ISSN 0115–4974

Asian Aquaculture

VOL. 2 NO. 4 TIGBAUAN, ILOILO, PHILIPPINES APRIL 1979

TRAINING PROGRAM EXPANDS, MOVES OUT TO GRASSROOTS

More participants from the Third World are now attending SEAFDEC's training courses even as the program to reach out to the small fish farmers has been stepped up.

This month, six third world countries have fishery officers training under various programs in the SEAFDEC Aquaculture Department.

Egypt has sent two, Sierra Leone in West Africa has one, and Malaysia has one officer training in a 3-month fish cage and pen construction and management course at the Department's Freshwater Fisheries Station which is located along the Philippines' largest lake, Laguna de Bay. Their training is sponsored by the International Development and Research Centre of Canada.

Four fishery technologists from Cuba start undergoing this month specialty training programs covering aquaculture engineering, aquaculture management, milkfish culture, and freshwater fish

(Continued on page 2)

Fish farmers participating in the SEAFDEC-BFAR mobile training program trek to a pond of one of the participants where SEAFDEC and BFAR training and extension specialists would conduct demonstrations The mobile aquaculture training course is held on farmers' farm sites. It will eventually cover the Philippines' 13 geo-political regions.

RANKING FAO FISHERIES OFFICIAL VISITS SEAFDEC

FAO Assistant Director General for fisheries Dr. Kenneth Lucas (r) is briefed by SEAFDEC milkfish program leader J. Juario (l) on the Aquaculture Department's milkfish R & D thrusts and progress. With Dr. Lucas are Dr. Arthur Woodland, Programme Leader of the UNDP/FAO South China Sea Fisheries Development & Coordinating Programme (2nd from left) and Mr. Peter Wilson of the Papua New Guinea Fisheries Division.

TRAINING PROGRAM EXPANDS, (from p. 1)

culture. This is the offshoot of the visit here late last year of the Cuban deputy minister of fisheries.

Four fishery scientists from the Indian Council for Agricultural Research are studying mass culture of fishfood organisms while another two from India recently arrived to study induced breeding of milkfish. This brings up to 10 the number of specialists from India who have trained or are training under the ICAR-SEAFDEC technical collaboration agreement.

Three Nigerians and two Indonesian graduate fellows are currently enrolled under the University of the Philippines-SEAFDEC graduate program leading to the Master of Science in Fisheries major in aquaculture degree.

Fish Farmers' Training

Meanwhile, the on-site fish farmers training program which last year covered four areas in Central Philippines including Sorsogon and trained 312 farmers, has become a regular extension function of the Department. This May, fish farmers in four regions of Luzon will benefit from the mobile training program which has also been scheduled to be held in several areas in the Mindanao region late this year. The on-site training program was started by the Department in 1974 in which 44 fish farmers from Mindanao participated. It is now a joint program of SEAFDEC and the Bureau of Fisheries and Aquatic Resources.

Also on the national level, the Barangay (village) Prawn Hatchery training course which recently graduated 10 participants for a total of 27 since it was started, will now be a periodic offering. The next session, this time for Bureau of Fisheries and Aquatic Resources technologists, is scheduled for June. Other courses designed for Filipino aquaculturists, technologists, extension workers, and management/production personnel are *fishpen construction and management, prawn culture, mussel and oyster culture* (also to be held in the provinces), fishery and aquaculture *extension methods,* and *fishpond engineering.*

Specialized courses that have been lined up for both local and international participants especially from SEAFDEC member-countries include *aquaculture management* with special emphasis on milkfish, *small-scale prawn hatchery technology, fishpond engineering,* and *aquaculture research methodology.* ●

