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Impact of Inter River Basin Linkages on Fisheries

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Introduction

Human societies have always tried to expand the spatial extent of availability of water by the diversion of streams or rivers. The idea of drawing water from the rivers in eastern India, which have larger runoff, in comparison to certain places in the peninsular region, where the precipitation levels are much lower, can be seen as an extension of that practice. In the 19th century, Sir Arthur Cotton had thought of a plan to link rivers in southern India for inland navigation. Though partially implemented, the idea was later abandoned because inland navigation lost ground to the railways. In more recent times, the 'Ganga-Cauvery Link' proposal mooted by former Irrigation Minister, Dr. K.L. Rao was examined and found impracticable because of the very large financial and energy costs involved, and the 'Garland Canal' idea put forward by airline pilot Captain D. Dastur, was termed as technically unsound.

The recent revival of the idea of interlinking of 'surplus' basins with 'deficit' basins has been the result of work done by the National Water Development Agency (NWDA) and bears a conceptual continuity with Dr. Rao's proposal. The Himalayan rivers component and the peninsular rivers component constitute the two parts of the river-linking project. The Himalayan segment envisages 14 links, *viz*., Manas-Sankosh-Tista-Ganga, Kosi-Ghagra, Gandak-Ganga, Ghagra-Yamuna, Sarda-Yamuna, Yamuna-Rajasthan, Rajasthan-Sabarmati, Chunar-Sone Barrage, Sone Dam-Southern tributaries of Ganga, Ganga-Damodar-Subernarekha, Subernarekha-Mahanadi, Kosi-Mechi, Farakka-Sunderbans and Jogi-Gopa-Tista-Farakka. The general idea is to transfer waters from 'surplus' eastern rivers to 'deficit' central, western and southern regions.

The peninsular segment involves 16 links, *viz*., Mahanadi (Mani Bhadra)-Godavari (Dowlaiswaram), Godavari (Inchampalli low dam)-Krishna (Nagarajunasagar tail pond/Pulichintla), Godavari (Inchampalli)-Krishna (Nagarjunasagar), Godavari (Polavaram)-Krishna (Vijayawada), Krishna (Almatti)-Pennar, Krishna (Srisailam)-Pennar, Krishna (Nagarjunasagar)-Pennar (Somasila) Pennar (Somasila)-Cauvery (grand Anicut), Cauvery (Kattali)-Vaigai-Gundar, Ken-Betwa, Parbati-Kalisindh-Chambal, Par-Tapi-Narmada, Damanganga-Pinjal, Bedti-Varda, Netravati-Hemavati and Pamba- Achankovil-Vaippar. The project is expected to provide irrigation facility to 25 m-ha land through surface water and additional 10 m-ha land through groundwater as also generate 34,000 MW of power.

As regards impact on fisheries, there could be positive as well as negative impacts. With creation of more water basins and canals, the resource for fisheries and aquaculture is expected to increase, while on the other hand, there could be mixing of fish species between the river basins, loss of certain amount of biodiversity as also entry of some invasive fish species.

Indian Fisheries

Fisheries is an important economic activity in the country, with over seven million people involved in the sector, majority of whom live in 3,937 coastal villages and fisher-hamlets, along major river basins and reservoirs in the country. The sector has also been

