

Impact of Dams and Siltation on Fish and Fishers of Ganga River

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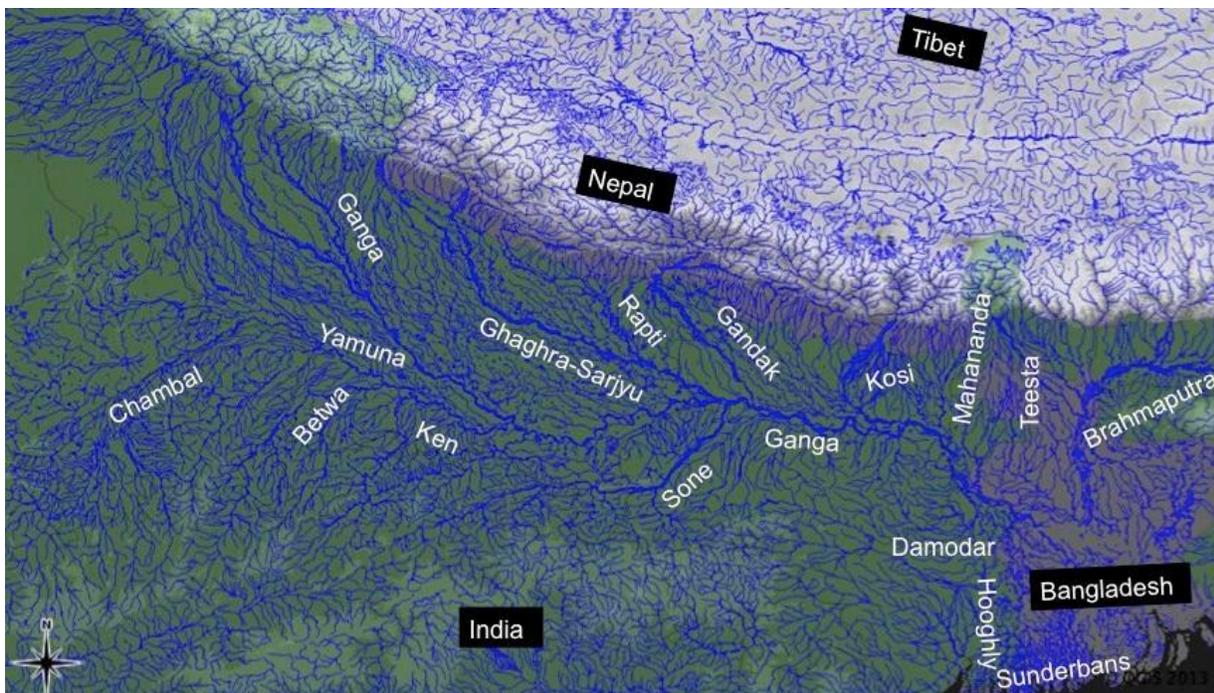
India stands second in terms of fisheries production in the world with a production recorded at 9.3 million tonnes (m T). 60% (5.8 m T) of the 9.3 m T is contributed by inland fisheries (FAO FISHSTAT 2010). Inland fisheries sector of India is not only a livelihood provider (75% of 14.49 m fisherfolks are from the inland sector), but a crucial source of food/ nutritional security to millions of poor lining the banks of its 7 m ha of inland water area including 45,000 km of rivers, 1.2 m ha of floodplains, lakes and wetlands etc. Riverine fisheries are a mirror of riverine health. Rivers in India are facing multiple problems of severe pollution, over extraction, encroachment, dams and barrages which cut off the connectivity of the river with its associated ecosystems, climate change, deforestation in catchment areas. According to Central Inland Fisheries Research Institute (CIFRI) “severe and drastic changes in the entire hydrological cycle of the river by dams and water abstractions has affected recruitment of most of the species. Hydrological modification, absence of water in rivers, obstacle to migration, changes in salinity, changes in sediment, loss of riparian areas and floodplains brought about by dams are perhaps the most important reason behind the dismal scenario of riverine fisheries. Riverine fisheries have been a blind spot in Independent India, despite the fact that they provide nutritional and livelihood security to millions of people. In the post independence water management discourse, river has been equated to water and water to irrigation, water supply, and hydro power. The profound impacts of irrigation, water supply and hydropower dams on sectors like riverine fisheries have been entirely ignored.

