



ECOLOGICAL IMBALANCE AND DANGEROUS IMPACT ON FISH FAUNAL DIVERSITY OF GANGA RIVER SYSTEM: A REVIEW

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Abstract

Riverine fisheries are an indicator of the health of the river itself. Reviving fisheries by restoring rivers and their flows will help not only the poorer riverine fisherman, it will help a number of other communities and livelihoods dependant on rivers. The inherent resilience of riverine ecosystems will ensure that socioecological impacts of restoration work will be evident in a short to moderate time span and will benefit millions of fisher folks and ecosystems. Fisheries in Ganga are on a steep decline due to hydrological changes and various other changes associated with large scale water diversion through barrages and canals. Impact of these changes on the fish faunal diversity of Ganga river system and associated canals has been discussed.

Introduction

More than 10.86 million Indians depend on rivers, wetlands, floodplains, estuaries, ponds and tanks for subsistence and market-based fisheries. Though the absolute contribution of riverine fisheries may not be huge in economic terms, it is a very crucial component in livelihood and nutritional security of the rural poor. With declining health of rivers, riverine fisheries are declining and collapsing rapidly. This is indeed worrisome and needs to be ameliorated. Reviving riverine fisheries goes hand in hand with reviving rivers and this will lead to bettering lives of millions of Indians who depend on rivers in myriad ways

The Ganga originates from the confluence of Bhagirathi and Alaknanda in the Himalayan. After traversing a distance of about 250 Km in the Himalayas it enter the plains at the Haridwar and after travelling a distance of about 2290 Km through the plains of Uttar Pradesh, Bihar and West Bengal joins the Bay of Bengal. The high precipitation brings enormous

quantity of silt and alluvial soil along with the water. The river was once potentially rich in fisheries. Major fauna of the Ganga system in the high altitudes are *Snow trouts* namely, *Schizothorax spp.* *Semiplotus spp.* and certain catfishes. *Mahaseer* *Acrossocheilus* and *Bagarius bagarius* form the main food fishes.

In the plains ,Ganga stretches 2290 km between Haridwar, Uttar Pradesh and Nabadwip (W.B.). The dominant species of Commercially important fishes are

A).Indian Major carps

Cirrhina mrigala, *Catla catla*, *Labeo rohita*, *L. calbasu*

(B).Other Carps

Labeo pangusia, *L. bata*, *L. dero*, *Cirrhina reba*

(C). Large cat fishes

Mystus aor, *Mystus seenghala*, *Silonia silondia*, *Wallaga attu*, *Pangasius pangasius*, *Bagarius bagarius*, *Rita rita*

(D) Other cat fishes

Clupisoma garua, *Eutropiichthys vacha*, *Ailia coila*, *Ompok bimaculatus*, *Ompok pabda*

(E).Clupeoides

Hilsa ilisha, *Setipinna phasa*, *Gudusia chapra*

(F).Feather backs

Notopterus notopterus, *N. chitala*

(G).Exotic and other fishes

*Cyprinus carpio**, *Oreochromis niloticus**, *Aristichthys nobilis** (Stray catch)

*Ctenopharyngodon idella** (Stray catch), *Hypophthalmichthys molitrix** (Stray catch), *Clarias gariepinus** (Stray catch), *Puntius sophore* , *P.conchoniuss*, *Channa punctata*, *C. marulius*.

Fisheries in the Ganga river system are on a steep decline due to obstacles, hydrological changes and various other changes associated with large scale water diversion through upper Ganga, Middle Ganga and Lower Ganga barrage and canals. According to 10th five year plan the average yield of Major carps in river Ganga has declined from 26.62 to 2.55Kg/ha/yr during last

five year. The Biologically and economically desirable fish species have started giving way to the low value species, exhibiting an alarming swing in the population structure. Contribution of Major carps and large catfishes which formed an important group is drastically low, Exotic fishes have increased sharply as they prefer lower and more stagnant water levels. Impact of these changes on the fish faunal diversity of Ganga river system and associated canals has been discussed Currently India is the second biggest inland fish producer in the world. However, though blessed with one of the richest riverine fish gene pools and a network on hundreds of rivers, floodplains, ox bows and estuaries, the contribution of riverine and capture fisheries is declining sharply and many have collapsed, despite having a great potential to grow. The current riverine fishery is below subsistence level with an average yield of 0.3 tonne per km, which is about 15% of their actual potential. This is a matter of serious concern.

