

# Water Crisis: Some Strategies for the Sustainability of Inland Fisheries and Aquaculture in India

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Over 97 percent of water on the earth is in the oceans. The rest of the water on the earth comprises freshwater, in the form of ice-caps, glaciers, rivers, lakes and other inland confined waters, groundwater, atmosphere and soil moisture. Water crisis is reported to have gripped the globe and it has already become a critical and contentious issue. World's water resources are reported to be under threat because of the rapacious and unsustainable abstraction of water from rivers, lakes and aquifers, coupled with unabated pollution and uncontrolled contamination. One of the fallouts of climate change, the consequence of global warming, is stated to be on water sources. A WWF report indicates that the Himalayan glaciers are among the fastest retreating ones on the globe due to the effects of global warming resulting in water shortage to millions of people dependent on glacier-fed rivers. This melting is expected to first increase the volume of water in the rivers causing widespread flooding, ultimately resulting in reduced flows.

The water crisis in India is compounded by problems of land management and of protecting the environment and ecosystems. The land, forests and water bodies need protection from encroachment, exploitation and pollution. Of all the natural resources, water is probably the most significant one. Water lies at the foundation of the entire ecosystem. Since it is an ubiquitously needed natural resource, optimal sustainable utilisation, conservation and management of water resources, rather than efforts at augmenting supplies through unviable grandiose plans should be emphasised, for the future. Merely commemorating March 22 of every year to the elixir of life, the declaration of Water Year as was done recently (2007) would be meaningful, only when vigorous steps are not taken to meet the crisis.

The forecast of bleak freshwater stocks in future can severely constrain freshwater fish production since climate change would impact both the glacier-fed rivers of the north and the monsoon-fed rivers of the south. Added to this catastrophe, the vagaries of monsoons and erratic precipitation, also due to climate change, would aggravate the situation. The present paper highlights the challenges inland fisheries and aquaculture are likely to face and suggests some strategies for meeting the same.

## Present Status of inland fisheries resources

Rivers constitute the major freshwater resource of the country as well as the primary habitat of freshwater fishes. They form a great network across the length and breadth of the country forming the main source of water for all the connected inland aquatic ecosystems like the lakes, reservoirs, canals, tanks and ponds. The estuaries, backwaters and lagoons, also connected to rivers and the sea, provide an altogether different and diluted saline environment or partially saline and partially freshwater environment. The rivers of the country, which provide such a varied and dynamic environment for fishes and other aquatic animals are now in a pathetic condition. The germplasm of major carps now faces a noticeable fall because fish catches have been dwindling, creating a threat to their migration and safety to their life histories. The effects of climate change, chronic pollution, large scale damming, heavy abstraction of water, construction of reservoirs, encroachment of river basins and courses, over fishing and climate change are combining to spell a catastrophe for the rivers with deeply worrying implications for the fishers and others who depend on them. Agriculture accounts for a major part of all water use. Deterioration and degeneration of the rivers in the country would severely affect agriculture and all other economic sectors.

Due to the degeneration of rivers, production of major carps was reported to have declined and that of less valuable species increased. For want of normal waters flows in rivers, the migration of species, breeding and spawning grounds and early life histories of species have been affected. Vulnerable and endangered species, especially the Gangetic dolphin, continue to be threatened. Environmental threats and man-made influences have greatly crippled the rivers. Developmental projects and plans impinging on the floodplains, river courses, deltaic regions and river banks are in direct clash with life giving functions of the rivers. They have been severely throttling the riverine flows, damaging the riverine ecology and biodiversity.