The Indian inland waters are also home to 877 indigenous species of freshwater fishes and 113 species of brackishwater species. Though our inland waters are biodiversity rich supporting millions in terms of fisheries-based livelihoods and / or food (cheap protein in the form of fish), this very environment is constantly under threat of depletion and degradation due to changed land and water use pattern, in the name of development. The major culprit are the 5,100+ large dams of India that hamper water cycle by drying up rivers, changing hydrology, increasing sedimentation, concentrating pollution/ pollutants, etc. This in turn blocks migration, destroy spawning grounds, spawning cues, etc affecting the fisheries and thereby fisheries-based livelihoods as well as the source of cheap nutrition for the poor. Similarly, water pollution, over fishing and introduction of exotic species are also factors adversely affecting freshwater fisheries.

Gangetic River Basin

Ganga River, from her headwaters to the delta, along with hundreds of her tributaries drains across northern and eastern India, flowing through 10 states in India and also in Nepal and Bangladesh. These rivers form one of the largest alluvial mega-fan regions of the world, and deliver huge quantities of sediment from the Himalayas to the northern Indian plains and to the Bay of Bengal in the Indian Ocean. The Gangetic floodplains shape not only landforms but also complex human cultures that attempt to stabilize themselves and adapt to the constantly changing riverine forces. Biodiversity, hydrology, geomorphology and social dynamics influence each other through constant interaction and multiple feedback mechanisms. The dynamic balance of these factors triggers opportunities for spawning, reproduction, population dynamics and viability, migration and movement of freshwater species, including fishes, river dolphins, otters, crocodilians, turtles, invertebrates as well as terrestrial biodiversity.

Fish Diversity in the Gangetic Basin



Riverine fisheries of the Gangetic basin support one of the largest fishing populations of the world, about 10-13 million riverine fisherfolk and about 300 freshwater fish species. In the Gangetic basin, fisheries are practiced in a range of diverse freshwater habitats including natural and man-made, lentic (stagnant water) and lotic (flowing

The major rivers of the Gangetic Basin (Based on 'hydro1k-rivers-Asia.dbf').

water) ecosystems. Natural freshwater areas include large floodplain rivers, non-perennial rivers, perennial and seasonal streams, cold-water rivers and streams, glacial lakes, estuaries, tidal rivers, floodplain wetlands, oxbow lakes, grassland swamps and marshes. Manmade habitats include dug or built-up wetlands, ponds, man-made reservoirs, dam reservoirs and canals. To the fisher, flow velocity, depth profile, substrate type, vegetation structure, current patterns and habitat stability are key indicators for fishing effort allocation and logistical decisions. The floodplain fisheries are dominated by major and minor carps (Cyprinidae), catfishes (Siluriformes: 6-7 families), Clupeidae, Notopteridae and a mix of many other families. Major carps and the Clupeid fish, Hilsa (*Tenualosa ilisha*) and some large catfishes form the most valued catches across most parts of the Gangetic floodplains. Major carps, the most preferred freshwater food fishes, include species like Catla, Rohu, Mrigal, Mahseer etc. exhibit potamodromous (along freshwater upstream-downstream gradients) migration. These fishes have suffered serious declines due to overfishing, pollution and dams. In wild fisheries, catfishes come lower in the preference order, but with the decline of carps, medium and small catfishes have become the main fishing targets. Further, as most catfishes are sedentary and do not show long-distance movements, the fisheries have completely switched from carp- to catfish-targeting fisheries. The estuarine fishery in the Hooghly and Sunderbans tidal rivers in West Bengal is dominated by shellfish (prawns, mud crabs and shrimp), Clupeidae and Engraulidae, Sciaenidae, catfishes of the Ariidae and a far more diverse set of families compared to truly inland fisheries. These fishes are of high commercial importance and are in high demand by professional sport fishers and anglers, apart from being highly prized as food locally. Mahseer in particular, have recently led to the opening of new markets of luxury wildlife tourism that is based on angling and recreation in the Western Himalaya.

