

Problems for the Conservation of Freshwater Fish Genetic Resources in India, and Some Possible Solutions

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Introduction

The concept of fish conservation in India is known from the time of King Ashoka (246 B.C.) when catching of freshwater fish was prohibited during the third Chaturmass (July to October-November) based on their breeding periods, which peak from July to September (Menon 1988). Prespawning and spent broodstock and young life history stages (in November) were thus protected. Rules and regulations prescribed how such living aquatic resources were to be used and assigned responsibilities for the upkeep of tanks (fishponds) and other waterbodies.

In 1873, scientists like Francis Day and Sir Arthur Cotton drew the attention of the then Government of India to large-scale slaughter of fish fry and fingerlings and pleaded urgent conservation measures (Paul 1990). After persistent pressure, the Indian Fisheries Act was enacted in 1897. It prohibited destructive fishing methods, such as dynamiting and poisoning. Based on this, the Provincial Govern-

ments prepared their Fisheries Acts from time to time and formulated rules according to their local conditions. These rules prevented the use of destructive fishing methods, restricted the creation and use of fixed 'engines' (dams, weirs, etc.) for catching fish, the mesh size of nets, the size of fish catches and the duration of the fishing season, and established fish sanctuaries (protected areas).



A fish farmer's catch from a pond developed under the Fish Farmers Development Agency (FFDA) in district Raipur, Madhya Pradesh State, India. (Photo by G.P. Dubey)

The close season for fishing was similar to that of the Ashoka period.

During the last few decades, certain states (e.g., Punjab, Haryana and Himachal Pradesh) have promulgated and enforced rules successfully, whereas others have not. Enforcement has not been popular. For example, in Madhya Pradesh, Uttar Pradesh and other states, fishers, tribals and others living on the

banks of rivers do not like any restrictions to be placed on fishing. A close season (breeding time) is beneficial to them, but even during that period they put emphasis on fishing and ultimately get permission from the authorities.

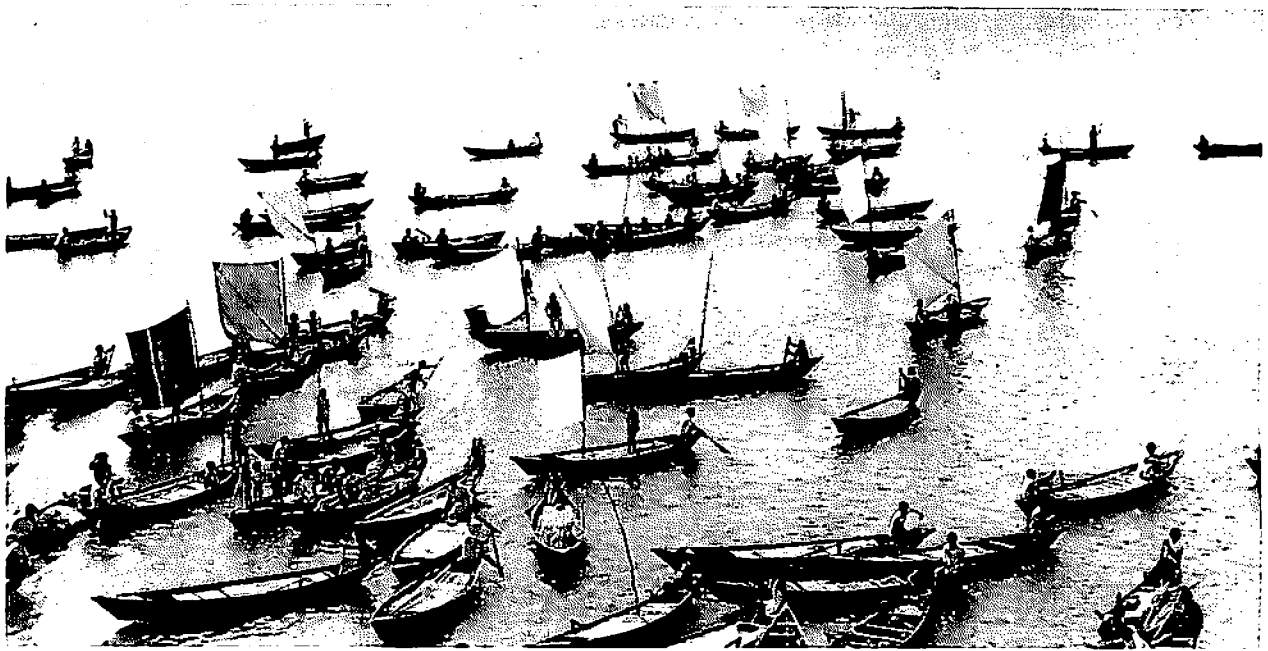
With the rapidly growing human population, water resources are coming under increasing pressure from competing and often conflicting demands. To conserve living aquatic resources, new Acts have been promulgated; e.g., the Water (Prevention and Control of Pollution) Act, 1974 and Cess Act, 1977; the Wildlife (Protection) Act, 1972 with rules, 1973; the Environmental (Protection) Act, 1986; and the Insecticides and Pesticides Act, 1968.