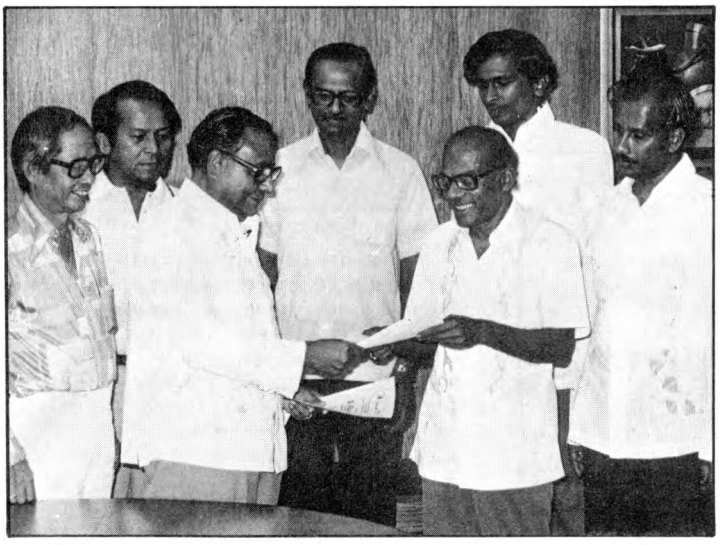
Cage & Pen (from p. 3)

The third was stocked with 300 *Mugil* spp. in the size range of 14 – 33 mm and an average weight of 0.2 g. In about eight months (May to December), the mean size increased to 190 mm and the weight to 180 g.

The fourth pen was stocked with 200 milkfish with a mean size of 60 mm and weighing 0.8 g each. The stock, introduced in May 1977, increased in size to 301 mm and grew to 240 g by October – an increment of 51 mm and 48 g per month. One hundred *Mugil* spp. were also stocked in the same pen at about the same time as the milkfish. They grew from a mean size of 26 mm to 169 mm and from a mean weight of 0.2 g to 90 g over a period of five months.

Remarks

This is the first time that pens were erected in the shallow bays in the Indian seas. Tests are being done to build pens out of palmyrah leaf stem and sliced palmyrah wood to study the durability and cost factors. ●



The first group of Indian Council for Agricultural Research (ICAR) fishery scientists to train at SEAFDEC receive certificates of training from AIA Deputy Director Hiralal Chaudhuri. Shown receiving his certificate is N. C. Basu. The others are, from right, N. N. Pillai, P.Ravichandran, and M. S. Muthu. Looking on are, from left AIA head of special projects J. Agbayani and AIA Deputy Director T. G. Flores The 4 are from the Central Inland Fisheries Research Institute. They studied for 3 months prawn breeding and culture.

The second group of ICAR fisheries researchers started recently a 3-month program on mass culture of fish food organisms. They are, from left, A.C. Nandy of the Central Inland Fisheries Research Institute in Barrackpore; C. M. James and C. P. Gopinathan of the Central Marine Fisheries Research Institute in Cochin; and K. L. Sehgal, also of CIFRI. Briefing them on their program of study are AIA Director J. C. Madamba (far right) and Deputy Director H. Chaudhuri (back to camera).

Meanwhile, 2 others from CMFRI have begun a six-week study of SEAFDEC's techniques on capturing, transporting and induced breeding of milkfish. They are G. Mohanraj and V. Gandhi. This brings to ten the number of Indian scientists to train in SEAFDEC under the ICAR-SEAFDEC technical collaboration agreement.

Cage and Pen Culture in India*

Culture of green crab *Scylla serrata* in cages was undertaken in the Tuticorin Bay and Karapad Creek in 1977-78. The cages were of the basket type, rectangular box type, and metal framed synthetic twine mesh type.

The basket type cages were made of cane splits closely woven to form a basket with a lid at the top. They measured 30 cm in diameter and 25 cm in height. These were found suitable for the culture of young crabs whose carapace width did not exceed 40-60 mm. It was found disadvantageous for the culture of bigger-sized crabs.

The box type cages were made of soft wooden planks and measured 2 x 1 x 0.3 m. Consisting of 10 compartments with sufficient space (0.3 m^2) to accommodate big-sized crabs, this cage was suitable in many respects for crab culture although some drawbacks were noted: deterioration of the planks from continuous soaking in water and fouling of planks by barnacles.