Sub stretches of river Ganga

<u>Upper Ganga; Gangotri to Haridwar</u>	<u>Middle Ganga; Haridwar to Varanasi</u>	<u>Lower Ganga; Varanasi to Ganga Sagar</u>
UG-1. Gangotri -Gangnani (35.4 km)	MG-1. Haridwar-Bijnor (77.39 km)	LG-1. Varanasi-Patna (253 km)
UG-2. Gangnani-Devprayag (145.8 km)	MG-2. Bijnor-Narora (156.45 km)	LG-2. Patna-Bhagalpur(234 km)
UG-3. Dev Prayag-Haridwar (84.88 km)	MG-3. Narora-Fatehgarh (185 km)	LG-3. Bhagalpur-Farakka (154 km)
	MG-4. Fatehgarh-Allahabad (331 km)	LG-4. Farakka-Ganga Sagar (98 km)
	MG-5. Allahabad-Varanasi (144 km)	

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, etc. Particularly, the links between dams, hydrological changes and fisheries require urgent attention and more work. Local communities and increasing number of studies are highlighting that 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. 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 species, especially large carps, which like flowing water. Larger dams are major cause of degradation of aquatic environment and disruption of livelihood communities dependent upon the fishery along the rivers.

In India, natural flow of all major rivers have been regulated for fulfilling water demand of agriculture and power sector, without giving any attention to fisheries sector. As a result, rivers have lost their character and fisheries have suffered huge losses. The tenth five year plan working group on fisheries had said, "Riverine fishery is already showing a declining trend. Millions of fishers and their families depend on rivers for their livelihood. These factors prompt an accent on development of riverine fisheries, which has rarely got the deserved emphasis of the planners. Therefore, it is the time, to take emergent steps to conserve our riverine fish biomass, to restore their habitat.

Sadly, these words did not lead anywhere. Rivers and riverine fisheries continued to deteriorate in the past ten years. Of the Rs 6000 Crores outlay for the fisheries sector proposed by the working group in the current (12th) 5 Year Plan, most of the investment goes to marine fisheries and a whopping Rs 1000 Crores to National Fisheries Development Board, which does not even consider riverine fisheries as its thrust areas! Of the outlay of Rs 1200 Cr for inland fisheries and aquaculture, riverine fisheries only get three schemes and majority of the rest is diverted to aquaculture.

Reallocation of water through dams has severely affected downstream ecosystems and fisheries. Outfalls of nearly all east flowing peninsular rivers is approaching zero without any freshwater releases in the downstream. Fisheries in Krishna, Godavari, Mahanadi, Pennar, Narmada, Tapi, Sabarmati, Mahi and Cauvery estuary have collapsed or are rapidly collapsing or declining because of absence of freshwater in the estuaries all round the year and destruction of the mangrove forests. Salinity changes due to water abstractions are affecting mangrove forests of Bhitarkanika and Sunderbans, which are breeding and nursery grounds of several freshwater as well as marine fish. Riverine and estuarine fisheries in Narmada are already affected by the Sardar Sarovar, Narmada Sagar, Omkareshwar, Maheshwar, Tawa and Bargi dams and reduced flows to the estuary.

According to World Commission on Dams report 2000, "Substantial losses to downstream fishery production have occurred as a result of dam construction around the world."

Hilsa fisheries in Cauvery collapsed in the upstream after Mettur dam. Puntius species also disappeared in Cauvery post dam, which formed 28% of the landings prior to dam construction. **Mahseer**, once an abundant game and food fish in India is now on the list of endangered species, with extremely limited range in rivers like Narmada, where it was abundantly found. Mahseer has been virtually wiped out from all Indian rivers due to dams and barrages and upcoming dams in North East and Himalayas will compound this problem. Tehri dam on the Bhagirathi has already impacted Mahseer migration to a great extent. At Allahabad, the yield came down from 935 Kg/km in sixties to 368 kg/km in 2001-06. In this 368 Kg/km, the contribution of major carps and large catfish (imp commercial species) is drastically low, exotics have increased sharply as they prefer lower and more stagnant water levels. The importance of water levels for fisheries is illustrated by the fact that fisheries improve considerably after Allahabad where a number of tributaries meet Ganga, bringing freshwater and sediments with them. The major role played by hydrological changes is also highlighted by the fact that the productivity of the river is relatively good, yet fish catch is falling steeply. The accompanying figures illustrate the decline in fisheries in Ganga down the decades.