Pollution has emerged as the major threat to the life giving rivers. The sources of pollution are undoubtedly the untreated industrial wastes and domestic sewage. Reports are galore that river waters have become poisonous and unfit for the multidimensional uses they are hitherto put to. Fish mortalities in rivers are often reported. Several rivers in the country are reported to be in this plight today. Unfortunately, several major cities are also located on the banks of rivers. Some rivers flow through cities like Delhi. Major industries, dealing with chemicals, textiles, steel, paper, leather petrochemicals and others are also located close to rivers and estuarine areas facilitating easy discharge of untreated effluents intentionally or unintentionally. There was no dearth of national and internationally aided projects to control pollution of rivers but no tangible results had so far been achieved. A classical example of such initiatives is the Ganga Action Plan, with Ganga, still remaining as polluted as ever. Several other rivers are no better as far as pollution is concerned. The National River Conservation Plan (NRCP), ostensibly for cleaning the national rivers of pollution, has also not delivered any results. Lack of progress



is attributed to lack of adequate funds. Recent reports indicate that the Government has decided to revive the plan. It would be the fond hope of several affected people in the country to see the rivers once again flowing with pure water. However, it stands out that, with all the efforts and funds spent on controlling pollution of water bodies, no worthwhile results have been obtained so far. Before time runs out, factors leading to the lax enforcement of pollution norms have to be thoroughly investigated and remedial measures taken.

The ambitious plan of interlinking the rivers to solve the problem of floods and droughts in the country had become highly controversial. Due to rapidly declining water resources, interstate water disputes are on the rise and most States do not seem to favour interlinking of rivers. While, on the face of it, the proposal may be appealing to people and policy makers but no one really knows what would happen when the rivers are actually linked. Countries which have tampered with rivers are reported to be tracing back their steps. Further, construction of more than 200 reservoirs and a network of crisscrossing of canals proposed in the plan would be a stupendous task, leading to unprecedented ecological and demographic damage. The life in the rivers and livelihoods dependent on rivers, may be shattered. The proposal, of interlinking rivers, if implemented, may generate innumerable environmental refugees. The Narmada and Tehri dams have already created such problems. From the fisheries point of view, linking of rivers may bring in large-scale physical, biological, hydrological changes affecting all the aquatic ecosystems connected to the rivers. The nutrient loads, fertility, biological productivity, freshwater-saltwater interactions, sedimentation, coastal-estuarine productivity, interaction between flora and fauna may be drastically altered, affecting the life cycles, migrations, stock replenishment and fish production in the rivers and coastal areas. Therefore, the author feels that the riverlinking project would not be in the interest of fisheries development. Water knows its own levels. Therefore, it is best to allow water to flow freely and make the best use of it. Fisheries resources flourished when rivers flowed freely. Aquatic

systems were not polluted and encroached upon. Changing the courses and flows of rivers is surely against the laws of nature. Man has already interfered with nature in several ways and this is yet another attempt but a colossal one in magnitude, without knowing the consequences. The effects of global warming and climate changes on the rivers have also to be seriously considered in the context, so that public money may not be wasted in unfruitful projects. The predicted disruption to the water cycle over the sub-continent in the coming years is attributed to climate changes. It would be prudent to prepare a national climate change response programme and implement adaptation plans to meet the possible and adverse flood and drought conditions that may be imposed by worldwide predicted global warming.

All other freshwater ecosystems, especially the large and small lakes have suffered more due to anthropogenic disturbances than environmental changes. The freshwater and salt-water connections to brackishwater lakes have largely been obliterated and encroached upon for developmental purposes (as well as for fish culture and shrimp culture on the peripheries). The very ecology of the lakes has been greatly altered affecting the flora and fauna. The lakes have also shrunk in their water area, and polluted. Fish and production were reported to have dipped down over the years. Because of extensive encroachments, the groundwater recharging capacities of these water bodies would have drastically come down.

The smaller lakes in different parts of the country have been also facing the onslaught of human interference. Lakes, as natural water bodies, have been utterly neglected. Meeting the livelihood activities of communities living in their vicinity lakes, serve as water storage places for irrigation and drinking water and serve as avenues of fishing activities. Maintaining the water tables in adjacent areas is no more possible with the present state of the lakes. Lakes have greatly shrunk, silted, water-starved and highly polluted, mostly by domestic sewage and garbage. In Karnataka State, lakes are going abegging for maintenance,