Despite such enactments and rules, many problems remain. Fisheries are declining in most rivers and many fish species, particularly endemics, are greatly threatened. A few are on the verge of extinction: e.g., chital (*Notopterus chitala*), *Tor* spp., *Semiplotus semiplotus*, *Bagarius bagarius*, *Puntius chilinoides*, *Labeo potail* and *Puntius jerdani* (Menon 1988).

A Complex of Problems

Conservation of freshwater fish genetic resources depends upon effective management of inland fisheries, so as to ensure their sustainability. Many interconnected problems are involved, among them:

- Major engineering works like dam con-



A view of cooperative fishing in the Gandhi Sagar reservoir which covers 66,000 ha area; located on the river Chambal, Ganga Basin, Madhya Pradesh State. Every two fishers own a boat and about 400 boats operate everyday except during the close season (breeding period). (Photos on this page by G. P. Dubey)

struction and barrages for irrigation, hydropower, drinking water supply, flood control, etc., have helped self-reliance for food and socioeconomic development but have had negative impacts on important endemic and migratory food fishes such as mahseer (*Tor tor*, *T. putitora*, *T. khudre*), hilsa (*Hilsa ilisha*) and on many small species; e.g., *Glyptothorax lonah*, *Noemocheilus dayi*, *Gariagotyla sp.*, *Gageta cima*, *Ompak pabda* and *Ailia coila*. There has been no legal provision to conserve and promote fisheries during the planning for these structures. For example, after the construction of the Farakha barrage, river Ganga in West Bengal, 10 km upstream of the border of Bangladesh, the hilsa fishery, once abundant in the Ganges up to Allahabad, was 83-98% depleted. The Central Inland Fisheries Research Institute (CIFRI) has now established a hilsa farm for production of seed for stocking in the upper reaches of the Ganges. Similarly, mahseer (*T. putitora*) angling spots on the Sutlej and Beas rivers are now just names, because the large fish have disappeared.

- Unregulated development of dams and reservoirs, without environmental planning, has reduced the floodplain breeding

grounds of important commercial fishes; especially those of the Indian major carps that spawn in the Ganges. Collection of riverine seed of carps and mahseer from the Narmada river, which formerly yielded hundreds of thousands per day, no longer gives realistic yields for farmers (Dubey 1959).

- Thermal effluents from power stations, established on certain reservoirs [e.g., Rihand (Ganga Basin) and Sarni (Narmada Basin, Madhya Pradesh)] have changed their temperature and overall ecology. In the Rihand reservoir, power station ash has blanketed rivers and the reservoir bed with reduction or elimination of benthic fauna and spoilage of fish breeding grounds (Jhingran 1989). Chatterjee and Sharma (1994) observed that, in the Sarni reservoir, the Satpuda thermal power station caused excessive growth of macrophytes and changed the reproductive cycle of fishes.
- Toxic chemicals, including agricultural pesticides and indus-

