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Asian Aquaculture

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Third World Outlook

Aquaculture in Asia, Africa and Latin America

Aquaculture production goals should be attainable with the necessary financial investments, scientific expertise, technological inputs, and support services. Provision of these is crucial to the development of aquaculture in Third World countries.

Fish farming is an age old practice – said to have started in Egypt 2,500 years ago – but a relatively new significant industry in most countries of the developing world. Its expansion and development has become the focus of interest of international, national and non-governmental agencies for its potential role in increasing food production, human nutrition, rural develoment, employment generation, and environmental management. However, as an industry, it suffers from inadequate support services and scarcity of well-trained practising aquaculturists; as a science, it has not benefited from a well-organized interdisciplinary systems-oriented research.

This is the gist of an FAO/UNDP report on the recently concluded Consultation on Aid Requirements for Aquaculture Development held in Pontevedra, Spain on 20-23 June, 1978. The consultation was sponsored by FAO/UNDP with participants coming from six international agencies and six countries including the Philippines. Participants from the Philippines were SEAFDEC Aquaculture Department executive director, Q. F. Miravite and newly appointed Asian Institute of Aquaculture director, Joseph C. Madamba.

Prospects

The consultation noted that of the total 70 million tons annual world fishery production, aquaculture contributes some 6.2 million tons of which

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SEAFDEC Aquaculture Department Marks 5th Year

The SEAFDEC Aquaculture Department is now five years old.

In fitting ceremonies July 7 to 9, highlighted by a review of accomplishments by officials of key divisions, the Department marked its first five years as one of three major arms of the Southeast Asian Fisheries Development Center – a multi-national treaty organization committed to the development of fisheries in the region.

In five years, the Department has grown from a 15-man task force working in make-shift research and administration huts to a community of 600 highly-skilled research and support personnel providing the lead role in aquaculture research and development in Southeast Asia. The research facilities now includes eleven stations equipped with modern research hardware. Over the past few years, the Department has chalked up a number of research breakthroughs, notably in prawn – a high potential dollar earner, and milkfish – an important food item for the masses.

The beginnings of all these can be traced to the pioneering research work of Dean Domiciano K. Villaluz, the Chief of the Aquaculture Department, who has steered the Department through its first five years. Early in his career

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Aquaculture Dept. in Five Years...

as a fisheries man, Villaluz, former dean of the College of Fisheries of Mindanao State University – which was the implementing agency for establishing the Aquaculture Department in the Philippines – drew attention to the life requirements of the developing world and inspired the Filipino aquaculturists, a new breed of scientists today, to work on alternative and more efficient ways of producing low-cost protein food for the people as well as opening new opportunities for rural employment.

Dean Domiciano K. Villaluz

Background

From a task force of 15 members from the Mindanao State University in 1972, then 82 staff members in 1973, the Department's personnel force rose to 425 in 1975 then to 600 in 1977. Its main station at Tigbauan, Iloilo, Philippines, was inaugurated in April 1975. Just as the actual research work began, it became necessary to establish outreach stations to support the main station especially for prawn and milkfish spawners as well as sites for seafarming projects. As of the close of 1977, the Department has set up 10 research substations in various parts of the Philippines.

The Department was established in July 1973 by a treaty agreement involving six nations, namely: Malaysia, Singapore, Thailand, Vietnam, Japan and the Philippines. It is one of three departments organized under the SEAFDEC Agreement; the two others are the Marine Fisheries Training Department in Bangkok, Thailand and the Marine Biology Research Department in Singapore. A Secretariat headed by a Secretary-General based in Bangkok coordinates the functions and programs of the three departments. SEAFDEC was established in 1968.

The Research Score

The research activities of the Department are aimed at the eventual elimination of the need to capture wild spawners and fry from their natural habitat through complete breeding and culture of fish and other aquatic species.

