



On Some Degraded Aquatic Eco-systems in India, their Impact on Fish Production and Human Welfare

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The ever increasing population and consequent developmental activities in the country have increased pressure on land and water resources for human needs. Industrialization and urbanization have caused land, air and water pollution. Erratic weather and unpredictable monsoons have been severely constraining production systems. Natural disasters including floods, drought, cyclones, storms, coastal erosion, sea level rise, tidal waves, tsunami, global warming and climate change have been increasing, causing panic destruction and loss of life. In this context of environmental and man made maladies, the aquatic environment in general and the aquatic ecosystems in particular, have degraded in that the water quality deteriorated, water bodies have shrunk or disappeared, polluted, natural flow of rivers impeded, biodiversity endangered, ground water depleted and salinated, water scarcity increased leading to 'water wars', 'water woes' and inter-state river water disputes.

As a result of the above environmental and anthropogenic stresses, certain aquatic ecosystems got degraded and became less productive. Indiscriminate and unsustainable exploitation of their resources also contributed to their deterioration. If appropriate measures are not quickly initiated to revive their function, their very existence may become questionable. The following ecosystems need priority attention because of their invaluable contribution to human welfare and prosperity.

Rivers: Most Indian rivers are rain-fed. The drought-flood-drought syndrome in the country repeats periodically, requiring small, medium and big storages for river water along their course as well as for harvesting rainwater. The multi-dimensional

use of large quantities of river water has placed tremendous pressure on water resources which are fast depleting. Damming the rivers, abstraction of water for agriculture, irrigation and power projects, measures for flood control and reclamation of floodplains had severely constricted flow of water in the rivers, resulting in heavy siltation and altering the natural hydrographs. The recurring annual phenomenon of unmanageable floods during monsoon and the almost dry condition in lower reaches of several rivers in summer seem to be out of reach for human control. The man made changes and adverse environmental conditions, apart from signs of overfishing in certain pockets of riverine stretches, drastically deprived the fish of water as needed and interfered with the very functioning of the riverine ecosystem. The result would be decline in fish production and delimitation of species which can survive adverse conditions. While it would be a Herculean task to reverse the situation, efforts are certainly needed to make the rivers flow as in the past. There are instances elsewhere in the world to emulate for the revival and purification of rivers to make them re-inhabitable for fish. The inter-country purification project of the Rhine river is a classical example of how a riverine ecosystem has been restored to facilitate the return of the salmon to the river. The Ganga action plan of our country is yet to show such results. If the situation is allowed to slip out of hand, many species of fish like the hilsa may soon become extinct. Artificial production of such species for replenishment of stocks in the country is only on paper for decades. Almost all the rivers in the country are polluted. If pollution is not controlled effectively, it would decimate the valuable fish populations. Because of contamination of water with various

types of hazardous pollutants the breeding grounds may vanish, food chains affected and biodiversity lost.

Interlinking of rivers has been proposed to overcome water shortage, remove imbalances of excess water and drought conditions in different parts of the country, increase food grain production and power generation. Further interlinking would facilitate inland navigation for the common good. However, the project would involve large scale construction of dams, affect river flooding, delta formation, cause coastal erosion and consequential sea incursions, alter hydrological cycle (sea-land-rivers), impair marine productivity and may disturb the monsoons (air-sea-land-life interactions). The pros and cons of such a project on the open water fisheries of the riverine ecosystem as well as the hydrodynamics affecting the coastal waters and fisheries potential have to be carefully evaluated.

Lakes: The three famous brackish-freshwater lakes of the country, viz., the Chilika, Kolleru and Pulicat lakes no longer retain their pristine character, resourcefulness and economic utility. They used to abound in rich and valuable brackishwater (penaeid and non-penaeid shrimp, seagrass, mullets and fresh water fisheries resources (carps, cat fishes, murels, eels etc) and support livelihood of several fishermen. For over the past about 25 years the lakes have been encroached upon by fish and shrimp farming activities and developmental projects which resulted in reclamation of land along the peripheries restricting and cutting of the natural flow of fresh and brackishwater into the lakes, increasing siltation and ultimate shrinking of water area. Road laying across the Kolleru lake for linking various villages almost destroyed the aquatic flora and fauna and caused depletion of fish catches.





While production from aquafarming from the peripheries of the lakes increasing tremendously, capture fisheries resources drastically decreased. Increased human activities in and around the lakes have also disturbed the natural balance of flora and fauna. The lakes are reported to be highly polluted due to entry of several types of pollutants along with the effluents. The lakes are home to a wide variety of migratory birds and the Irrawady dolphins are found in the Chilika lake. The past two decades have witnessed several anthropogenic, developmental and environmental issues which have been threatening the very existence of the lakes and affecting the livelihoods of fishermen depending on the resources of the lakes. The lakes have also been supporting eco-tourism. In this background, urgent measures are required to scientifically restore the ecosystems of the lakes through hydrological interventions to improve the water quality, free flow of water in and out of the lake, proper functioning of the bar mouths/feeder canals and periodic desiltation. Eco-restoration and ecological rejuvenation of aquatic systems are attempted with spectacular results elsewhere in the world. Some lessons have to be learnt from such examples.