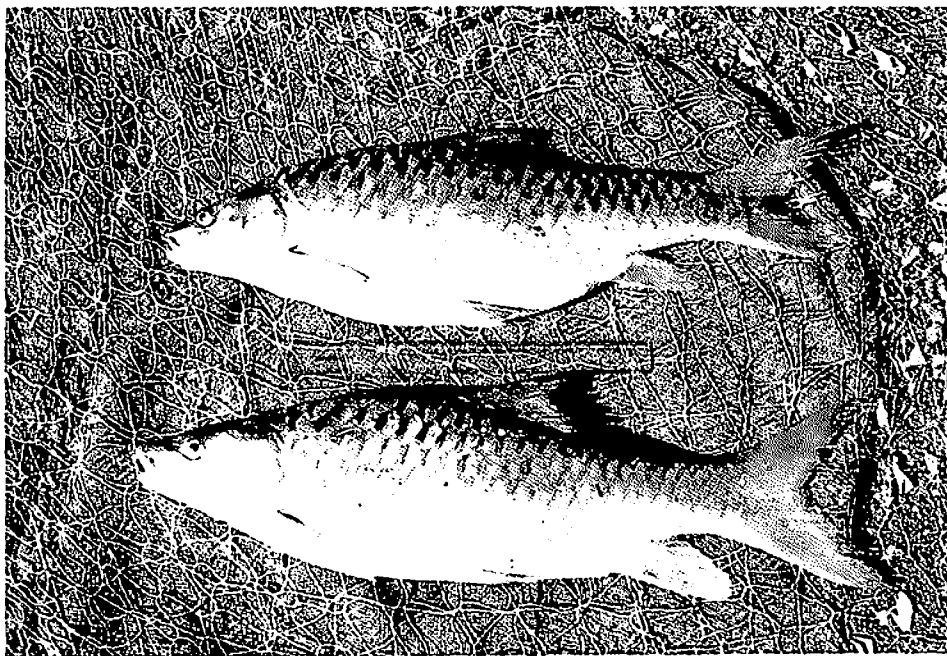
trial wastes find their way to aquatic ecosystems, harm fish and put fish consumers at risk (Jhingran 1990). There have been mass mortalities due to effluent



A good harvest of cultured fishes, mostly *Catla catla*, in the Gandhi Sagar reservoir, through cooperative fishing.

loads, particularly in the summer. About 2,573 t of pesticides are used annually by the agricultural sector in the Ganga Basin. This has increased the accumulation of DDT in molluscs (65-150 ppm), fish (31-460 ppb), plankton (15-150ppb) and sediments (21-70 ppb). Damage to liver cells, anemia and slower growth in *Oreochromis mossambicus*, *Labeo rohita* and *Cirrhinus mrigala* have been attributed to this (Jhingran 1989). It is essential that anti-pollution legislation is strictly enforced.

- Deforestation in the catchment areas of rivers and reservoirs, causes massive soil erosion during rains and the consequent sedimentation destroys the breeding grounds of some fish (e.g., major carps in Gandhisagar Reservoir in Madhya Pradesh and mahseer [*T. tor*] in Bhimtal and Naini Lakes in U.P. Himalayas) and harms the benthos and the fisheries in rivers and reservoirs. There is no legal check on this.
- Overfishing in rivers is widespread, despite regulations to the contrary. Examples are mahseer fishing in the Beas in Himachal Pradesh and major carp fisheries in the Narmada river.
- The introduction of certain exotic fishes like silver carp (*Hypophthalmichthys molitrix*) have already created adverse effects on important indigenous commercial fishes like *Catla catla*. A small consignment of 360 early fingerlings of silver carp was brought to India for the first time in 1959 from Japan and 47, ranging from 0.5 to 2.5 kg, had accidental access to the Govind Sagar reservoir in Madhya Pradesh State (M.P.) from the nearby Deoli Farm in 1971-72. The fish started appearing in catches from 1974. In 1977, fingerlings were caught indicating establishment in the reservoir. Later catches started increasing from 0.6 t (0.01%) in 1977-78 to 334 t (61.3%) in 1986-87. The landings of catla, which stood at 210 t (28.6%) in 1977-78 decreased to 36.7 t (6.8%) by 1987-88. By 1988-89, the landings of silver carp comprised nearly 80% and had almost replaced the indigenous catla (Jhingran 1989). Similarly, tilapias (*O. mossambicus*) in the Vaigal reservoir in South India replaced almost all other fishes, including major carps



A pair of mahseer (*Tor tor*): once abundant in Indian rivers, now endangered. (Photo by A. Ahmad)

and other indigenous fishes, and comprised 99% of the total fish in 1964-65 (Anon. 1992).