Research projects are presently organized under four major programs: Prawn, Milkfish, Freshwater and Seafarming. Each program covers the following areas: 1) seed production; 2) pond design, construction and management; 3) fish nutrition; 4) control of diseases, parasites and predators; 5) biological manipulation of stocks; and 6) prevention and control of aquatic pollution.

Prawn Program

Prawn researchers of the Department achieved the completion of the life cycle of the *Penaeus monodon* F. Employing the unilateral eyestalk ablation technique first achieved by the Department in 1975, 3,600 prawn spawners were produced in 1977 compared to only 1,360 in the previous year giving a 300% increase in spawner supply and demonstrating the feasibility of mass-producing sugpo spawners under laboratory conditions.

Studies on the effect of the quality of light on the maturation and rematuration of spawners and on the effect of various artificial diets on maturation, fecundity and egg quality of spawners are in progress.

The Department has concrete prawn hatchery tanks of 50–, 120– and 200-ton capacities which, in full operation, can produce 2.5 million prawn fry per run (18-20 days). This year, the projected production is 2.4 million fry. Studies are being conducted to solve hatchery problems such as water quality, parasites and diseases, and spawner quality.

Intensified research has been conducted on the small-scale prawn hatchery in an effort to make available prawn hatchery technology to small operators in the villages as a means of increasing food production, improving nutrition, and raising the level of employment and income at the village level.

The most significant problem faced in prawn pond cultivation is low survival in nursery and grow-out ponds. Research efforts at the Department's experimental ponds at Leganes, Iloilo – now equipped with a new laboratory complex – are directed towards the solution of this problem.

Milkfish Program

With assistance from the International Development Research Center of Canada, research was conducted on the domestication of wild captured sabalo (adult milkfish), broodstock development from pond-reared milkfish, induced breeding, larval rearing, ecology and pond cultivation and management. Techniques for catching, transporting and domesticating of sabalo have now been perfected.

In April and May, 1977, the Department accomplished a world breakthrough in milkfish research with success in the artificial fertilization and hatching of milkfish eggs. Adult female milkfish spawned under controlled conditions by hormone injection. The feat is a major stride towards solving the perennial shortage of milkfish fry particularly in the Indo-Pacific region. Department researchers are confident that with standardization of hormonal injection procedures, a mature female milkfish may now be induced to ovulate in captivity provided it is not badly injured prior to injection.

Success in the larval rearing of milkfish has also been achieved after conducting a series of experiments involving salinity and food preferences, rearing tanks and rearing conditions, giving rise to optimism in mass producing milkfish fry next year.

Seafarming Program

Mussels and oysters are of major interest to the Department since these are rich sources of cheap animal protein. Research under the Seafarming Program seeks to scale down bivalve farming technology to make it adaptable to rural areas with minimum inputs, to increase food production, improve nutrition and raise the income level of coastal villages. Work has centered on spat surveys to discover new mussel populations. Under a recent grant from the Government of Australia, plans are being prepared for the establishment of pilot farms on oyster culture in four provinces.

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Another recent major research achievement of the Department is the completion of the life cycle of the mud crab (*Scylla serrata*) and the stone crab (*Portunus pelagicus*) with success in larval development under laboratory conditions.

For its Fin Fish Project, the Department has bio-screened 15 species of marine fish out of which seven species represented by six families have shown potential for pond, cage, pen or cove culture.

Freshwater Program

Research studies are being undertaken on freshwater fish species to optimize utilization of lakes, rivers and other inland waters for food production with emphasis on the breeding, rearing and culture of *Macrobrachium rosenbergii, Penaeus monodon, Chanos chanos,* catfish, tilapia, carp, mullet, eel and others.

In analyzing the ecosystem of Laguna de Bay, the largest lake in the Philippines, Department researchers have found out that the lake is suitable for cultivation of most species, provided that present pollutants that flow into the lake are significantly decreased.