Metal framed cages fabricated for the experiments were of two dimensions 1 x 0.6 x 0.2 m and 2 x 1 x 0.5 m. Frames were of 6 mm mild steel rods knitted with synthetic twine. The metal frames were coated with tar. The mesh of the sides and top portion of one cage was 10 mm while that of the bigger cage was 15 mm. At the bottom, the mesh was much closer to retain bits of food. The smaller cages were rested on racks while the bigger ones were tied to bamboo poles which served as floats. They were anchored with heavy stones. The smaller cages were stocked with 5-7 crabs, the bigger ones with 25-30 crabs. Similar sized crabs were stocked to avoid cannibalism.

* From the paper "Culture of fishes in cages and pens along the coastal waters of India" submitted by R. Marichamy, G. Venkataraman, K.M.S. Ameer Hamsa, P. Nammalwar, S. Shanmugam and P. Bensam to the International Cage and Pen Culture Workshop, SEAFDEC Aquaculture Department, 13-21 Feb. 1979.

Results

Seed crabs 45 – 60 mm in carapace width and weighing 15 – 40 g were stocked in the cane cages. The tip of the chelipeds was cut to avoid possible damage to the basket cage. Grown up crabs were transferred and cultured in the wooden or the metal framed cages.

The diet included trash fish, crushed bivalves and gutted wastes of fish. Rate of growth was relatively fast: crabs in the size of 45 – 110 mm showed a monthly average growth of 12 – 15 mm in carapace width and an increase of 45 – 60 g in weight. The crabs attained the marketable size of 145 – 160 mm (400 – 500 g) after a period of 9 to 10 months passing through 4 to 5 molts.

Pen Culture of Milkfish and Mullet

In another area, a site in the Gulf of Mannar was selected for pen culture of milkfish and mullet. The sea forms a small bay and is relatively calm even in rough weather. It has a sandy bottom suitable for driving casuarina poles which acted as braces for the pen enclosure. The pen consisted of a double-layered *thatti* (bamboo screen) firmly joined by iron straps. The outer layer of the thatti is of bamboo splits 9 mm thick while the inner layer was of 5 mm in thickness. The pen was square and covered an area of 81 m^2. Tar was applied to a height of 0.5 m from the bottom and over it kriside was painted.

Water depth in the pen ranged from 1.2 m in low tide to 1.8 m in high tide. There was good flushing in and flushing out of water in the minute crevices in the thatties.

Fingerlings of milkfish and *Mugil* spp. were stocked. The fishes were fed every morning at one-tenth of the weight of the fingerlings. The feed comprised equal portions of minced fish meat and oil cake paste and was placed in an aluminum tray (0.5 x 0.5 x 0.2 m) which was fixed at the center of the pen in such a way that the tray was just above the low tide water level. The fish also fed on the natural food in the pen.

Results

Over a three-month period, the *Mugil* registered a growth of 18 mm per month. The average weight increased from 0.8 g to 15 g.

Milkfish introduced in March 1977 increased in mean size from 60 – 90 mm at stocking to 277 mm by June of the same year. Another batch of milkfish introduced in February 1978 increased in weight from 4 g to 100 g in 3 months. In the subsequent period of June to September, the mean size of the milkfish increased from 226 to 380 mm registering a growth rate of 51 mm a month, while the mean weight increased from 110 g to 448 g.

Culture of marine prawn and fishes

Marine prawn and fishes were cultured in enclosures in mud flats. Four pens were built each of 20 x 10 m in extent. Each pen was made of split bamboo screens. The split sticks were spaced closely and interwoven with synthetic twine. The screens were erected in the Tuticorin Bay supported by casuarina and teak poles.

Results

The first pen was stocked with 1,500 seeds (equivalent to 75,000/ha) of *P. indicus* in the size range between 25 to 72 mm with an average weight of 1.3 g. The prawns showed a growth of 7 mm and an increase in weight of 0.7 g per month for a period of 5 months.

The second contained 800 (equivalent to 40,000/ha) *P. indicus* and in five months the animals registered a growth of 12 mm and an increase in average weight of 1 g per month.

