

Status of Research on Inland Fisheries in India, Nepal, and Sri Lanka

Catalino R. dela Cruz¹

Team Leader, Inland Waters Commodity
Philippine Council for Agriculture and Resources Research

This report presents information gathered during a short trip (November 14 to December 2, 1978) which I made to observe the recent developments in inland fisheries research in India, Nepal, and Sri Lanka. The trip was fruitful and gave me new perspective and insights into inland waters fisheries research and development in the Philippines. The following is a brief account of the inland fisheries of each country with emphasis on freshwater aspects.

India

India's present total fish production per year is approximately 2.2 million metric tons, of which 70% comes from marine and 30% from inland fisheries. The inland water resources are composed of brackishwater and freshwater natural lakes and manmade reservoirs and rivers. The freshwater resource is about 1.6 lakhs ha (1 lakh ha = 100,000 ha), broken down into 0.6 lakh under pond culture, 0.4 lakh ready for culture, and 0.6 lakh reclaimable area. Natural lakes and reservoirs covers 12 lakh ha, whereas rivers comprise about 27,000 ha.

Because of the vast inland water resources, the major thrust in fisheries is directed towards pondfish culture; lacustrine, estuarine, and riverine fisheries; and brackishwater development. The potential area for brackishwater fisheries is about 200,000 ha but its development is just beginning.

The major freshwater species for culture are major Indian carps (catla, mrigal and rohu), Chinese carps (silver, bighead, and grass), *Tilapia mossambica*, and air-breathing species such as *Clarias batrachus*, *Ophiocephalus* sp., *Anabas* sp., and *Notopterus* sp.



Catalino dela Cruz

The main research facility visited in India was the Central Inland Fisheries Research Institute (CIFRI) in Barrackpore, West Bengal. In addition, I also visited the Rahara Research Center operated by CIFRI and the state-owned West Bengal Fishfarm in Kalyani. The Rahara Research Center works on the pond culture of *T. mossambica*, *C. batrachus* and major Indian carps. It has an ongoing integrated project on the recycling of sewage wastes for fish and agricultural production. Part of the waste effluent, after passing through the primary and secondary sections of the treatment plant, goes directly to the fishpond, whereas the sludge component is used to fertilize the truck crops in the surrounding area. The estimated production of *T. mossambica* grown in 0.076-ha ponds in this set-up was claimed to be as high as 9,300 kg/ha per year, while production by five species of carp in 0.17 ha was 7,200 kg/ha per year. Tilapia is not well accepted as a food fish by the Indians, and consequently it is produced for fishmeal and feeds for high-priced species. Because of the high production obtained, the utilization of sewage for fish and agricultural production will be expanded by developing a 22-ha area for fishponds and rice-fish culture.

The Kalyani station is one of six state-owned stations collaborating with CIFRI in demonstrating polyculture of major Indian and Chinese

carps. The polyculture began at the station in 1972, and to date five trials have been completed. When six species of carps were stocked in production ponds of 0.12-0.15 ha, the highest production attained was 7,820 kg/ha per year at stocking density of 6,000 fish/ha. The stocking ratio of the six species was 10% each of grass carp, catla, and mrigal, 25% each of silver and rohu, and 20% of common carp.

There are other main inland fisheries stations in India which were not visited due to lack of time. These are the freshwater fish culture stations in Bhubanswar and Cuttack (Orissa), the riverine and lacustrine species station in Allahabad (Uttar Pradesh), and the brackishwater fish farm in Kakwip, West Bengal. The last station is for mixed culture of prawns and mullets.

The research programs of CIFRI for 1978 comprised 21 project areas in addition to three all-India coordinated research project areas:

1. Indian Fisheries Research Projects

- Optimizing production of fry, fingerlings and market fish
- Induced fish breeding and bundh breeding
- Selective breeding and hybridization
- Prospecting and collecting techniques for riverine carp spawn
- Culture of the freshwater prawn, *Macrobrachium* spp.
- Culture of air-breathing fish
- Culture of exotic fish
- Coolwater fish culture
- Freshwater aquaculture in and near urban areas
- Fish culture in running water
- Brackishwater aquaculture
- Fish farm design
- Frog culture
- Fish pathology
- Weed control
- Estuarine and brackishwater lake fisheries

¹Associate Professor, College of Inland Fisheries and Director, Freshwater Aquaculture Center, Central Luzon State University, Nueva Ecija.