one of the major contributors to foreign exchange earnings through exports, to the tune of Rs. 6,800 crores annually. India is the fourth largest fish producer in the world and second in inland fish production. The fisheries sector contributes 4.5 per cent to the agricultural GDP and 1.4 per cent to the total GDP. The country is endowed with about 8,118 km of coastline with some of the richest fishing grounds in the world and estimated potential of fish production from the seas is 3.9 million metric tonnes. The main inland fishery resources include about 1.20 million hectares of brackish water area, 2.38 million ha of fresh water ponds and tanks, 3 million ha of reservoirs, besides about 1,91,000 kms of rivers and canals. The potential fish production from inland waters is 4.5 million metric tonnes. The present total fish production of 6.12 million metric tonnes is expected to increase to about 8.4 million tonnes, with the annual growth rate of around 4.5 per cent. Both inland and marine fisheries directly or indirectly depend on the river systems. The different river systems, *viz*., Ganga, Brahmaputra, Mahanadi, Godavari, Krishna, Cauvery, Narmada, Tapi and their tributaries have been studied over the years, with regard to hydrobiological conditions, biota, distribution and abundance of fish species, and so on. Major fish species along with the endemic and endangered ones have been listed for the river systems and the effects of impoundments documented. New approaches of regulatory measures, river ranching, protected habitats and sanctuaries are also being evaluated. The aspects of minimum flow and environmental flow in river systems are being debated in the context of aquatic biodiversity and fisheries management.

International Scenario

International experience in linking of rivers has shown both beneficial and harmful aspects. Diversion of water in upper reaches in the case of the Aral Sea in Central Asia (in former USSR) resulted in loss of over 60 per cent of its surface area and two-thirds of volume. The cause is attributed to a vast expansion of irrigation in the Central Asian Republics beginning in the 1950s, which greatly reduced inflows to the Sea. China has officially launched the world's largest water diversion project, which will divert water from the Yangtze River in the south to the country's dry north, including Beijing. The project, valued at US $ 59 billion, may cost twice as much as the ongoing Three Gorges Hydroelectric Project. The project will be the biggest of its kind in the world and the largest engineering programme in China. It consists of three canals running about 1,300 km through the country's eastern, middle and western parts.

The Spanish National Hydrological Plan (SNHP) has proposed a massive transfer of water from the Erbo river in the north of the country to the Valencia and Murcia rivers in the south, which suffers severe water shortage difficulties due to such things as intensive agriculture and tourism. There, however, have been reactions regarding the loss of Europe's most ecologically important wetlands and the proposal is being reviewed.

Impact on Fisheries

Positive Impacts

- *Canals and reservoirs*: The proposed interlinking of rivers would comprise more than 36 major dams and 30 canal links. In addition, there will be many more irrigation canals and barrages. These major reservoirs, canals and other water harvesting structures will add to the potential fishery resources of the country.

- *Rejuvenation of lakes and rivers*: The rivers and lakes in the water recipient zone will bring benefit with increased water perennially, congenial habitat and consequently, higher fish production.

Negative Impacts

- *Loss of habitat*: River interlinking might affect fish feeding and breeding habitats in the rivers and lakes in the water donor zones due to lowering of water volume and enhanced siltation load. The flood plains and wetlands connected with donor rivers would also be affected. River run-offs provide energy for a number of vital processes in downstream estuaries, delta and coastal areas. Reduced river discharge could result in loss of coastal habitats such as mangroves, coral reefs, sea grasses, estuarine and delta regions.

- *Water quality changes*: Significant changes in water quality of rivers, lakes, estuaries and coastal waters could occur due to changes in sediment load, nutrients and contaminant levels. The levels of toxicants and contaminants in donor rivers may go up owing to reduction in self-purifying functions subject to changes in flow regimes.

- *Loss of biodiversity*: Each river system has distinct groups of biota different from other water bodies. When environment is altered, they are affected, with particular threat to endangered and endemic species. The linkage of rivers could also lead to loss and homogenisation of genetic diversity of fishes.

- *Changes in land-ocean interactions*: River is a critical component of the delta-estuary-coastal sea ecosystem. Un-impounded rivers provide energy for a number of vital processes in downstream estuaries, delta and coastal areas, upon which healthy fisheries are dependent. The linkage of rivers could alter the timing and quantity of river discharge into the sea, which may alter the river-mediated land-ocean interactions and coastal fisheries. A recent study conducted by Central Marine Fisheries Research Institute, Kochi, on 'Impact of Dams on River into Sea and Changes in the Coastal Waters' has shown that reduction in river discharge into the sea will adversely affect the water chemistry and productivity profile of coastal waters and the estuarine fisheries.