(Continued on page 2)

Aquaculture in Hawaii: Species and Systems*

Aquaculture, the farming of fish and aquatic plants, has been practiced for thousands of years. The Japanese have cultured oysters since ancient times, and growing carp in ponds is a tradition in China. The growing of oysters in Europe is recorded in the works of Aristotle, the Greek philosopher.

In Hawaii, aquaculture dates back hundreds of years. Prior to the arrival of Captain Cook in 1778, there were approximately 360 fishponds which covered a total area of over 6,000 acres and produced about 350 pounds of fish/acre/year. Inland ponds, often located near streams or springs, were frequently operated in conjunction with taro farming. Along the coast, ponds were built in sheltered areas, sometimes near freshwater or brackish water springs.

The types of fish raised in these coastal ponds included mullet or ama'ama, milkfish or awa, ahole-hole, and various members of the jack family, such as omaka and papio. The Hawaiian crab, oysters, and a small shrimp (opae) were also raised or collected. Many small fish and shellfish were swept into the ponds with the tides where they grew until they were harvested. Although these pond animals fed on natural food, additional food, such as taro, was sometimes provided.

Modern aquaculture is the culture or husbandry of aquatic life for profit or social benefit. It is practiced in seawater, freshwater, and brackish water.

The four basic types of management systems for aquaculture are *release and recapture, pond culture, cage* or *basket culture,* and *raceway culture.* These systems begin with plants or young fish and shellfish that are generally produced in hatcheries. One of the ways in which they differ is in the amount of control that can be exercised over the cultured animal or plant.

There is no example of the *release and recapture* system, also known as "ocean ranching," in Hawaii. However, in the Pacific Northwest, salmon culture is a good example of this system. Young salmon are bred in hatcheries and then released into streams. After 3 months, they travel to the ocean and feed on natural foods. They remain there for several years, then return to the stream where they are harvested.

The *pond culture* system with its many types, shapes, and sizes is the most widely used system in Hawaii and in the world. Animals or plants are raised in natural dirt, concrete, or specially constructed ponds. Feeding and water quality in ponds can be controlled to a large extent, but temperature is difficult – if not impossible – to regulate.

Although practiced only on an experimental basis in Hawaii, the *cage* or *basket culture* system is widely used in Asia. Usually housed on rafts, it is used in estuaries, bays, and ponds. With this system feeding and the amount of fish stocked can be controlled.

More animals can be raised in a given space with the *raceway culture* system because the quick-flowing water maintains high oxygen levels and removes wastes. Stocks are kept in trays through which the water is passed. Although this system is costly, a great degree of control can be exercised over nutrition, water quality,

(Continued on page 6)

*From an article of the same title written by John M. Shklov and C. Richard Fassler. The article was published by the University of Hawaii Sea Grant College Program in November 1978.

Report: Technical Consultation, Philippines, Part II

AVAILABLE TECHNOLOG AND PRODUCTION POTE FARMING IN THE PHILI

Broodstock Development and Reproduction. Available information on reproductive biology includes size at first maturity and first mating, courtship and mating behavior, ovarian maturation stages, spawning, rematuration (subsequent spawning), fecundity, egg quality, and hatching rates.

Current broodstock technology includes sources, transport and acclimation methods and the ablation process itself. To obtain good fecundity and hatching rates, ablated females should come from either pond stock at least one year of age or wild stock at minimum sizes of 90 g for females and 50 g for males. There are two broodstock systems – land-based tanks and off-shore pens – and the choice of a hatchery operator would depend on the conditions and requirements peculiar to his hatchery.

Gaps in the technology include kind of substrate, sex ratio, stocking density; use of hormones, pressure and other methods as alternatives to ablation; increasing rematuration rates; development of pen systems that reduce fouling and increase survival; maturation of ablated females in ponds; and broodstock of other penaeids.

In some areas, wild spawners are abundant in catches from trawlers and various shrimp traps. Research should be directed also on minimizing stress on the prawns by appropriate handling and transport methods from the source to the hatchery.