There are no legal provisions to check the introduction of exotic fish in the country and diseases can cause serious problems. Epizootic ulcerative syndrome has spread from the waters of West Bengal to other parts of the country (Das 1988). New Acts and Regulation, like the United Kingdom's Diseases of Fish Act 1983 are needed.

The Role of Central and State Government

Since the enactment of the Fisheries Act of India in 1897, and the subsequent promulgation of rules in the different states, riverine habitats in India have deteriorated. Therefore, legislation urgently needs revision. In 1944, the then Imperial (now the Indian) Council of Agricultural Research (ICAR) discussed legislation for the conservation of inland fisheries and collected views from all provinces and state governments, but no decisions were taken. Further, unsuccessful attempts to revise the Act have been made from time to time to make it more effective. The National Commission of Agriculture (NCA), in a 1976 report, reviewed the history and status of leasing waters and found that leasing generally failed to promote conservation and development. The ICAR drafted a model bill on Fisheries

in 1989 and circulated it to all states. Recently (1993-94) the Ministry of Agriculture, in charge of fisheries, attempted to revise the 1897 Act and rules but nothing concrete emerged. A meeting of the Technical and Legislative Committee on Restoration of Fisheries in the Ganga river system, hosted by the CIFRI in 1990, also brought no results.

In 1990, the Technical and Legislative Committee of the Government of India on Restoration of Fishes in the Ganga River System suggested that the fishing rights of the Inland waters vested in other departments of State Governments (e.g., irrigation, public health, etc.) should be transferred to the Fisheries Departments of the States for all fisheries purposes. For fishing in rivers, canals, estuaries and backwaters, a licensing system should be adopted and administered by the State Government after making proper provision of rules, acceptable to each State, keeping in view the local conditions. Further, we suggest that effective systems to limit entry should be adopted for fishing in reservoirs and beels; e.g., licensing, royalties, leasing, etc.

Before new legislation is finalized to safeguard endangered fish and fisheries, interstate and international coordination are essential. Most important rivers pass through a number of states and the important Himalayan rivers (like the Ganga/Indus/Brahmaputra and Irrawady) pass through other countries; e.g., Bhutan, China, Myanmar, Nepal and Pakistan.

Suggestions for Effective Measures

In order to conserve the fish genetic resources of India, particularly the endemic species of inland waters, we suggest the following:

1. The Fisheries Departments of the different states should have complete control of the fishery rights of inland watercourses and waterbodies.
2. Revision of Fisheries Act of 1897 of India should be done immediately by the Central Government and the Acts of different states should also be revised. As far as possible, common rules should apply in all states.
3. Auctioning of river and reservoir fishery rights should be abolished, because license owners could kill all the fish in waters for which they hold fishing rights.
4. As suggested by NCA (1976), licensed entry to fishery in rivers and other waterbodies except ponds and tanks would be appropriate. In reservoirs, a royalty system should be followed to benefit fishers. When a reservoir is created on a river, the fishers, including tribals, who have been fishing in that area, would prefer to continue fishing in the reservoir. Fisheries development would be done by the Department of Fisheries and fishers could be allowed to fish after paying a certain fixed rate per kilogram. This system ensures some income to the Department to set against development costs and the fishers, after paying fixed royalty charges, are free to sell their catch whenever they get the best price.
5. The rules should ban fishing with dynamite or poisons.
6. The rules should ban the catching of certain important endangered fish species such as mahseer (*Tor spp.*).
7. The punishment for breaking rules should be severe enough to deter offenders, as has been attempted in the Wild Life (Protection) Act of India (1972) and the Environment (Protection) Act (1986).
8. Detailed Environmental Impact Assessments (EIA) should be carried out before implementing any projects which might have negative impacts on fish and their habitats and management plans for ecologically sustainable development should be adopted (Afroz 1988).