In view of the above concerns, NAAS organised a Round Table[*] on 'Impact of Inter-linking of river basins on Fisheries' to have a comprehensive assessment of the plan on interlinking of rivers, discuss the similar proposals in other countries, understand the aquatic biodiversity and fish distribution in Indian rivers and project the fisheries scenario in the event of the linking of rivers. The recommendations emerging from the deliberations are given below.

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[*] *Round Table held during 21-22 May 2004, under the convenership of Dr. S. Ayyappan, Deputy Director General (Fisheries), ICAR. The Round Table, which was basically an interactive meeting of different stakeholders, was inaugurated by Sri S. Regunathan, Secretary, Department of Animal Husbandry and Dairying, Govt. of India; with Dr. S.Z. Qasim, Former Member, Planning Commission, chairing the Meet. With participants from a number of organisations, the discussions and the plenary session were chaired by Dr. V.L. Chopra, President, NAAS. Experts from various govt. departments like Joint Secretary, Department of Animal Husbandry; Member, Task Force on Interlinking of Rivers; Ministry of Water Resources; International Water Management Institute; World Fish Center; and ICAR participated in the discussions.*

Recommendations

- *Data mining*: Large volume of raw data on water quality, productivity, aquatic ecology and fish biodiversity are available for river systems 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 various river systems.

- *Modelling studies and scenario analysis*: Software-aided modelling studies are required to assess the impact of changes in river runoff on water chemistry, productivity, aquatic ecology, biodiversity and fish production. The impact of interlinking of river basins on fisheries will vary from one 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.

- *Scaled-down approach*: Before initiating large-scale river basin linking at national level, it will be appropriate to conduct studies on linking adjacent river systems with 10 similar ecosystems. Such scaled-down approach will be very useful to assess and understand the environmental impacts of river linking on aquatic ecosystem.

- *Environmental flow*: Environmental flows may be broadly defined as the 'provision of water for freshwater-dependent ecosystems to maintain their integrity, productivity, services and benefits in cases when such ecosystems are subject to flow regulation and competition from multiple water users'. There is an urgent need to assess the minimum environmental flow in donor rivers. It is anticipated that the knowledge base created through this process will strengthen the level of understanding of methodologies available for use, their relative strengths and deficiencies, and their potential for application under various circumstances.

- *Loss-gain statement*: There is an urgent need to work out a lossgain statement on the possible impact of interlinking of river basins on fisheries, using the available data.

- *River ranching*: River ranching of fishes is being carried out in various parts of the country by different agencies. It is necessary to evaluate the usefulness of river ranching for enhancing the fish production in our river systems. River ranching with fish seed in altered scenario needs to be addressed in a proper perspective.

- *River siltation and dredging*: The siltation pattern in donor and receipt rivers could change due to interlinking. Heavy siltation of rivers, canals and lakes is already an acute problem in the Himalayan region. There is urgent need to assess the usefulness of river bed dredging for improving the river ecology and fish production.

- *Impact on estuarine and coastal waters*: River run-offs provide energy for a number of vital processes in downstream estuaries, delta and coastal areas. These processes include transport of nutrients, organic matter and nutrient-rich silt, oxygen enrichment, entrainment of nutrients in bottom sediments, dilution and flushing of

pollutants, etc. The most widely discussed and well-documented impacts of large-scale hydrological alterations (river damming and river diversion, for example) on marine systems are, reductions in water and sediment discharge. Immediate attention should be given to study the impact of altered river flow due to river interlinking on biodiversity pattern of estuarine and coastal fauna.

- *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 project the post-linking scenario.

- *Taxonomic studies*: Taxonomists and taxonomy related studies are required to assess and document the aquatic biodiversity patterns. Hence, there is an urgent need to give stress to taxonomic studies and developing human resources in the field of taxonomy.