Asian Institute of Aquaculture

In further recognition of its role in regional and international cooperation and to assure concerted effort in developing and disseminating aquaculture technology, the SEAFDEC Council of Directors created the Asian Institute of Aquaculture as a unit of the Aquaculture Department at its 10th meeting in Manila in December 1977.

Before AIA was established, the Department, in cooperation with private, governmental and international agencies had undertaken training activities on the local, national and regional levels in the following subject-areas: Aquaculture Research Methodology, Aquaculture Management, Prawn Culture, Mussel and Oyster Farming, Small-Scale Prawn Hatchery Management, and Fishpond Engineering. Through its Training and Extension Division, the Department has trained over 900 pond owners, extension workers, pond technicians and agency observers since 1974. Forty-one of the trainees involved were participants from overseas. With the establishment of AIA, the training programs will be expanded.

RP Prime Minister Ferdinand E. Marcos congratulates Aquaculture Department officials on the latest research breakthroughs particularly in milkfish. Also in photo are Bureau of Fisheries and Aquatic Resources director Felix R. Gonzales (second from left) and natural resources minister Jose J. Leido, Jr. (extreme right).

TRAINING

Peace Corpsmen Special Pre-service Training and Fishpond Engineering Workshop Launched

The SEAFDEC Aquaculture Department is conducting two training programs this month: a technical pre-service training for 39 new U.S. Peace Corps Volunteers and a workshop on fishpond engineering and related topics.

This was announced by Atty. Jose A. Agbayani, Jr., Head of Training and Extension, Asian Institute of Aquaculture.

The special training for U.S. PCV's which started on July 23 will proceed until August 17. The topics covered in the training are: fish capture, freshwater, brackishwater, mariculture, research, and fisheries administration. The training is designed to help prepare the Volunteers for their work as fisheries extension workers and will be conducted initially in the Department's main station at Tigbauan, Iloilo before farming out to selected field sites depending on specialization required.

The workshop on fishpond engineering — scheduled from August 7 to 26 at Tigbauan, Iloilo — seeks (1) to provide a general understanding of the biology of cultured species and their environmental requirements, (2) create awareness and interest among aquaculturists on the inextricable relationship of engineering to aquaculture and (3) extend knowledge and skills in applying biological and engineering principles in the fish farm.

The workshop is open to fishpond owners/operators and their technicians, aquaculturists, faculty of fishery schools offering inland fisheries courses, and agency observers. It will be led by Dr. Juichi Katoh of the Laboratory of Environmental Hydraulic Engineering, Department of Marine Environmental Science and Technology, Tokyo University of Fisheries. This will be the third workshop of this nature conducted by the Department with Dr. Katoh as principal lecturer.

A number of international organizations and governments have signified interest or pledged financial support to specific projects of the Department. Among them are the International Development Research Center (IDRC) of Canada, the Australian Government, the New Zealand Government, the Federal Republic of Germany, the Danish International Development Agency (DANIDA), and the Canadian International Development Authority (CIDA).

Aquaculture Status, Prospects and Practices in Selected Countries

This issue of *Asian Aquaculture* attempts to provide a general view of the status, prospects, and requirements of aquaculture in the Third World. The main article on page 1 gives a scenario of aquaculture as an industry and as a research and development concern in *Asia, Africa,* and *Latin America.* R & D Notes spotlights on selected countries from each of these three regions, namely, India, China, Nigeria, and Brazil. In the case of China, focus is on her lake and reservoir fishery systems.