Construction of dams, barrages, canals and weirs, etc. for national development should keep in view the potential for requirements of fishery development and maintain adequate flow in the rivers for the breeding and conservation of fish, especially indigenous species.

9. Dam and reservoir fisheries should be closed for about two months, during the rainy season, to safeguard prespawning and spent fishes.
10. Fish sanctuaries should be established in consultation among experts from the State Fisheries Departments and local people, particularly those inhabiting the river basin and depending upon the fishery resources. Deep pools in rivers should be designated as sanctuaries.
11. Rules should be formulated to control the introduction of exotic species and diseased fishes.
12. The enforcement of rules and the protection of river fisheries require the creation of a river police force under the Fisheries Departments; provided with necessary equipment, including motor boats. Here again the participation of local people is needed.
13. Factory effluents should be treated by appropriate physical, chemical or biological methods before discharge into rivers or reservoirs.
14. Discharges from sewage treatment plants should comply with the provisions of the Water (Prevention and Control of Pollution) Act, 1977.
15. There should be frequent monitoring of waterbodies to assess whether water quality is suitable for healthy fish and other aquatic biota.
16. Deforestation should be prevented close to rivers and their tributaries, on res-



Fisher with gear to exploit small fishes, in a tributary of the Narmada River: a major factor responsible for declining fish populations in rivers. (Photo by A. Ahmad)

ervoir catchments and in other environmentally sensitive areas, so as to check soil erosion. For this purpose, the Forest (Conservation) Act (1980) should be strictly applied. Large-scale afforestation of catchment areas should be carried out to rejuvenate springs and streams.

17. Whenever possible, pesticides and agricultural wastes should be properly treated before their discharge into waterbodies.
18. Pollution associated with the power plants, whether nuclear or conventional, should be monitored and controlled.
19. Hatcheries for the propagation of endangered and commercial species should be established at important river sites.
20. Sustained awareness programs should be established in the vicinity of the rivers and other waterbodies to encourage the conservation and management of fish genetic resources.
21. An International Coordination Committee should be established, with two



Chital or Moi (Notopterus chitala) which is on the verge of extinction in Nasmoda River due to overfishing and other human activities.

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or more countries participating, to ensure effective management and long-term sustainability of shared water resources; patterned after the Helsinki Commission¹, which covered the protection of the marine environment of the Baltic Sea.

Social Issues Involved in Protection of Fishers' Earnings

The many fishing families whose livelihood has traditionally derived from riverine fishing in rivers and, for the last few decades, from reservoirs now face increased poverty because of the auctioning of rivers and reservoirs in some states, widespread overfishing in rivers and inflation. Most live below poverty line. In India, as per the Integrated Rural Development Programme (IRDP) Guidelines, any person getting an average income below Rs.11,500 (US\$1=Rs.31) per annum is termed as living below the poverty line. In States like Madhya Pradesh, most of the tribals (35% of the population) and many fishers are below the poverty line. The auctioning system has displaced them, so that many have had to take low paid jobs; e.g., as domestic servants or landless laborers. Attempts to help them include the introduction of a licensing sys-

tem, in place of the auctioning system in a number of states; e.g., Rajasthan and Uttar Pradesh (Welcomme 1985).

In reservoirs, fishing is best conducted under a fixed royalty system. This provides the fishers confidence that the resources belong to them and they then take extra care that no undersized fish are taken. It also encourages them to form societies to earn a better living, but many societies have failed. In each State, there is a Department of Cooperation. Its main function is to help people to form cooperatives for agriculture, animal husbandry, fisheries and small-scale industry. However, Fisheries Departments could make better provisions and rules for fishing cooperatives.

There should be more opportunities for fishers, tribals and harijans. As they get low catches from capture fisheries, they should be provided with small tanks (ponds) for fish culture, as envisaged by the Fish Farmers Development Agency (FFDA). FFDA was set up by the Government of India during the Fifth Five Year Plan, in order to develop inland fisheries. Its general objective is to popularize improved techniques of fish culture (NCAER 1981). It has allocated 10-15-year leases "Panchayat" on tanks (belonging to the village community) on a priority basis from 1978-79, benefitting over 290,000 farmers, most of them below the poverty line.

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