- Sewage-fed fisheries
- River fisheries, especially the Hilsa fishery
- Beel fishery
- Fishery economics
- Catch statistics of riverine and estuarine fisheries

2. All-India Coordinated Research Projects

- Polyculture and fish seed production
- Culture of air-breathing fish
- Ecology and fisheries of freshwater reservoirs

Nepal

Nepal is a landlocked country, the fishery resources of which are mainly freshwater and composed of fishponds and natural waters such as lakes, reservoirs, and rivers. Development of the resources is in its infancy, and at present potential areas for fisheries are being surveyed.

The Fishery Development Office is under the Ministry of Agriculture. Fisheries are far less important to the country than grain crops.

The initial thrusts of the country towards developing its fisheries are production oriented. Demonstration projects in pond and lake fish culture for the people to adopt under the technical guidance of the Fisheries Office are being established at the Fisheries Development Centre. Nepal's Agriculture Development Bank is providing loans to interested families without collateral. Direct recommendation and supervision by the Fishery Development Office are required, however.

The major developmental effort is the Integrated Fishery and Fish Culture Development Project, a joint undertaking between His Majesty's Government of Nepal and the United Nations Development Programme (UNDP). The major activities under the project which began in 1975 are:

1. Fish culture in floating cages in the lakes of Pokhara Valley;
2. Development of fishponds in Bhairahawa
3. Fry production to support the needs of farmers in Pokhara, Bhairahawa and those engaged in paddy-cum-fish culture in other districts and in stocking the important lakes

4. Integration of animal husbandry (duck and pig) in pond culture and lake fish production

5. Marketing and processing of fish products

6. Boat construction program

7. Paddy-cum-fish culture

The Pokhara Valley has three important lakes whose total area is approximately 800 ha and which support some 300 families who depend solely on fishing for a livelihood. Because of this dependence, imposing conservation measures such as mesh size regulations and catch limits in the lakes has not been feasible. Cage culture and duck husbandry are now being introduced to the lakes to provide alternate sources of income for these families, the capital for which ventures can be obtained through loans. Once most of the fishermen have established their own cage culture or duck-raising ventures, plans for rational exploitation of fish stocks in the lakes can be implemented. The effect of introducing ducks in the lakes can be evaluated later, as baseline data on the lakes' limnology were taken before the ducks arrived.

Results of cagefish culture that began in May 1978 and continued until October 1978 in the private sector are encouraging. Cage owners will be able to settle their loans from the sale of fish produced in the second summer, or third at the latest. The income derived from the sale of fish during the first summer plus the value of remaining fish in the cages has already exceeded 50% of the loan. With regular maintenance, the cages with metal frames will last an estimated 10 years. The period for loan repayment is 10 years.

Integration of duck and swine husbandry with fishponds is also being demonstrated at the Hetanuda and Bhairahawa Fishfarms. To meet the demands for ducklings by prospective farmers, duck hatcheries with facilities such as open space for duck rearing and brooding and rearing houses are being operated under the full control of the Fishery Development Office at the Pokhara Fishery Development Centre, Hetanuda Fishfarm, and Bhairahawa Fishfarm. The total capacity of six egg incubators in the three sites is approximately 8,600

per month. The breeds of ducks used are Peking and Ng Chow (cross between Peking and local Hongkong breed).

The fish species for culture in ponds and cages, mostly in polyculture systems, are the Chinese carps (silver, grass, bighead) common carp or mirror carp, and major Indian carps (catla, rohu, mrigal). Using an arbitrary combination of these species, an average pond production of about 1 ton/ha per year can be obtained at a total stocking density of 5,000 fish/ha. The size of ponds ranges from 1-13 ropani (13 ropani = 1 ha). The common carp is the main species for paddy-cum-fish culture.

Sri Lanka

The fisheries of Sri Lanka are both marine and inland. About 90% of the fish production is from marine waters and only 10% from inland waters. Inland water resources are composed primarily of about 132,666 ha of man-made reservoirs and 120,000 ha of coastal lagoons and estuaries. Natural lakes do not exist. There are few or negligible household-type fishponds. As far as inland fisheries are concerned, reservoir fisheries are relatively more advanced than the brackishwater lagoon and estuarine fisheries. Production from inland fisheries was approximately 27,433 tons in 1978, and with the development efforts planned, production is envisaged to increase up to 50,500 tons by 1982. Of this, production from freshwater reservoirs (including the few ponds) will increase from 20,275 tons in 1977 to 47,075 tons by 1982 in comparison to production from brackishwater aquaculture which will increase from 1823 tons in 1978 to 3225 tons by 1982.