The reports were based on the following FAO documents: *Aquaculture Planning in Asia,* Dec. 1975; *Aquaculture Planning in Africa,* July 1975; *Supplement 1 to the Symposium on Aquaculture in Africa,* Oct. 1975; *Aquaculture Planning in Latin America,* December 1975; and *Freshwater Fisheries Aquaculture in China,* June 1977. The article on freshwater aquaculture research in India was contributed by Dr. Hiralal Chaudhuri, regional aquaculture coordinator of the SEAFDEC Aquaculture Department. Dr. Chaudhuri served CIFRI, India for 28 years and was head of the Institute's Aquaculture Division and administrative Head of the station at Cuttack before joining SEAFDEC in 1976. At present he is attached to the milkfish breeding program of the Department as consultant. Dr. Chaudhuri recently visited the IDRC Carps (Malaysia) Project at Malacca and the IDRC Aquaculture (Sudan) project at Khartoum, as a consultant to advise and assist the project leaders in the planning and implementation of the research program of the two projects.

Advanced Technology Generated in Freshwater Aquaculture in India

India's vast freshwater resources offer great potential for development of aquaculture. Although fishculture has age-old traditions in India, fish culture practices are mainly based on empirical knowledge without scientific understanding, resulting in low production. The average production is reported to be only about 600 kg per ha per yr.

With the establishment of the Central Inland Fisheries Research Institute (CIFRI) in 1947, planned scientific research on various aspects of pisciculture have been pursued and considerable progress made in the last three decades.

The main constraint in the development and expansion of aquaculture in India was observed to be the dearth of seed of cultivated species since the Indian major carps do not reproduce in captivity in ponds. Concerted efforts made by the scientists of the CIFRI at Cuttack led to a major breakthrough in 1957, when, for the first time, the difficult-to-spawn Asiatic carps were induced to spawn by pituitary hormone injections. The technique was subsequently further refined and standardized. Today it has become the most dependable source of mass production of seed of the cultivated fishes in India.

Recognizing the importance of the hypophysation technique developed at CIFRI, Cuttack, India, for the development of aquaculture, FAO/UNDP organized an International Seminar in 1969 at CIFRI to train participants from 11 countries of Asia and the Far East on this technique. The induced breeding technique is now very popular with the aquaculturists of many countries. Dearth of pituitary glands, however, has been one of the constraints to seed produc-

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Lake and Reservoir Fisheries in China

Background

The People's Republic of China, with a total land area of 9.6 million sq km and a population of some 800 million, has about 20 million hectares of freshwater.

Together, the traditional "five lakes of China" (Tungting, Poyang, Hungtze, Taihu, and Chao) make up about 1.4 million ha and yield some 70,000 tons of fish yearly.

Larger rivers are also fished although it was noted that little attention seems to be given to their management for fishery purposes. There are however small rivers and canals in the delta regions that are managed intensively for fisheries. These are stocked and provided with additional food materials so that productivity is as high as nearly 1,500 kg per ha.

Special Methods

The FAO mission noted and gave special emphasis on the five aspects of the Chinese approach to lake and reservoir fisheries: stocking, fertilizing, large-scale catching, subdivision, and bottom grading and clearing. Although these methods are not unique, these have often been regarded by other countries as not worth the high cost, according to the Mission.

Stocking

The practice of stocking a combination of grass carp (herbivore), silver carp (phytoplankton), along with such bottom feeders as mud and common carp, utilizes more of the natural production of the system. These species do not reproduce naturally in the still waters of lakes and ponds so that stocking must be regularly done. Although it needs extra work and facilities the system allows close control of stock size. It was felt that low labor costs and species that do not require

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Status, Prospects for Aquaculture in Nigeria

Background

Production from aquaculture is less than 10 percent of the country's total annual domestic fish production of 700,000 tons. However, there is a great potential for large-scale production; some 1 million ha of swampland are available in Nigeria's delta area for brackishwater culture.

The country's Third Development Plan 1975-1980 earmarked N$ 10 million for aquaculture development and research. This sum is about 10 percent of the total capital outlay for fisheries development and research during the Plan period. The program involves the stocking of irrigation dams and reservoirs as well as the construction of modern fish farms.

Construction of ponds is labor-intensive. Invariably, fishpond farming is a part-time operation. However, some half a million people are estimated to be engaged in some phase of aquaculture or the other.