Y, TECHNOLOGY GAPS, NTIALS OF PRAWN PPINES

Larval Rearing and Sugpo Hatchery. There are essentially two larval rearing systems for prawn. In the fertilized system, natural feeds are produced in the same tank used for larval rearing. This system requires a lower initial investment but has relatively lower efficiency and production levels. It is highly site-specific. In contrast, in the unfertilized system, algal and zooplankton cultures are produced separately from the prawn larvae. Efficiency and production levels are better but a higher initial investment is required.

The Mindanao State University-Institute of Fisheries Research and Development hatchery at Naawan, Misamis Oriental, the first prawn hatchery to operate in the Philippines, utilizes the unfertilized system whereas both the large-tank and small-tank (barangay) hatcheries of the SEAFDEC Aquaculture Department depend on the fertilized system. Barangay hatchery technology has been extended to other SEAFDEC Stations as well as the private sector with initial runs showing promising results.

Among the more significant aspects of a barangay hatchery are source of spawners, seawater quality, seawater supply system, air supply system, larval culture tanks, culture of natural feeds and larval rearing.

Research attention is needed on the use of preserved natural feeds for larval and algal tank design and construction.

Edible Crustaceans in the Philippines

5. *Penaeus japonicus* Bate
English name: *Kuruma prawn, Japanese King prawn.*
Philippine dialect: *Bulik, Hipon Bulik*

Body length reaches about 18 cm. Carapace has well developed orbital, antennal and hepatic spines. This prawn is quite similar in appearance to *P. canaliculatus* referring to the similar color pattern. But the differences between the two species are: telson bears three pair of spines in *P. japonicus,* while no spine in *P. canaliculatus,* and well marked transverse bands are slightly narrower in *P. canaliculatus* than those in *P. japonicus.*

This is a beautiful species having light brown with broad red-brown transverse bands on its body. The pereiopods and pleopods are white and blue-yellow in color.

The species is mostly inhabiting open sea area where bottom consists of sand or muddy sand, and is sometimes caught by commercial trawlers.

Its distribution is from Japan through Taiwan, Tahiti, Philippines, Malaysia, Arabian Gulf to South Africa.

This species is not so important compared to other prawns; few are caught in the Philippine waters.

The retail price is the same as of *P. latisulcatus* – P20–25 per kg.

by H. Motoh; 5th in a series

Prawn Pond Engineering. Pond system layout and design include site selection, biological considerations, pond engineering, and pond system structures. Pond structures and equipment include those for protection, water measurement, water conveyance, water impoundment, pumps and wells, and others.

Although the subjects of water flow, levees and embankments, etc. are well-advanced in the field of hydraulics, soil mechanics and foundation engineering, there is a need to simplify these concepts and principles and to fully apply them in prawn pond layout, design and construction.

Nutrition. Experimental work include laboratory and field work on nutrient re-

(Continued on page 6)

Aquaculture in Hawaii *(from p. 4)*

and the physical environment. In Hawaii, an example of this is the raising of oysters by the Kahuku Seafood Plantation.

All of these management systems, with the possible exception of *release* and *capture,* appear to be feasible for use in Hawaii. Species presently being researched or grown here in the pond system include mullet, milkfish, catfish, grass carp, and freshwater prawns. Moi are being raised in cages, and oysters and clams in raceways.

The Kahuku Seafood Plantation raises oysters in Kahuku. Aquatic Farms, another oyster producer, is located in Kaneohe. These firms grow oysters in 9 months.

Catfish farming takes place at a 15-acre facility on Maui. The catfish are harvested by net and sold to restaurants.

The culture of baitfish is expected to aid Hawaii's tuna industry. Local fishermen use baitfish to "chum" for skipjack tuna. Baitfish are being raised on Maui using technology developed at the Hawaii Institute of Marine Biology in Kaneohe.

Mullet have been induced to breed out of season by an injection of hormones. Scientists at the Oceanic Institute at Makapuu hope to share this technology with developing countries of Asia and the Pacific.

Brine shrimp are a highly important source of nutrition for many aquaculture species. Because imported brine shrimp are expensive, several projects are underway to produce most of the state's needs.