There are several other small and big freshwater lakes across the country. Recent reports indicate intensive human interference for promotion of developmental projects, land reclamation for construction of buildings, effluent discharge from industries, domestic sewage, and dumping of wastes and toxic substance leading to mass mortalities of fish. Rapid urbanization and unplanned growth of cities are at the root of deterioration of quality of water in the lakes and their disappearance. One of the world's largest natural water bodies, the famous Dal lake in Srinagar, abused by 100 hamlets, floating gardens, hotels and lodges, is stated to be dying. Human settlements, water pollution, constructions along the peripheries, continued agricultural activity lead to deterioration of water quality, disappearance of aquatic life and choking by weeds. Though the lake

supports tourism and provides livelihood for local people, the very same appear to threaten the very existence of the lake. Examples of ecological rejuvenation of lakes available elsewhere have to be emulated.

The National Lake Conservation Plan (NLCP) and the National River Conservation Plan (NRCP) aim at restoring the lakes and control pollution of rivers respectively, but crunch of funds appears to be hampering their progress. However, how far these projects concern themselves with the problems faced by the fisheries sector is not known. Pragmatic action is needed to revive and restore these aquatic ecosystems from the present derelict and defunct state, if the demand for fish in future has to be met. As per the reports, project seems to be based on considerations other than those of fisheries interest.

Mangroves: There mangrove forests in the country constitute a very delicate and fragile ecosystem (3,56,000 ha) supporting significant populations of marine life including a variety of fishes, shrimp, crabs, molluscs and juveniles of several economically important species. In addition, they also provide food and shelter to numerous terrestrial animals. It is an extremely rich and productive ecosystem, performing the functions of efficient biofilters, sediment trappers, as a system for harbouring periphyton that serves as food material for fishes and other organisms, as a source of organic material to increase productivity and as nursery grounds for several species.

Mangroves and coral reefs are components of typical tropical ecosystems and are known to co-exist or found separately. They are found in the intertidal regions co-existing with coral reefs in Andaman Islands, Gulf of Mannar and the Gulf of Kutch. A unique feature of coral growth as a narrow fringe very close to the mangrove roots is seen only in Andaman and Nicobar Islands. Tropical rain forests on hill slopes and mangroves at the edges of the islands not easily accessible to man, act as efficient sediment trappers keeping the water clean and ideal for

coral growth. Corals benefit from association with mangroves for clean water, food material and high productivity. Few mangrove patches are found in the islands of Gulf of Mannar, where they are separated from coral reefs. They serve as feeding and nursery grounds for reef fishes. The mangroves are not much disturbed by human activity because of the intervening distance from the mainland. The remnants of mangroves and coral reefs are found on the Pirotan Island in the Gulf of Kutch. Even these have stunted growth, covered with filamentous marine algae due to high tidal amplitude. The reef system is almost dead, with loose mud and sand exposed due to the removal of mangroves. Few hardy corals thrive in turbid waters. In the Lakshadweep, only sparse mangrove patches are found on the Minicoy island.

The globally famous Sunderbans area in West Bengal, the largest delta and mangrove forest in the world covers 10,000 sq. km. in India and Bangladesh, of which 4,000 sq. km. lies within Indian boundaries. Sunderbans is home for the Royal Bengal Tiger, 50 of the 60 mangrove species found in India, hundreds of species of migratory birds, turtles, dolphins and a wide range of fishes and other biodiversity. The rich and productive ecosystem, which had already deteriorated to a great extent mainly due to human developmental activity, should not be allowed to succumb further. Plans for tourism projects are better curbed to retain the nature's balance and natural resources intact. Such projects involving dredging, generation and disposal of wastes and sewage, spilling of oil, grease and other substances from boats, barges, floatels would surely endanger life systems in the area, besides displacing local communities and fishermen. Often, such projects violate principles of conservation, environmental sustainability and involvement of local communities, flout Environment Impact Assessment (EIA) and coastal regulation zone (CRZ) rules. It would perhaps be wise not to locate resident eco-tourism projects in such a sensitive and fragile aquatic ecosystems to protect the same from environmental disasters.