Manpower

The main problem in Nigeria's aquaculture development is not land, labor or capital but technical skill. In some states, the extension staff of government experimental and demonstration farms are well-trained and could carry out surveys and supervision of pond construction and management.

Facilities

Nigeria has the following types of aquaculture installations: (1) hatcheries and breeding centers for raising fish seed for government production farms and private ponds (2) pond farms whose sizes range from 0.5 ha to 400 ha (3) man-made lakes and reservoirs (4) cages, which are purely for research purposes (5) indoor tanks, also for research purposes particularly in the study of *Clarias, Tilapia* and *Chrysichthys* and (6) oyster and mussel farms.

Prospects for Aquaculture Development in Brazil

Background

By 1985, the population of Brazil is projected to reach 142 million (108 m in 1974). Per capita fish consumption is 7.1 kg. In 1974, Brazil's fish production was 861,700 tons 13 percent of which comes from freshwater aquaculture. Brazil is a traditional exporter of crustaceans, principally prawn and lobster, and the "Piramutaba" fish species of the Amazon region. It also imports a substantial amount of dried and salted fish (24,600 tons in 1974).

By 1985, assuming that per capita fish consumption is maintained, Brazil would be needing some 1 million tons of fish. For 1985, it is estimated that the marine fishery production will go up to 400,000 tons. The deficit is expected to be filled up through aquaculture production.

National Fishery Plan

Brazil's Bureau of Fisheries Development, which is attached to the Ministry of Agriculture, has formulated a 1975-1979 national plan for fishery development which seeks to implement programs and projects designed to improve production at different levels through an integrated scheme of (a) research on fishery resources (b) manpower training (c) development of improved fishponds (d) strengthening of commercial fishing (e) development of fish ports (f) improvement of fishery laws, and (g) development of an effective fishery administration.

The Plan's long-term strategy is to establish aquaculture as a substantial source of animal protein at all levels in rural and urban areas.

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Filipino Aquaculturist Goes into Egg Production of Brine Shrimp

Brine shrimp, an essential feed for prawn larvae and milkfish fry is now being grown successfully by a private commercial fishpond operator, Atty. Ceferino de los Santos, Jr. of Iloilo Province.

Atty. de los Santos who is the author of *Modern Aquaculture for the Philippines,* an authoritative book written for the ordinary fish farmer, claimed he was able to evolve the technique for producing viable eggs of the San Francisco strain of *Artemia salina* with technical expertise provided by two SEAFDEC Aquaculture Department visiting scientists from the University of Ghent in Belgium, Dr. Patrick Sorgeloos and Mr. Etienne Bossuyt, and a Filipino researcher, Einstein Laviña.

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Atty. Ceferino delos Santos inspects one of his *Artemia salina* grow-out ponds.

Freshwater Aquaculture Technology in India.. *(from page 4)*

tion in several countries. The FAO Aquaculture Conference at Kyoto (1976), recommended establishment of a "Pituitary Bank" to facilitate supplies for seed production programs in developing countries.

The CIFRI, Cuttack, established a "Pituitary Bank" a decade back when pituitary extracts preserved in glycerine were ampouled and stored at the bank to be supplied on request to fish breeders all over India. In 1976, the CIFRI even supplied pituitary glands to FAO, on request, for other countries who were in need.

Success in controlled reproduction also opened up a new line of research in evolving superior strains of fish by selective breeding and hybridization.

Another important constraint in the development of fish culture was the heavy mortality (97-100%) of post larvae (early fry) encountered by the fish farmers. The Institute identified the various causes of mortality and evolved remedial measures. The improved nursery management technique generated at the Institute increased survival rate considerably (60-70%) and accelerated the rate of growth of fry by addition of growth-promoting substances with the feed. Production as high as over 6 million fry from a hectare of water in about two week's time has been achieved.