may be for want of funds. Even if there are no funds, lakes should have been left alone as before without initiating harmful activities. Harmful and undesirable initiatives would sound the death knell for lakes, in the long run because lakes maintained for commercial purpose would no more retain their natural functions. Tourism, recreational developments, floating hotels and other urban activities would gradually destroy the ecology, flora and fauna of the lakes and lead to ultimate decimation. Revenue collection should not be the sole purpose of lake maintenance. Large scale letting in of untreated industrial and domestic sewage had polluted the lakes bringing down the water quality, leading to recurrent fish mortalities. Obliteration of river canal connections to the lakes disrupting natural inflows lead to spoilage of lakes causing severe eutrophication and choking of water with weeds and water hyacinth. The degradation of lakes is reflected in dwindled fish catches.

Other wetlands, *beels*, tanks and small impoundments have also been suffering from such destructive and manmade activities. The brackishwater *bheries*, estuaries, backwaters and lagoons are also losing their identities, encroached upon with constructions, reclamation and pollution resulting in shrinkage in water areas, natural productivity and fish production. Natural flows in rivers would regenerate and maintain the ecosystem functions of these water bodies.

Thus, the freshwater ecosystems are facing serious challenges from human and environmental factors. Scarcity of freshwater can be crucial for the sustainability of inland fisheries and aquaculture in India, in the years ahead.

#### Suggested Strategies for the Sustainability of Inland Fisheries and Aquaculture

The foremost approach to the problem faced is to afford utmost protection to all freshwater bodies in the country from encroachment, excessive exploitation and pollution. The alarming and turbulent water situation has to be met through progressive, practical and preventive measures. Instead of trying to develop additional water resources, measures



have to be taken for proper utilisation, management and conservation of water for the multi-dimensional purposes. Improved technologies for agriculture (major user of water) and other sectors have to be developed with proper innovations and reasonable investments. Water literacy has to be improved in the country through awareness programmes.

Cleaning rivers of pollution should be given top priority by fixing targets, responsibilities and accountabilities. This should have a time frame, adopting methods, which have been found successful elsewhere. Maintaining the water quality in rivers is of utmost importance for protecting riverine ecology. Water flows in rivers have to be ensured to maintain the health of all other water bodies directly or indirectly connected to the rivers. Governments have to protect river flows and water allocations to safeguard habitats and livelihoods dependent on them. Revival of rivers requires deeper understanding of ground water-surface water interface, sustainable withdrawal of groundwater, recharging of aquifers, rejuvenating all tanks and other water bodies and proper management of catchments areas. All destructive and even developmental activities of the kind encroaching on rivers have to be controlled. Environmental and other factors affecting, the health of the rivers have to be expeditiously addressed. Rivers should be considered a national wealth, countering fissiparous tendencies amongst vested interests. Individual, community and institutional involvements are essential for revival of rivers. Conservation of rivers and wetlands is part and parcel of national security, health and economic success. The threats of climate change should be suitably and effectively met by proper response programmes nation wide.

Freshwater ecosystems like lakes, wetlands, ponds, tanks and other water bodies which are rich sources of fishes and other aquatic animals have to be rejuvenated and reinvigorated to bring back the biodiversity that sustains life. Due to water scarcity, siltation, poor maintenance, growth of weeds and vegetation and pollution, tanks and ponds all over the country are becoming obsolete and derelict. They used to be