Indiscriminate cutting of mangroves for fuel and wood, reclamation of mangrove forests for shrimp farming, heavy industrialization and toxic effluent discharge and other developmental activities encroaching on coastal and estuarine areas have greatly reduced the extent of mangroves in several areas of the country. Such destructive activities have to be curbed by mapping the mangrove coverage and initiate transplanting and re-planting mangroves. Mangroves are known to absorb the destructive power of waves, a demonstration of which was seen during the December 2004 tsunami that struck the Indian coast. The impact of the killer wave was reported to be comparatively less along the coastal areas bordered by mangroves, seagrass beds and coral reefs, a lesson to be learnt for protecting the coast by biological interventions.

Wetlands: There are numerous lakes, ponds, marshes, lagoons, estuaries, backwaters and mangrove swamps widely spread across the country, which are vital to the country's water needs, food production and biodiversity, (plants, insects, amphibians, reptiles, birds, mammals). The inland freshwater wetlands cover seven million hectares. Bihar State has the maximum wetland area followed by Uttar Pradesh. Gujarat State has the least. Flood prone wetlands rich in fisheries resources are found in U.P. Bihar, West Bengal, Assam, Manipur, Tripura and Arunachal Pradesh. They are highly productive nutrient-rich water bodies formed due to changes in the course of rivers, amenable for culture fisheries production, ranging from 50-400 kg/ha. The estuarine wetlands (*Bheris*) of West Bengal covering about 40,000 ha, once rich sources of capture fisheries production, got converted to culture systems for production of the highly valuable tiger shrimp and fish (210-515 kg/la). However, the potential of these freshwater and brackishwater wetlands has been estimated to be much higher.

Wetlands are sometimes considered waste lands and used for dumping garbage, solid waste

materials, and hazardous substances ignoring the great protecting, recycling, purifying and power generating capacities of the wetlands. They are often filled up for construction of houses and other buildings. Their role as floodplains, natural defences that deflect the impact of heavy rain and floods is ignored, incurring heavy economic losses. The quality of water in the wetlands is reported to have deteriorated due to heavy pollution, loss of biodiversity and accumulation of toxic residues in fish. Pesticide, fertilizer and sewage wash-down had increased making aquatic fauna and flora succumb to the lethal levels. Other environmental and human stresses include siltation, eutrophication and encroachment. Creation of a buffer zone of organic farming around wetlands has been recommended to control pollution.

The wetlands are also havens for several species of endangered and threatened species of birds. India recommended only 19 wetlands for listing under Ramsar Convention of 1971 but a recent study by Salim Ali Centre for Ornithology and Natural History (SACON) found 655 water bodies worth preserving. According to this study, in the past 10 years, 40% of the country's wetlands are lost. Wetlands are among the least protected ecosystems in developing countries, with India particularly vulnerable to their degradation and loss. It would be prudent to adopt an environmental policy in the form of a National Wetland Act to conserve the wetlands rather than restore the lost ones, with due participation by communities living in the areas. The proposed national network of wetland protected areas and a national wetland policy are in the right direction but they should be comprehensive to cover all resources, including fish. The recent deluges in Mumbai and Chennai should partly be attributed to developmental activities, especially for construction of buildings, by reclamation of low lying areas, wetlands and mangroves which are natural defences against floods. Why cities are inundated but not villages or rural areas is food for thought because north-east monsoon and south-west monsoon

rains occur every year, although they are unusually heavy now and then.

Coral Reefs: The Indian coral reefs are distributed in four major regions, viz., the Andaman and Nicobar Islands, Lakshadweep, the Gulf of Mannar and the Gulf of Kutch. They are some of the richest and complex ecosystems in the world, sustaining millions of animal and plant species, food security in the form of fish, other animals and plants and protection for coastal communities throughout the world. They are the most productive ecosystems in the marine realm. These largest and the oldest living communities are said to have evolved 200 million years ago and the modern reefs 60 million years ago. Because of the remoteness of coral areas from civilization, adverse atmospheric and environmental conditions prevailing in the coastal areas, hazardous terrains and often uninhabitable and difficult living conditions hamper rapid progress in research and development to fully utilize the living and non-living resources. World over, the reef resources have been exploited for food, industrial uses, road and building materials, precious stones, bioactive compounds and tourism development. However, even to day, Indian coral reefs remain the least explored, studied and utilized. On the other hand, they are indiscriminately damaged by human exploitation mainly for the cement industry as a source of calcium carbide, as road and building material, especially in the Gulf of Mannar and Gulf of Kutch. The Andaman and Nicobar Islands and the Lakshadweep areas, because of their farflung location from the mainland. These are comparatively less affected by human depredations.

The corals have a slow growth rate from 2 cm. to 20 cm per year for massive corals to branching corals. Adverse environmental conditions cause slower growth, failure of reproductive mechanisms and in extreme cases, a shutdown reaction which results in the expulsion of zooxanthellae and the death of entire coral colonies. Corals are in peril not only in this country but also

(Contd... at page 162)