Upcoming dams in Uttarakhand

It is documented that Tehri Dam on Bhagirathi in Uttarakhand has affected migration and populations of Mahseer fish. Uttarakhand is now embarking on a dam building spree. It has more than 330 dams (some estimate put the figure even higher, here dams include hydro projects of all sizes) in operation, under construction or planning stages. Only a few of these dams are in no fish zone, all the others will severely affect fish diversity. Nearly all riparian villages depend on Alaknanda and Bhagirathi rivers for subsistence fisheries. None of these dams will have fish passes or ladders, some will have hatcheries, but there has been no credible external monitoring of performance of hatcheries. Both Mahseer and Snow trouts are endangered, migratory species and these, with many other species will be very seriously impacted if the dams come up. Wildlife Institute of India, in its report on Cumulative Impact of dams on Alaknanda and Bhagirathi Rivers recommends that two rivers Balganga and Nayar should be kept 'dam free' as river sanctuaries as they are important aquatic habitats supporting numerous fish species. Balganga is one of the critically important habitats for mahseers and snow trouts which occurs in Tehri Dam and associated rivers. Many migratory species congregate along the rivers for breeding especially after the monsoon. However, the fate of these rivers, their fisheries and dependent

communities hangs by a thin thread as the Government is refusing to take decisions based on socio ecological welfare.

Factors responsible for ecological imbalance of the Ganga river system-

- 1. Construction of Dams and Canals-** Dams are constructed for multiple purposes viz., water storage for irrigation, for industrial and domestic uses, flood control, hydroelectric power generation, for navigation, recreation, development of fisheries and sports fishing. But fish and their habitat are affected by river valley projects. The problems, which may arise for fishery due to the construction of dams canals, are associated with the unfavourable physio-chemical conditions of water, unavailable food and feeding areas, barrier for fish migration, damage of spawning grounds, excessive growth of aquatic weeds and changes in species consumption of fish. Because of these reasons, loss of habitats, water quality changes and loss of biodiversity in Ganga river are seen.
- 2. Domestic and industrial wastes-** Along the banks of Ganga, over 29 cities, 70 town and thousands of villages are situated. Nearly all of their sewage over 1.3 billion liters per day- goes directly into the river along with thousands of animal carcasses, mainly cattle. Another 260 million liters of industrial waste are added to this by hundreds of factories along the river banks. Municipal sewage constitutes 80% by volume of the total waste dumped into the Ganga and industries contribute about 15%. The majority of the pollution of Ganga is organic waste, sewage, trash, food and human and animal remains. Besides, industrial pollutants also contaminate the Ganga to a great extent. Pharmaceutical companies, electronic plants, textile and paper industries, tanneries, fertilizer manufacturers and oil refineries discharge metals, bleaches and dyes and pesticides. And Domestic and industrial pollution combined with use of pesticides and fertilisers and other factors, have rendered the water of Ganga unfit for fish production.
- 3. Deforestation-** Associated with deforestation heavy rainfall encourage high rate of silt erosion and are brought down to the main Ganga basin along with the water.
- 4. Sediment load-** High rate of sedimentation is caused due to deforestation.

Recommendations or solutions-

We must take the following steps to save the ecological imbalance of the Ganga river system.

Make the Ganga aviral- we must make the Ganga aviral and take time bound decisive steps to make it and its tributaries completely free from industrial effluents, sewage of the cities and

towns, hazardous chemicals from agricultural run off within 5 or 10 years as our short term goal and make serious effort to solve the problems of industrialization, urbanization, population growth and corruption which are direct or indirect causes of our problem of environmental degradation in general and slow death of Ganga river.

Environmental restoration- To prevent the pollution of river Ganga and to improve its water quality, The department of Environment, Government of India, prepared an action plan for immediate reduction of pollution load of the river Ganga. To oversee the implementation of GAP, the National Ganga River Basin Authority (NGRBA) must take the responsibility of the protection of the Ganga river.

Promotion of Organic farming- Entry of hazardous chemicals from agricultural run-off into the rivers must be prevented through promotion of organic farming in a massive way.

Data mining- Large volume of raw data on water quality productivity, aquatic ecology and fish biodiversity are available for Ganga river system from various parts of the country. Most of these data are not properly analysed and interpreted. Hence, there is an urgent need for data mining and analysis to gather base line information on water quality, aquatic ecology, productivity and fish biodiversity for the Ganga river system.

Modelling studies and Scenario analysis- software aided modelling studies are required to assess the impact of changes in run-off on water chemistry, productivity, aquatic ecology, biodiversity and fish production. The impact of interlinking of river basins on fisheries will vary from the river system to another and from region to region. Hence, detailed scenario analysis and simulation studies have to be carried out for each of the river systems to assess the impact under varying flow conditions.

Biodiversity studies- It is necessary to study and identify the endangered species which could become extinct due to interlinking. Based on existing biodiversity lists of exotic and native species, it is necessary to identify the prevalent differences between the rivers likely to be linked and projects the post-linking scenario.