Polyculture technique of raising together a number of compatible species of selected cultivated fishes of different feeding habits, grazing in different ecological niches in the pond so as to utilize the available food to the maximum, has been successfully developed at the Institute. A decade of research with various quick-growing indigenous species in combination with selected exotic species developed the technology known as *Composite Fish Culture* and a maximum of about 10 tons per ha per yr of marketable fish have been produced with an average of 8 tons per ha per yr in dug-out ponds without any flow or circulation of water. Such high yields have been achieved by judicious stocking of a combination of several species in fertilized ponds provided with cheap supplementary feed of vegetable origin and by manipulation of stock. The production could be increased two to three times by intensive multi-species culture provided with well-balanced pelleted feed, elimination of the accumulated metabolites, provision of aeration devices, multiple cropping, and periodic replenishment of the old water. Highly encouraging results have also been obtained from studies on the utilization of domestic sewage for fish culture, control of noxious aquatic weeds and algae, culture of air-breathing fishes in swamps, and on pond fertilization.

The technology thus developed is now under verification in different regions of India under different agro-climatic conditions through the institute-based All India Coordinated Research Project on "Composite fish culture and fish seed production" and through the "Operational Research Projection Rural Aquaculture." The results so far obtained are highly promising.

For popularization of the polyculture technique in rural areas in an effort to develop the rural economy, the Indian Council of Agricultural Research (ICAR) has sponsored a project on "Rural Aquaculture in India" through the CIFRI, in collaboration and with the financial assistance of the International Development Research Center (IDRC), Canada.

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Aquaculture in Third World Countries.... *(from page 1)*

Asia's share is some 84 percent or 5.21 million tons, Africa 107 thousand tons, Latin America 70 thousand tons, and Europe 817 thousand tons.

The report stressed however that various projections of future production increases worldwide range from 5 to 10 times by the end of the century. Projected production goals of some 32 countries in Asia, Africa, and Latin America shows that Asia will attain about 4.26 million tons more, Africa 850 thousand tons more, and Latin America 1.55 million tons more per year – a total additional production of around 6.6 million tons per year – in ten years time.

Increased productivity, the Consultation declared, is expected to be achieved through (1) wider application of known technologies, including the expansion of areas under culture, (2) improvement of existing technologies to enable more intensive farming, and (3) development and utilization of new technologies.

Some experts have also noted that the reportedly declining marine catch and the new regime of the seas will push aquaculture into the forefront of the total fishery resource picture even faster.

Problems

Aquaculture is considered a labor intensive and high-risk bio-industry. Although it can be organized as a large-scale industry or as small-scale rural enterprises, the former would be more attractive to financial investors. However, in the developing countries, emphasis is and should be on the development of small-scale farming, as it lends itself very well to integration into a rural economy and can have an important role in overall rural development, the report said.

Success of such a pattern of development depends much on the support services such as extension services, production and distribution of inputs, and marketing facilities. These services, the report said, are at present rudimentary in most countries.

Technologies being recommended are not often, if at all, subjected to technology verification and ecological adaptation.

Though a practice of long-history, aquaculture as a science has not so far benefited from multi-disciplinary systems-oriented research. More scientific workers are getting involved in research on various aspects of aquaculture, but there is a scarcity of experienced practical aquaculturists with expertise on production management and extension work. In all countries, the lack of well-trained practising aquaculturists is a major constraint.

Despite the attention to aquaculture, it remains an unfamiliar field for administrators, financiers, and funding agencies. Appealing though it may be, there is a general reluctance to risk support. Existing credit schemes, grants, subsidies or other support services do not at present usually apply to aquaculture. (NEXT ISSUE: *DEVELOPMENT REQUIREMENTS OF THIRD WORLD COUNTRIES*)

India... *(from page 6)*

The project has recently completed the first phase of three years and demonstrated the feasibility of the technology in obtaining high fish yields in rural areas in the States of West Bengal and Orissa.