Fisher communities in Ganga

Around 10-13 million people in the Gangetic floodplains are estimated to be dependent on fish resources for their livelihoods, directly or indirectly. However, accurate estimates of active traditional and non-traditional fisher populations are still wanting. It is important for any discussion on fishing communities to clearly separate traditional fishing communities from ‘non-traditional fishers’, who may be practically from any other local community and with the possession of other livelihood options, but also opportunistic fishing, due to unrestricted access to imported nets and gear available in markets to anyone. Traditional fishing communities were always the craftsmen of their own nets and gear, and also possess remarkable ecological knowledge about rivers, fish and biodiversity, their breeding biology, ecology, seasonality, and distribution. Of course, with the degradation of fisheries throughout the Gangetic plains, the traditional knowledge and practices of fishing are eroding fast. Hence such knowledge needs to be documented well, especially from old fishers with whom it still persists, to

identify historical baselines of river fisheries with a different, past ecological reference. Traditional fishing communities today form a highly marginalized, politically unorganized and socio-economically impoverished people. Caste discriminations and political history form the chief reasons for their poverty and subjugation over centuries of fish working. But the present condition of rivers does not seem to offer hope to any improvement in their economic position unless and until there is collective voicing of their concerns, especially against large-scale water engineering projects that threaten their livelihoods. With regards to their economic viability and status, a large proportion of the traditional fish workers fall Below the Poverty Line (BPL), and are recorded as Economically Backward Castes.

Major threats

i. Dams and flow regulation of Gangetic basin:

The key problem of fisheries today is that low level of water in the dry-season, because of flow regulation by dams, barrages and hydropower projects. Release of more water is needed for the protection of riverine fisheries in the Gangetic basin. Widespread river habitat degradation, industrial, agricultural and domestic pollution, altered flows and modification of sediment and nutrient fluxes by dam projects, and resource overexploitation (by fisheries, agriculture or industry) have had major consequences for the unique biodiversity and fisheries of floodplain rivers across Asia. Obstruction and fragmentation of river flow, habitat destruction, accelerated erosion and siltation, long-distance water diversions (involving huge amount of transmission losses and waste) and poor flow releases are the major direct threats of dam-canal systems in the Gangetic plains.

ii. Flow volume problems:

Lower-than-minimum flows have been consistently recorded across the Ganga, Yamuna, Chambal, Kosi, Sone, Ken, Betwa, Ghaghra and Gandak rivers. The reduction of freshwater discharge reaching the Sunderbans because of the Farakka barrage has led to high degree saline ingress throughout the estuary, causing die-offs of considerably large tracts of mangroves and aquatic vegetation, as well as severe losses to the upstream fishery. Downstream, fishing practices suited to brackish and fresh waters now have to adapt to saline intrusion into the estuary's waters. Globally, fragmentation and flow regulation have caused the most severe impacts through drastic alterations to riverine biota and ecology. Low flows and fragmented connectivity of river channels lead inevitably to fish population declines and breeding failure. Over time, dams have probably led to genetic isolation of fish populations as well as river dolphin / crocodile populations, destruction of fish breeding habitats and spawning triggers and loss of valuable wild fish germplasm. These losses are so large in their ecological value and opportunity costs that they cannot be recovered with artificial fish culture techniques or hatcheries.

iii. Aggravation of pollution effects:

The Ganges basin is one of the most polluted large river basins in Asia, especially with regards to domestic sewage and agricultural runoff. Poor flows reduce the dilution and self-purification capacity of river water to reduce concentration of pollutants and local impacts on fishes. Agricultural fertilizers (organophosphates, organochlorines, nitrates etc.), heavy metal pollution from industrial effluents, thermal power plants, oil refineries, distilleries and tanneries, and nitrogen-rich sewage, waste-water and non-biodegradable substances such as plastics, mercury, radioactive compounds and hospital wastes can cause fish kills or even worse, lead to high levels of toxicity in tissues. Pollution problems are especially acute in highly regulated river reaches, especially around Delhi (Yamuna River), and the Gomti at Lucknow, Yamuna until Panchnada in UP and Ganga River at Kanpur, Allahabad, Varanasi, Patna, Barauni, Bhagalpur and Farakka.

iv. Siltation in dam reservoirs and barrage gates:

Excessive siltation in the Ghaghra barrage has led to, as per local fishers, breeding failure in *Labeo angra* (Ghewri), a preferred spring-fisheries target in the region. The fishers claimed that over the past 5 years they have not captured a single fish with eggs inside it, and also added that catches have plummeted heavily. Siltation of gravel/sediment in reservoir or storage zones is a problem of huge magnitude for fisheries, especially through breeding failure. Accumulated silt in reservoirs is estimated to be so high (in tens of meters height) that it cannot even be easily flushed out, and leads to nearly 60-90% reductions in sediment fluxes of rivers. Siltation adds to obstruction of flow release through barrage gates. In the Farakka barrage, sediment load accumulation is leading to breakage of gates every year, adding to maintenance costs.

v. Habitat destruction and alteration of erosion-deposition dynamics:

Soil erosion by erratic and sudden releases before floods can potentially lead to alteration and destruction of fish breeding habitats and stock depression. Changes in depth and flow velocity lead to fish not being able to receive natural physiological cues for movement and spawning that are otherwise provided by variability in discharge. Flow alteration also alters hydrological connectivity and sediment transport with wetlands and confluence channels during flooding. As a result these productive breeding habitats often become unavailable for catfishes and carps. These factors together become a problem for pre-settlement of fish juveniles and recruits, which move into the main channels.

Mitigation measures

Given the current state of riverine fisheries, there is an urgent need to consider possibilities for large-scale ecological restoration of rivers by modifying dam operations and improving ecological flows.

- a. Provide enough water, adequate natural flows in all rivers. Allow fish movements upriver, currently blocked by large dams and barrages. Stop new dams and mindless, high-cost, destructive and unsustainable engineering projects such as river interlinking.
- b. Ban on destructive practices of fishing, especially mosquito-netting, poisoning, dynamite-fishing, shooting net operation.
- c. Fishers are in need of government loans or credit, technical know-how, permits and I-cards, housing, education and displacement packages.
- d. Clearly define fishing use and access rights across all rivers, provide clear guidelines on multi-objective management of fisheries amidst other economic activities
- e. Urgent need to reduce the presently excessive river pollution, especially industrial but also domestic wastes.
- f. Poor fishers require alternative livelihoods. Other alternative livelihoods include working with river management authorities, conservation agencies, ecotourism, agriculture etc.
- g. Focus on community-based management of river fisheries and help it develop in an ecologically friendly and sustainable manner by formation of co-operative society.
- h. Needs to be ensured through continued monitoring of fishing activity and behavior, including by-catch or hunting of species. This will help safeguard endangered wild species such as gharial, turtles, river dolphins, birds etc. This can also help to stop the spread of exotic food fishes that are rapidly invading our rivers (the worst examples are *Tilapia* species, Chinese and Common Carps, and more recently, Red-bellied Piranha
- i. Use of Food Security Act, Rural Labor Programs, which can facilitate daily incomes by which fisheries losses could be offset; while also providing a solid community-level incentive to regulate and monitor fishing.
- j. Restoration of native riverine fish communities Fisheries need to protected not only by revival of stocks, facilitating better fish recruitment, but also by protecting fish breeding and spawning ground.
- k. Owing to natural uncertainty linked to flow regimes and channel course changes, new flexible systems of tenure in fisheries are required. Such systems would fit in well with providing a clear definition to fishing rights in any riverine stretch.