Initiative from the Govt. of India-The supreme court has been working on the closure and relocation of many of the industrial plants along the Ganges. And In 2010, Government declared the stretch of river between gaumukh and uttarkashi ‘an eco-sensitive zone.

Afforestation

Public awareness and participation

Procedural recommendations

- New dams affecting outstanding wild and edible fisheries where a large population depends on fisheries either for subsistence or livelihood should not be sanctioned in the absence of proper mitigative measures.
- Cumulative impacts of large dams coming up in North East, Uttarakhand, Himachal Pradesh, Jammu & Kashmir, Karnataka, Maharashtra, etc., should address cumulative impacts of these interventions on fisheries.
- Cost benefit analysis of large dams should include current benefits of riverine fisheries to communities and benefits of aquatic biodiversity and other services that the river provides.
- Environmental flows recommendation should be river specific and fish should be an important consideration while calculating e-flows MoEF should set up project specific monitoring mechanisms to ensure the compliance of clearance conditions regarding fisheries given by the EAC to dam proponents: about environmental flows, hatcheries, fish ladders, fish breeding, etc. The local affected communities should have effective say in this monitoring mechanism.
- Environment Impact Assessment of Dams to include downstream impact of hydrological modifications on wild and edible fisheries and associated livelihoods.
- Dams which have outlived their lifespan and dams with extensive impact on fisheries and livelihoods should be considered for decommissioning to reinstate fisheries.
- No more embankment projects should be cleared, looking at their impacts on a number of sectors, including dramatic impacts on fisheries, without impact assessment, management plans, and public consultations. EIA notification needs to be appropriately modified.
- In case of projects like ports and thermal plants on estuarine coasts (like in the case of Konkan in Maharashtra), fishing communities should be a part of impact assessments, public hearings and monitoring and compliance mechanisms. If the projects receive clearances, compensation to be given to fishing communities
- Rivers with high number of endemic and endangered species, religious fish sanctuaries, etc. should be protected in their free flowing condition. At least one river in each ecological zone and one in each state should be urgently identified for such protection.

Conclusion

The major role played by hydrological modifications and other changes in rivers caused by dams and barrages is undeniable. CIFRI claims that major hydrological alterations and changes brought about by dams are by far the most important cause for collapse of riverine fisheries, even more so than pollution and bad fishing practises. Water quality is a crucial component in fisheries and release of untreated effluents and domestic sewage has been leading to fish kills several times a year in several rivers. Ganga, Yamuna, Krishna, Sutlej, Ravi, Beas, Narmada, Tapi, Mahi, Sabarmati, Pennar, Cauvery, Betwa, Gomti and all major rivers are severely affected by pollution and this issue needs to be tackled on priority. However, according to CIFRI, “Most of these impacts of pollution are confined to specific stretches and the rivers have overall shown a good potential energy resource, with no declines, except in the point discharge areas. In spite of these favourable conditions, fisheries have been showing a decreasing trend and key factors for this are erratic flood pattern, regulation in flow, reduction in water volume. Dams, Hydropower projects, barrages, embankments and subsequent abstraction and regulation are the main reason for degradation of riverine environment and subsequently, degradation of fisheries. In this situation, while reservoir fisheries have helped to an extent, they are entirely dependent on external inputs, not equitable due to contracts and do not encourage endemic species.

The need of the hour is to explore and implement ways through which our existing water infrastructure becomes friendlier to fish and other aquatic species. Fortunately, many such options exist today which can be implemented if there is a strong political will, regulatory mechanism and community participation.

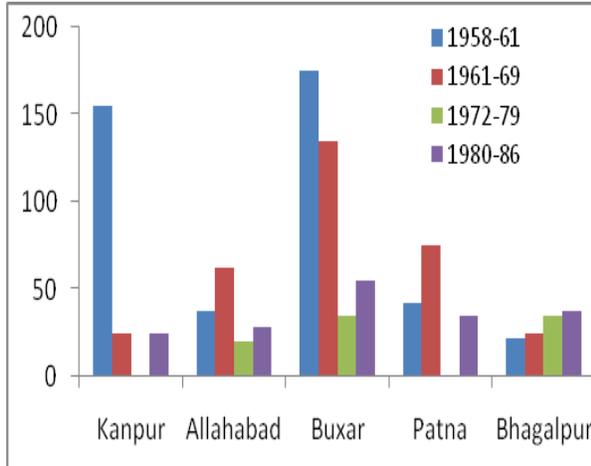
Legal and regulatory framework for protecting riverine fisheries