Technology in freshwater aquaculture in India has been generated, but unfortunately technology packaging and dissemination has been very slow and is yet to reach the farmers' level throughout India. The recent establishment of a *Krishi Vignan Kendra* and Trainer's Training Center at Dhauli (CIFRI) by ICAR and further intensification of the activities of the Extension wing of CIFRI would no doubt help in quicker transfer of the improved technologies generated at the Institute for the benefit of the end-users, thereby increasing the production of freshwater fish in the country.

China... *(from page 4)*

high protein foods are the most important factors in the success of this technique in China. It was also noted that bulk harvesting of stocks leaves time for other activities than fish catching. In China, it is the fisherman who usually produces the fish to be stocked.

In large lakes, harvesting is by conventional ways. But in smaller lakes and new reservoirs, quick large scale harvesting is done usually with seine nets up to 5 km long. Encircling nets and seine 1 to 1.5 km long are regularly used. Most of the work is manual.

The Chinese practice is to raise 15 or more pigs per hectare of water to provide manure to stimulate plankton growth. Green grass and vegetables are fed to grass carp which in turn produce fish manure and food for other fishes. "Feed one grass carp well and you feed three other fishes," the Chinese say.

Some Lessons

The FAO Mission pointed out that it is necessary to look at China's program of stocking, fertilizing, and fishing all available waters in the context of her emphasis on agriculture as the key to development and of the whole program of agricultural production that reflects the policy.

Cost-benefit ratio appear to be evaluated in terms of overall development rather than on an individual basis, it was stressed.

Brazil... *(from page 5)*

Development Activities

A priority move is to stock reservoirs and dams which today comprise some 2 million hectares. Brazil has launched a program of restocking in the different regional river basins by the industries responsible for the dams. The reservoirs are expected to produce about 700,000 tons by 1985.

Researches done at the Biology and Fish Culture Experimental Station in Pirassununga, Sao Paolo, on *Tilapia rendalli* confined in 14 sq m netted tanks and fed with a mixture of 60 percent chicken dung, 15 percent granulated feeds for laying birds, 15 percent ground maize, and 10 percent soybean made possible the production of 19.9 kg per sq m per year.

Research Priorities

Fisheries and related research in Brazil is undertaken or supported by 41 government institutions. The projects involve basic researches, development-oriented studies on fish culture, information-extension, and stocking of public reservoirs. Short term priorities include limnological studies, culture methods and economic studies, water potential for aquaculture, fertilization and feeding, pathological and pollution studies. The long term studies are those on the selection of indigenous and tropical species for aquaculture and breeding for aquaculture purposes, fish perservation, and by-products utilization.

Extension

There are no information and extension services specifically for aquaculture owing to the lack of basic information on aquaculture. Collating information is one of the immediate objectives of the present development plan.

Manpower Training

The manpower program is immediately aimed at producing technicians, on the supervisory level, for programs in regional basic researches and for information and extension.

Financing and Credit

The national fishery development plan provides a system of protection for aquaculture in the form of general fiscal incentives and bank credits for approved programs in which the Bank of Brazil, the Central Bank, the BNDE, and SUDEPE participate. The information campaign also includes educational programs on production planning and aquaculture techniques along with the application for and proper use of the loan.

Infrastructures

The aquaculture development plan provides for the establishment of 14 hydrobiological and fish culture stations with a total estimated cost of US $16.8 million. Operational cost of one station was placed at US $40,000 a year.

Acknolwedgement

Information source for this article is the report, "National Development Plan for Aquaculture in Brazil," which was translated from the original Spanish text to English by Cesar V. Recio of the Asian Institute of Aquaculture, Aquaculture Department, SEAFDEC.

Filipino Aquaculturist..

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According to De los Santos who is president of the Western Visayas Federation of Fishfarm Producers, Inc. and member of the Fishery Industry Development Council representing inland fisheries/ private sector, his interest in growing brine shrimp and producing eggs stemmed from a laboratory trial along these lines conducted early this year by the SEAFDEC researchers.