rich sources especially of murrels, catfishes and carps. The catchment areas and valleys that serve as store houses for water have to be protected from encroachment. Strict control of pollution of water bodies has to be exercised and the polluter-pays policy implemented. The defaulters have to be penalised and the system of controls made transparent with responsibilities fixed at all stages. Pollution Control Boards should be given full powers and responsibilities to free water bodies of pollution. Dead water bodies are vital for the well-being of the water table and the environment. They should be revived by giving them a productive green cover. Many such water bodies have vanished, having fallen prey to rapid urbanisation, growth of population and non-availability of dumping sites in several parts of the country, including metropolitan cities. A healthy water body is vital for a sound ecology. Restoring water bodies is crucial to ensure enough groundwater availability. It also curtails soil erosion. Restoration of wetlands should be a top priority, for it helps in attracting birds and also life dependent on aquabodies. The recent reports of flooding of cities like Chennai and Mumbai could be due to land-filling of erstwhile lakes, making excess rainwater and water overflowing storm drains entering the low-lying areas in the cities. Quick revival of all dead and defunct tanks in the outskirts of cities and rural areas can provide a solution to flooding of cities and at the same time taking care of water shortage besides providing additional potential for fish production. Land, sites for water filling have to be found for the ever increasing urban and industrial wastes with minimal impacts on threatened freshwater supplies. Rains bring in copious water, causing flooding. Rainwater tanks, retention ponds which hold water and release it gradually and detention ponds which hold water for a long time, all manage soil erosion and local flooding very well, according to a recent report from Australia. Drought prone areas would greatly benefit from such structures.

In India, water scarcity has been reported in eight of the 20 major river basins, which has led to exploitation of groundwater resources. While ponds and tanks are allowed to fall into disrepair, there is an alarming increase

in the number of bore wells. Indiscriminate drilling of these wells lead to water depletion. Groundwater exploitation in the country for agricultural and non-agricultural purposes is stated to be excessive, with water tables going down under. The erratic and scanty precipitation adds to the problem. The recharge of groundwater is greatly reduced due to encroachments and constructions obstructing natural flows. Reclamation of land surrounding catchments areas and water bodies has to be banned.

Aquaculture would be hard hit in the long run due to ever increasing water scarcity. Shrinking of water area and deterioration of water quality would be a serious setback. Excess water due to rains and floods has to be saved and conserved, by planning large storage reservoirs. Historically developed and existing derelict natural water storage reservoirs still found in parts of Andhra Pradesh and Manipur, and probably elsewhere also in the country, are worth reviving at minimum cost. At other suitable locations similar reservoirs can be established for agricultural, fisheries and other purposes through the participation funding and generosity of individuals and major public companies earning crores of rupees for meeting the needs of local communities.

Economical water use, better crop management, development of drought resistant crops, localised harvesting and recycling used and waste water can lead to conservation of water. Recycling of water can be another innovative way to meet water shortage in future for aquaculture. Such water should be purified and recycled under controlled conditions for aquaculture, depending on suitable species, locations and availability of water. The famous *bheries* of Bengal, now named as East Calcutta wetlands, which were originally brackishwater ponds used for shrimp culture for a longtime, are now turned ingeniously by the local poor into fish ponds for recycling millions of litres of sewage of Kolkatta City. Treatment of sewage for ensuring its safe quality, for growing, fish, vegetables and rice out of it are all developed by the local people. Pathogens, inorganic and organic pollutants, contamination of such sewage fed fish and vegetables are tested to be well within safe levels. Water hyacinth is grown on the bunds

to prevent erosion. Its roots filter pollutants. They also serve as food and shelter for fish including common carp.

India has a tradition of water harvesting which is very old. While the country receives abundant seasonal rainfall, a large quantity is allowed to go waste. Elaborate community based water management systems have been evolved over the years with people as the focal point. While these methods are neglected, at the same time they are not being revived due to the present water crisis. The country is forced to look at the traditional small-scale water harvesting systems once again. All the defunct large old wells are now receiving attention for revival. Rainwater harvesting has also the benefit of recharging the rapidly diminishing groundwater table. Other advantages include availability of freshwater, reduced dependence on conventional water supplies, and reduction of soil erosion and flooding. While it may not be potable, the harvested water can be used for several non-domestic purposes, including aquaculture.

Of all the water bodies to-day, reservoirs in the country offer the greatest scope for the development of inland, capture and culture fisheries. They are still the least exploited. Their productivity can be increased by artificial fertilisation for intensifying cage and pen culture. The large volumes of water should be put to productive use through fish culture by suitable methods.

Running water fish culture in hill streams which is at present done in a limited scale, needs to be intensified, taking advantage of several streams flowing down the hills in different parts of the country. Excess water flowing

down the hills in western ghats should be stored at different altitudes and made use of for fish culture as well as other purpose.