The Anuenue Fisheries Research Center of the Department of Land and Natural Resources has pioneered the development of specific techniques for the rearing and growing of *Macrobrachium rosenbergii.* Juvenile prawns are made available to farmers through a cooperative program.

Many institutions and agencies in Hawaii conduct aquaculture research and provide information and extension/advisory services. The University of Hawaii Sea Grant Marine Advisory Program can provide you with information or refer you to the institution/agency that can help you in special areas. Contact MAP offices on Oahu, 948-8191; Maui, 244-4157; Kauai, 245-4471; and Hawaii, 935-3830. ●

Available technology, technology gaps... *(from p. 5)*

quirements (protein quality, protein levels, lipids), feeding practices, and diet preparation. More laboratory experiments and pond tests are needed.

Nursery and Grow-out Ponds. The SEAFDEC nursery system at Leganes, Iloilo has demonstrated that it is economically viable to rear up to 150 P_4P_5 per sq m for 30 days up to P_{35} with survival rate above 50 percent. Some of the factors contributing to this successful rearing are the ability to change water, supplementary feeding, screening of predators by purely mechanical means, and the use of vertical substrates. Similarly, recent experiments on the grow-out phase show that survival rates after 3-1/2 months above 85 percent are possible even with densities up to 20 per sq m with supplementary feeding.

Is growth site-specific? Is growth a function of stocking density? Although these and other questions are important for research purposes at SEAFDEC, pond culture of sugpo is already very profitable even at relatively low stocking densities of 0.3-1 per sq m. Therefore, ways of increasing survival rates rather than maximizing stocking density *per se* might be more important to the private sector.

Cage Farming in Freshwater. Available technology includes transport and handling of fry, acclimation to fresh water, and lake farming.

Additional research is needed to improve transport, handling, and acclimation; find more varied and economical supplemental feeds; determine optimum feeding rates and protein requirements at different stages; determine suitable management techniques; and develop typhoon-resistant structures.

Pest and Diseases. Available technology covers the identification of most of the major larval diseases of *Penaeus monodon* and the use of a Treflan spawner bath to control fungal diseases.

Gaps include testing of other chemicals for better control of *Lagenidium,* control of protozoan and bacterial diseases in larval rearing, identification of microorganism-caused mortality in pond stock and in spawners, ascertaining source of *Lagenidium,* etc.

Post-harvest Handling. Available technology includes prechilling to 4°C, transport in polystyrene boxes with wooden frame, blast freezing at -40°C and sizing. These can now be promoted for adoption.

Artemia Culture. Techniques for decapsulation of *Artemia* cysts for use as live food for fish and larvae of crustaceans are routinely used at SEAFDEC and other research laboratories. Mass production of *Artemia* cysts in salt ponds has been achieved by a private pond operator in Iloilo. The technology should be tried in other salt ponds throughout the country.

PRODUCTION POTENTIALS

Seed Catching/Production

Wild fry. The present methods for gathering, storing, and transporting wild fry are considered primitive. With slight modifications and refinements, the total fry available for stocking in ponds can be easily raised by about 20 percent. There are methods used in other countries which may be tried directly in this country.

The estimated average number of fry caught from the wild and actually stocked in ponds is about 60 million per year. This figure assumes that shrimps and prawns constitute 3-1/2 percent of total fish production, at a survival rate of 30 percent during pond rearing and an average harvest size of 30 pcs per kg. With a 50 percent increase over the present estimate, the total available fry from the wild would be 72 million per year.

Hatchery reared fry. Existing hatcheries

in the country today have an average total production of about 12.3 million per year. Assuming that in the next three years there would be a total of 30 hatcheries operated by the private sector with an individual average production of 2 million fry per year, and assuming further that existing hatcheries would be able to increase production by making use of some recently developed technology, the total fry production would be about 95 million per year.