De los Santos announced he is ready to commercially sell canned highly viable (90 percent hatching rate) Artemia eggs at 30 percent less than the prevailing price. He revealed that current cost of importing eggs of brine shrimp is about US $75 per kg, tax free. In the local market, it is being distributed for about P785 for a 1.3 kg pack or around P603 a kilo. He is also ready to sell Artemia flakes for fish food.

The significance of this development lies in the tremendous reduction in cost of growing brine shrimp as feed and in the assurance of an important low-cost input to prawn hatchery operations, fry nursery ponds and aquaria fish food.

Meanwhile, De los Santos has been invited to present a paper on his work on the brine shrimp before the World Symposium on *Artemia salina* to be held at Corpus Christi, Texas, U.S.A. next year.

Research Director Promotes Recycling System in Integrated Plant and Animal Farming in Thailand

In two recent trips to Thailand, the Research Director of the SEAFDEC Aquaculture Department, Dr. Jose A. Eusebio, has created among Thai and Thai-based government, private, and regional institutions keen interest on the recycling system concept in integrated plant and animal farming.

At an ESCAP (Economic and Social Commission For Asia and the Pacific) sponsored expert group meeting on biogas development held in Bangkok on June 20-26, Dr. Eusebio introduced the information on aquaculture as practised in the Philippines involving the use of effluent to produce algae which are utilized as fertilizer, animal feed, and feed for fish raising. This was noted with interest by the expert group which urged, in its report, that a compilation be made summarizing the experience available in the Philippines to be the basis of a guideline for the development and management of aquaculture in conjunction with biogas plants. The Meeting referred to the importance of the processes mentioned in relation to protein production.

An offshoot of Eusebio's report to the ESCAP Meeting was his subsequent invitation by the Population and Community Development Association in Thailand and the Thai Ministry of Education to provide expert advise and assistance on the promotion and implementation of the system in Thailand.

The recycling system is an approach to maximizing food production, optimizing land use, and minimizing pollution in integrated plant and animal farming. The five components involved in the recycling system are: (1) algae production for animal feed and as plant fertilizer, (2) livestock, specifically pork, production, (3) biogas production, (4) rice and vegetable and mushroom production, and (5) inland fish production.

The recycling system showed a 35 percent return on investment, Eusebio said.

AIA Accorded International Status

Decree Provides P35 M Initial Funding From Philippine Government

The Asian Institute of Aquaculture formally established on May 23, 1978 as a unit of the SEAFDEC Aquaculture Department has been accorded international status by Presidential Decree No. 1475.

Signed by Prime Minister Ferdinand E. Marcos of the Philippines on June 11, the decree classifies the AIA as a foreign institution of special character, with an international student body, faculty, management composition and control.

The decree also provides for a contribution from the host Philippine Government of P10 million for capital outlay and local operating costs for calendar year 1978 and a yearly contribution of P5 million for the next five years, a total of P35 million.

Headed by former PCARR director general Joseph C. Madamba, AIA has been established to provide opportunities for regional and international scientists and technologists to conduct development-oriented research in aquaculture; provide training of scientific and technical level manpower in applied aquaculture research and development in Asia and other developing regions; promote regional and international cooperation among scientists, technologists, fish farmers as well as institutions; and provide opportunities for verifying and packaging aquaculture technology and disseminating the same to countries and institutions.

In promulgating P.D. 1457, Prime Minister Marcos recognized the need for an organization that will provide mechanisms for the development of technical and scientific manpower in aquaculture in Asia, particularly in SEAFDEC and ASEAN member-countries, to hasten the development of the aquaculture resources of the region.

The proposal for the development and implementation of AIA as a unit of the SEAFDEC Aquaculture Department was approved by the SEAFDEC Council of Directors at its 10th meeting held in Manila, 5-10 December 1977.

The Philippines is one of the five member-countries of SEAFDEC.

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