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Advanced technology generated in freshwater aquaculture in India

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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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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.