Hatcheries	Production, million fry per year	
	Existing 1978	Potential 1981
SEAFEC	8	30 (including those to be established in substations)
MSU-IFRD	2	5
Private Sector	3	60
Total	13	95

Nursery

A nursery system would be necessary for the hatchery reared postlarvae. Bigger fry (1 gm) may be stocked directly into grow-out ponds. For smaller ones (less than 0.1 gm), it would be desirable to stock them first in nursery ponds where average survival rate is 60 percent at a stocking density of 100 per m^2. At present, pond operators stock the fry directly into grow-out ponds.

Grow-out

For polyculture with milkfish, the existing stocking density of prawn is 1,000-3,000 per ha with a survival rate of about 30 percent and a harvest size of 15 pcs per kg. With the available technology, stocking density may be increased to 10,000-15,000 per ha with supplementary feeding. Survival rate would be about 50 percent and stock may be harvested at size of 25 pcs per kg.

For monoculture, the existing stocking density ranges from 3,000 to 5,000 per ha. The stock is harvested at 15 pcs per kg with an average survival rate of 30 percent. Stocking densities could be increased by refinements on the existing system to 15,000-20,000 per ha. Survival rates could be 50 percent and harvest could be made for stock size of 25 pcs per kg. ●

NEXT ISSUE: TECHNOLOGY ON MOLLUSC

Notes from our readers

Thank you very much for the September and November copies of your very interesting publication. We find the information very useful but unfortunately they travel over by surface mail and both arrived yesterday.

I should be very grateful, therefore, if you would consider airmailing this Newsletter to us, and in exchange I will be glad to have our quarterly journal FISH FARMING INTERNATIONAL airmailed to you.

Peter Jhul
Editor
FISHING NEWS INTERNATIONAL
London

We are very interested in the monthly newsletter ASIAN AQUACULTURE published by the Asian Institute of Aquaculture. Would it be possible for us to subscribe to this publication?

Kathy Stockwin
Assistant Editor
READER'S DIGEST ASSOCIATION
Hongkong

In exchange for the complimentary subscription of the AQUACULTURE DIGEST, I have received complimentary copies of the ASIAN AQUACULTURE. I found ASIAN AQUACULTURE to be an excellent publication and already feel that I could not do without it.

I would like to run an item on ASIAN AQUACULTURE in the AQUACULTURE DIGEST. .. .

Best of luck with your new publication. Judging from the quality of the first two issues, it should be a big success.

Robert Rosenberry
AQUACULTURE DIGEST
9434 Kearny Mesa Road
San Diego, California 92126

My warmest aloha to your entire staff! I am writing for the benefit of all the other shrimp technicians working here on our shrimp program. Our program goal is to evaluate the commercial feasibility of marine shrimp farming here in Hawaii. This consists of the following phases: 1) hatchery, 2) nursery, 3) grow-out, 4) maturation (spawning broodstock). Selected species are **P. japonicus, P. monodon, P. stylirostris,** and **P. vannamei.** We are presently in the last phase in evaluating **P. japonicus** as a possible species; hatchery nursery, grow-out are completed for **P. monodon;** and we are in the hatchery and nursery phases with **P. stylirostris** and **P. vannamei.**

We would like to have copies of any research cmpleted with penaeids or penaeid culture. Your success with **P. monodon** in all phases is impressive and the knowledge that you are able to share will aid us greatly in our program. All help is gratefully appreciated.

David M. Kailio
Oceanic Institute
Hawaii

Dear Dr. Madamba:

I read with interest ASIAN AQUACULTURE, Vol. 2, No. 1 of January 1979. It is reported that you have been given the PANTAS AWARD. I have heard of your work in PCARR. I believe you really deserve the award.

The same issue contained the article "Milkfish Research and Development Program of SEAFDEC" which stated among other things that the results should lead to a more efficient utilization of fish farming resources especially land.

To utilize land resources more efficiently, I am suggesting a "Kawali" System of Pond Operation. Briefly stated, the Kawali (literally, a large vat) system suggests a 1 to 1 ratio of lablab pond to rearing pond. The rearing pond need not be grown with lablab. It can hold as much as 6 or more feet deep of water. In lablab ponds, we want maximum surface area, shallow and stagnant water for the photosynthesis of lablab, while in rearing ponds, we want maximum volume and frequently changed water for holding more fish per unit area of pond. In this way, the respective land areas of both the "Kawali" and rearing ponds are used efficiently.

