna Lake is estimated to yield an average of about six times that of brackish-water ponds. Fish in pens are supported mainly by the planktons growing in the lake and with limited supplemental feeding. Trials in freshwater ponds gave low yields.

PRODUCTION POTENTIAL OF AVAILABLE TECHNOLOGY

Technology Level	Potential Yield* (tons per ha per yr)
High input (high yield) intensive feeding control of water quality lablab or plankton (pond inoculation) engineering system mechanization	2.5 – 3.0 and higher
Medium input (medium yield) pond fertilization supplemental feeding pest and predator control control manipulation lablab or plankton	1.0 – 2.5
Low input (low yield) little or no fertilization low stocking density lumot method	1.0 or less

*based on total effective production area

NEXT ISSUE:
TECHNOLOGY ON
PRAWN

International Foundation of Science Awards Grant to SEAFDEC Researcher

A nutrition specialist of the SEAFDEC Aquaculture Department has been awarded a research grant by the prestigious Stockholm-based International Foundation of Science.

Dr. Felicitas Piedad-Pascual, a researcher of the Department who has been working on the nutrition of various aquaculture species, will be the chief investigator of the research project, "Energy-protein requirement of the *Chanos chanos* fingerling," a research proposal of hers which has recently been approved for implementation by the Foundation. She is one of the very few Filipinos who have been awarded a research grant by IFS. The grant is equivalent to 38,250 (Swedish Crowns) or about US\$8,500.

The research seeks to establish calorie needs of the milkfish through the determination of the amount of fat and then the amount of carbohydrate needed in the milkfish diet. The information should lead to the determination of the protein required by the milkfish and, afterwards, the ratio of energy to protein in the diet.

All these information will be used in the development of practical diets. Such a diet is expected to shorten the rearing period of milkfish to enable fish farmers to have more crops per year and

higher yields per crop than present nutrition technology allows.

The significance of the expected technology output of the research project lies in its application in intensive fish culture, now a growing trend in aquaculture. Intensive culture requires the addition of supplemental or complete rations to the natural foods present in the water.

Founded in 1972, the International Foundation of Science whose secretariat is in Stockholm, Sweden is a non-governmental organization based on scientific academies and research councils in 41 countries including the Philippines. The Foundation is governed by an international Board of Trustees. Grant provisions require grantees to be native, and carry out the research in, a developing country. At present IFS supported research are confined to biological and agricultural sciences applied to the basic necessities of life.

Dr. Pascual holds a Ph.D. degree in nutrition from the Iowa State University, an M.S. degree in foods and nutrition from the Michigan State University, and a Bachelor of Science degree in pharmacy from the University of the Philippines. She also obtained a certificate in dietetics from the University of Oklahoma Medical Center.



Dr. F. Piedad-Pascual at work in the nutrition laboratory. Shown is a low-cost feed formulation in pellet form for juvenile milkfish and prawns stocked in the Department's experimental ponds.

CHANGE OF TRAINING SKED

The *in-situ* farmers' training programs in Luzon originally scheduled for May have been moved to May.

ERRATUM RE: CRAB FATTENING

Erratum

Crab Fattening

The article "Indications for crab fattening (AA 11, 2) should read (line no. 10) ". . . more molts were observed at 20 ppt . . ." not 30 ppt.

ASIAN AQUACULTURE is published monthly by the Asian Institute of Aquaculture, Aquaculture Department, SEAFDEC.

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Aquaculture**

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(Entered as second class mail matter at the Iloilo City Post Office on August 28, 1978.)