At present, the inland waters are being exploited through capture fisheries. Cages and ponds do not yet exist. Fishing pressure on the reservoirs is not great. A census taken in 21 reservoirs in 1973 indicated that 55 ha of surface area is available for every fisherman, and in 1976 in Polonnaruwa, 32 ha per fisherman.

Due to rising costs of marine products, development plans for the next few years are to intensify production of fish from inland waters. This will be done through:

1. Stocking of natural waters and initiating development of new freshwater ponds and brackishwater aquaculture in lagoons;

2. Producing fry from the fisheries stations for aquaculture activities and stocking the natural waters; and

3. Helping fishermen put up their huts and procure boats and nets.

To fill the demand for fingerlings, there are two large freshwater stations located at nearby reservoirs: one in Uda Walawe, established by the Chinese, and the other in Polonnaruwa. The function of the former is to breed mirror carps and Chinese carps for stocking in the reservoir. The station in Polonnaruwa produces *T. mossambica*, some common carp, and gourami. Unfortunately, this station was badly damaged by the November 24 cyclone that hit Sri Lanka.

Aside from the station at Polonnaruwa, five other stations exist or are being developed to produce fry of common carp, *T. mossambica*, and *T. nilotica*. In addition, these stations also receive fry and fingerlings from the Uda Walawe station for holding and stocking in reservoirs.

The only brackishwater fisheries station is located at Pitipana, Negombo. It is presently being improved after having been neglected for years. Its main activities are to gather statistics from catches in lagoons and collect fry for raising to fingerling size for distribution to small-pond owners. The species and number of fry collected from January 1978 to November 1978 were:

Fry of mullet and milkfish were reported to be abundant in some areas of the country.

<i>Mugil cephalus</i> (mullet)	138,000
<i>Chanos chanos</i> (milkfish)	235,000
<i>Etroplus suratensis</i>	24,000 (from breeding pond)
<i>Tilapia mossambica</i>	35,200 (from breeding pond)

Summary

In India, the research and extension efforts in inland fisheries and aquaculture are toward production of fry of Indian major carps and Chinese carps, as well as culture of fishes in ponds, lakes, reservoirs, estuaries and rivers. Emphasis in brackishwater fisheries is on prawns and mullets. Along with these activities is the nationwide trial and adoption of polyculture of the major Indian and Chinese carps and the culture of air-breathing species.

In Nepal, a landlocked country, fisheries are concentrated in small freshwater ponds and natural waters. Emphasis is on extensive development of ponds and lake/reservoir aquaculture integrated with animal husbandry. Paddy-cum-fish culture is also being encouraged. Indian major carps and Chinese carps are the principal species cultured. Tilapia is not being imported into the country because it might not be compatible with locally desired species.

Sri Lanka may be said to be in the

same state of fisheries development as Nepal. Development of its inland water resources was delayed or neglected because of its enormous supply of fish from marine sources. Freshwater reservoir fisheries are much larger and more advanced than brackishwater fisheries. Intensified production from brackish waters is planned.

Chinese carps, common carp, tilapia and some local species are cultured in freshwater, whereas mullet and milkfish are cultured in brackishwater.

Tan Investigates Potential of Carp Culture

Dr. Eddy S. P. Tan of the Department of Biological Sciences, Universiti Sains Malaysia, is currently investigating potential of local riverine carps as species for culture systems in riverine areas where these fish are a valuable source of animal protein and an important source of supplementary income. His research is being undertaken with the cooperation of the Pahang State Government and the Department of Wildlife and National Parks.

Carps being studied include *Leptobarbus hoeveni*, *Tor tambroides*, *Puntius bulu*, *Puntius daruhani*, and *Probarbus jullieni*. Basic

biology of these species has already been investigated, so an assessment of the seasonal availability of fry of selected riverine species is currently being planned to evaluate the possibility of restocking programs for rivers within Malaysia's National Park, as well as for culture purposes by the rural population. When fish of breeding size become available, an induced breeding program will be initiated.

For further information, contact Dr. Tan at the Universiti Sains Malaysia, Department of Biological Sciences, Penang, Malaysia.

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Ministry is presently assembling an interagency coordination and management body as well as taking necessary organizational steps to address this task. The Ministry of Agriculture is to be commended for this ambitious and aggressive undertaking which can add in a very meaningful way to the future animal protein needs of Egypt.