William U. Garcia
President
Sun Chemicals Corp.
Iloilo City

We thank Mr. Garcia for the brochures on the "Kawali" System of Pond Operation. Ed.

Dear Joe,

It was good to see you again at PCARR's Sixth Anniversary Program.

We have been affiliated with fisheries under the Aquaculture Project and will continue under the Freshwater Fisheries Project. Consequently we remain interested in aquaculture and would very much appreciate receiving your monthly publication ASIAN AQUACULTURE. Would you please add our office to the mailing list.

We wish you success and enjoyment in your assignment and congratulate you on your Pantas Award. It was certainly deserved.

Best regards.

Bill McCluskey
Chief Research Division
U.S. Agency for International Development
Manila, Philippines

Dear Dr. Madamba:

Many thanks for sending the SEAFDEC publications and newsletters together with details of training programmes.

We are very glad indeed to have this information available in our office.

J.W. Brodie
Regional Adviser in Marine Sciences
United Nations Educational, Scientific and Cultural Organization (UNESCO)
Jakarta, Indonesia

Slate Confab on Applied Biology in Southeast Asia

"Trends in Applied Biology in Southeast Asia" is the theme of a conference on applied biology to be held in Penang, Malaysia from 11 to 14 October 1979. The conference is being organized by the School of Biological Sciences of the Universiti Sains Malaysia in conjunction with the university's 10th anniversary.

The conference aims to facilitate exchange of ideas in applied biology between scientists, highlight progress in research areas within applied biology; and stimulate goal-oriented and applied research in biology.

Scientific sessions will be divided into the following fields: aquatic biology, entomology, plant pathology, parasitology, microbiology and general biology.

The conference will welcome papers on original scientific work which may cover any topic related to the theme. Those interested are requested to submit titles and abstracts of papers before May 30, 1979. Full text of papers should be submitted before September 1.

Registration fee is M$50 per participant and will cover: a souvenir program with abstracts of papers, reprints, tea/coffee, official lunches and dinners, and an excursion.

For details, write to the:

Organising Chairman
Conference on Trends in Applied Biology in Southeast Asia
c/o School of Biological Sciences
Universiti Sains Malaysia
Penang, Malaysia

MINDANAO AQUACULTURE RESOURCE DEVELOPMENT

The Mindanao State University in Marawi City and the SEAFDEC Aquaculture Department have agreed to collaborate in conducting research to enhance the productivity of aquaculture resources in Mindanao; designing and carrying out a techno-transfer program; and raising the level of manpower in aquaculture through grants and advanced training. MSU, through its Institute of Fisheries Research and Development and its College of Fisheries, is engaged in helping develop the aquaculture resources in Mindanao, Sulu and Palawan.

Shown signing the agreement are Dean D. K. Villaluz, chief of the Department (left) and Dr. Ali Macawaris, MSU vice president for academic affairs. Witness to the signing are (l-r) SEAFDEC director for administrative services and development J. M. Garay; SEAFDEC deputy director for planning and evaluation P. Manacop; Department deputy chief Noburo Hoshino; MSU college of fisheries officer-in-charge Fructuoso Escudero; MSU-IFRD acting director Warlito Sanguila; and SEAFDEC research director Jose A. Eusebio.

Phase 2 of milkfish program starts

IDRC has approved a $398,600 (Can) grant for the implementation of Phase 2 of the milkfish project.

The project aims to: perfect and standardise milkfish spawning technology; establish techniques for higher fry survival from collection to storage; investigate spawning grounds; develop economical and nutritious feeds from local sources; improve management and culture methods by nutrition and engineering, parasite and disease control; provide outreach application as well as training for operators, technicians and extension workers; and introduce and transfer innovations on spawning, fry development and culture. ●

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

Asian Aquaculture

P.O. Box 256
Iloilo City 5901, Philippines

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