- India does not have a unified Fisheries Policy or a policy for riverine fisheries. The Indian Fisheries Act is terse document dated 1897, which has serious limitations in addressing current problems.
- No Law for protecting the natural flow pattern or environmental flows in rivers

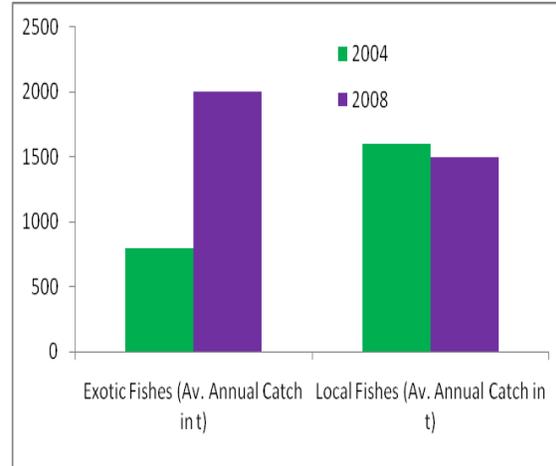
No specific laws to protect fisheries, apart from some provisions in the Indian Fisheries Act 1897, Water (Prevention and Control of) Pollution Act 1974 and The Wildlife Protection Act 1972, the Environment Protection Act 1986. None of them have been used effectively for protecting rivers or riverine fisheries.

References:

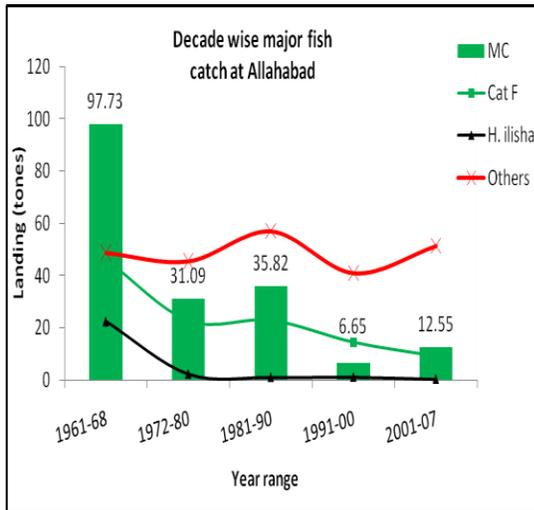
1. CIFRI Annual Report 2007-2008
2. FAO Manual 2007
3. World Commission on Dams Report 2000



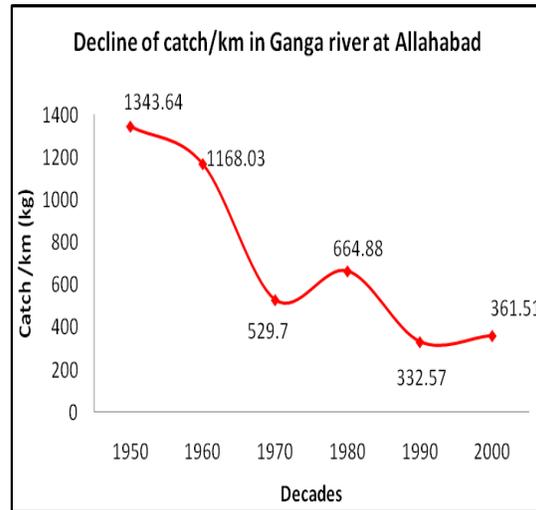
The trend in fish yield (kg/ha) from different stretches of the river Ganga during 1958-86.



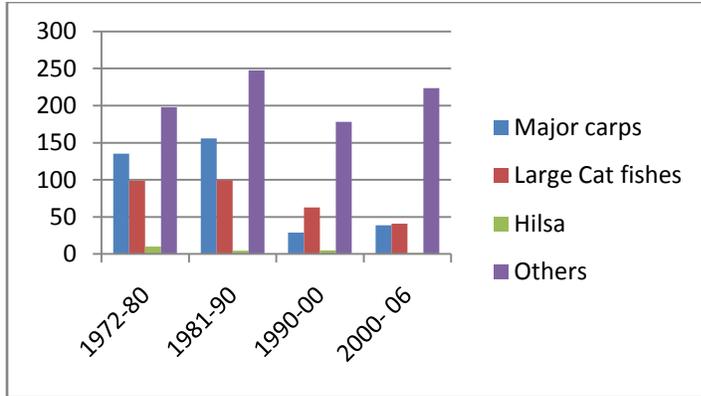
Increase Growth of Exotic Fishes



Fish landing at Allahabad CIFRI Annual Reports 1961-2007



Decline of fish catch/km at Allahabad during 1950s to 2000s



Decline in Fish catch from 1972-2006