Culturing of air-breathing fishes and propagating other cultivable species which can withstand adverse environmental conditions, especially scarcity of water, should receive high priority under the present conditions. They are still not extensively cultured, despite the very high demand. Technological gaps in breeding, seed production, feed formulations and methods of culture should be quickly bridged to tide over water scarcity conditions. These fishes have an edge over others in the context of depleting water resources. Swamps, mud flats, derelict water bodies can be made productive through culture of such fishes. Confined culture of suitable species in cages and pens may also assume importance.

Seepage in aquaculture ponds has been a problem in several parts of the country. Though some attempts have been made to control seepage, intensive and cost effective methods are yet to be found out to counter shortage of water for aquaculture. The use of geomembranes to line aquaculture ponds to prevent seepage needs experimentation and working out of economics.

Time may not be far off to make use of desalinated water for brackishwater and freshwater aquaculture after due experimentation with suitable species. Coming years would see a great thrust in desalination of seawater for drinking and other purposes. This is a vast and unlimited resource to be put to use as freshwater resources continue to dwindle. Already desalination plants are in operation in certain parts of the country, but large capacity plants are

required to meet the growing demands of freshwater. However, the economics of operating such plants need detailed investigation in the long run. Countries like China and Saudi Arabia and others are extensively using desalinated water for varied purposes.

### Summary

One of the fallouts of climate change, the consequence of global warming, is stated to be on water resources. The world is passing through water crisis, so is India. Freshwater resources are continuously shrinking due to environmental and man-made reasons. Over exploitation and pollution of water bodies are on the rise. Riverine ecology and biodiversity are under serious threats. All the connected water bodies are also losing their identity. Inland fisheries and aquaculture production may face serious challenges due to freshwater shortages in future. The ambitious river linking plan, which has become highly controversial due to several issues, would not be in the interests of fisheries development. Strategies to tide over the likely shortages of water for inland fisheries and aquaculture include immediate protection and purification of water for inland fisheries and aquaculture, revival of rivers, lakes, ponds and tanks, harnessing and storing excess water flows, recycling used and waste water, rainwater harvesting, controlling seepage of ponds through innovative methods, developing natural storage reservoirs, fuller exploitation of reservoirs and increasing their productivity, intensifying running water fish culture and culture of air-breathing fishes and other hardy fishes under adverse environmental and water scarcity situations, using desalinated water for fish culture and generating innovative, cost-effective and community based solutions to water crisis. ☹☹☹

## Olive Ridley Turtles on the decline, says expert

The migratory breeding population of Olive Ridley turtles has been declining due to various reasons: One of these is of from incidental mortality in offshore waters and the other of predation of eggs and hatchlings at nesting beaches, according Dr.P.S.Rajasekhar of Department of Environmental Sciences, Andhra University.

In a lecture delivered by him recently, on 'Status of conservation of Olive Ridley Sea Turtles along north coastal Andhra', Rajasekhar said that marine pollution combined with industrial development projects in the coastal area had caused

loss of nesting habitats and feeding grounds to the migratory population. Estimating that 0.1 percent of hatchlings would be reaching adult stage in the natural conditions, he explained that conservation and management of the turtles had assumed greater importance in recent years. He further said that awareness campaign had been launched among the fishing community for the implementation of the turtle excluder devices to reduce the incidental mortality of breeding population due to shrimp trawl nets, adding that the vulnerable sites of Olive Ridleys were frequently monitored to reduce

the natural predation and human depredation of eggs and nestling turtles.

Olive Ridley sea turtle is distributed in the tropics of Indo - Pacific. In India it is found all along the east and west coasts of India and has been placed in Schedule I of the Indian Wildlife Protection Act, 1972. It is listed in Appendix - I of the convention on International Trade in Endangered Species which prohibits trade in turtle products. All the five species nest on the coasts of Indian Ocean and its Bay islands, whereas the Olive Ridleys have their mass nesting (Arribada) area at Gahirmatha beaches of Orissa, it was mentioned. ☹☹☹

