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Coldwater Fisheries in India: Priorities, Policy, Institutional Support and Challenges

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Abstract

Technology developed for the culture, breeding and management of the economically viable cold-water fish species has a positive impact on the production and productivity, employment generation and sustainable management of the aquatic resources and their piscine fauna. The existing policy and institutional mechanisms clinching the priorities and promotion of cold-water fisheries and aquaculture on sustainable basis are presented in this paper. It is proposed that a collaborative framework for multiple uses of water for irrigation, energy, navigation, fisheries, tourism and domestic uses and also for appropriate benefit sharing should be promoted on sustainable basis. Further, knowledge and understanding of the dynamics of the food, water, and energy and the possible areas of trade-offs and synergies should be broadened through support integrated modelling research.

Keywords: Coldwater fishery, management, policy, priorities, climate change.

Introduction

Himalayan region is distinctly known as the "Water Tower of Asia" or the third pole of the world for its unique biogeographical, climate and hydrological set up. The Himalayas are a major source of fresh water for India's perennial rivers such as the Indus, the Ganga and the Brahmaputra. The Himalaya is covered with rich pristine forests, a diverse flora and fauna, and is home to a number of beautiful fishes (Sehgal 1999, Singh and Akhtar 2015, Singh and Sarma 2017). The diverse natural resource-base, wide climatic diversity of the cold water sector harbour plentiful gene pool which are conducive to conservation and rearing for developing domestic market, aquaculture and growing interest of people in fish farming, ornamental fish keeping and eco-tourism including angling. The present exploitation of fishery resources in upland regions comes mainly from capture fisheries, though fish production through culture practices is gaining momentum. Several constraints such as low productivity of upland waters, comparatively slow growth rate in almost all fish species, low fecundity and poor landing and marketing facility have been major obstacles in the rapid development and expansion of cold-water fish production. Though the aquatic resources are now much degraded and under tremendous stress, the diversity of the fish germplasm has forced international community to tag many local and endemic fish species under threatened category of Red Data Book (IUCN). The Schizothoracines are important dominant fishery of these river systems followed by cyprinids (Singh *et al.* 2014) while there are numerous small fish species having ornamental value (Singh and Akhtar 2015, Zaidi *et al*. 2018). Unfortunately, the fishery of Himalaya is suffering from anthropogenic stresses (Singh *et. al.* 2014, Singh and Akhtar 2015), physical barriers in the form of damming and hydropower projects (Singh and Agrawal 2017) and resulting habitat loss (Singh *et al.* 2014). Since societal development, climate change and ecosystem degradations are stemming into big threats to the natural aquatic resources and their fish germplasm, scientists and policy makers are facing several challenges for sustainable management of the aquatic germplasm resources and aquaculture production enhancement. Himalayan states have further suffered because of the remoteness of the areas and difficulty in execution of infrastructure development plans in a limited time frame of 5-6 months in a year because of the severe weather conditions that produce avalanches during winter and landslides due to incessant monsoon rains in these

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Table 1. Aquatic resources and their fish diversity in Indian Himalayan Region (IHR) (Based on our GIS based mapping and field data).

Sr. No.	State	Lakes (ha)	Reservoirs (ha)	Rivers (km)	Fish Species Diversity (No.)
1	Jammu & Kashmir	137275.3	4087.3	10893.5	21
2	Himachal Pradesh	27.2	31320.2	10464.3	62
3	Uttarakhand	212.0	16864 .0	10657.8	83
4	Sikkim	1004.5	--	1771.5	47
5	Arunanchal Pradesh	2792.7	--	12351.0	167

areas. Himalaya is one of the most delicate and fragile mountain ecosystems of the world and is under threat due to rapid increase in population, climate change and tourist expansions. The present Himalayan aquatic resources and their fish diversity are summarized in Table 1.

Conservation Priorities

In the Himalayan region, priorities to strengthen rural livelihood through aquaculture and fisheries has been considered through creating firstly the '*enabling environment*' which is more important than improving the '*production system*' due to its vital role in maintenance and support of the present practices, and to combat future threats of climate change scenarios. In present scenario, limited use of technology in agro-ecosystems and institutional weaknesses in Himalayan states coupled with limited capacities of rural people demands a favorable environment for adaption. Some of the important action targets proposed to be undertaken on priority are as follows:

- Conservation of key ichthyo-biodiversity areas and their effective management to secure long-term ecosystem resilience.
- Securing community livelihood and natural fishery resources management in Himalayan aquatic ecosystems.
- Enhancing enforcement, monitoring, prosecution and cooperation to reduce illegal fishing, trade and related threats.
- Knowledge management and M & E

Regulations for Aquatic resource management

There are a number of regulations in the Himalayan fisheries such as closed season, bag limit, size limit, fishing in protected waters, temple tanks as well as illegal fishing (poaching, poisoning & dynamiting). However, we do not have scientific guidelines and regulations on the following subjects:

- Guidelines on stocking of river & lakes
- Guidelines and regulations on stocking material such as trout, carp and mahseer in streams and lakes

Management Strategies

It is important to develop management strategy to protect, enhance and restore river/reservoir fisheries habitats supporting cold-water fish communities and critical habitat components which should include:

- Riparian zone/vegetation
- A water level management plan to protect spawning and nursery habitats
- Minimum winter pool depths
- Wetland habitats
- High dissolved oxygen concentrations
- Groundwater discharges
- Coldwater spawning and nursery habitats provided by tributary streams

The management strategy for reservoirs should also recognize the need to protect cold-water stream habitats located downstream from the reservoirs (e.g. the need to maintain bottom-discharge structures on dams).

Technological Opportunities and Challenges:

In spite of the above conservational limitations, we have several opportunities also which should be taken up as challenge to accomplish them. Some of them are as

Table 2. Existing Legislation and Policies in IHR related to aquatic resources, environment and fisheries.

Policies/Acts	Description	Gaps
National Environmental Policy (2006)	Prescribes sustainable conservation and development of critical ecosystems and the associated natural resources through equitable access, integration of environment and development, good governance, and multi-stakeholder partnerships.	Comprehensive, but implementation not uniform throughout the country
Environment (Protection) Act (1986).	Act aims at preservation of environment through a set of rules and also legitimizes declaration of Eco-Sensitive Areas (ESAs)	Presently there are no rules and regulations/guidance on use of resources in buffer zones/ESAs.
Wildlife (Protection) Act (1972)	Focus on the protection of threatened species of flora, fauna and their habitat and applicable uniformly throughout the country except in the state of J and K	Act is very general and wildlife habitats and critical wildlife corridors are not covered under this Act.
The Biological Diversity Act (2002)	It has provision for creation of Biodiversity Management Committees (BMCs) at Gram Sabha (Village Council), Block and District levels.	However, formation of BMCs in the high altitude rangelands especially in remote areas and their functioning may require substantial time as the State Biodiversity Boards lack adequate financial and human resource at present.

given under:

- Domestication of more number of endemic/local species for aquaculture diversification
- Development of package of practices and farming system and husbandry practices besides traditional integrated crop-fish-livestock production system with reduced negative impacts on environment.
- Improved feed management through development of cost effective and nutritionally complete feeds with reduced fishmeal use, alongwith efficient feed management system.
- The production of improved breeds through application of genetics, selective breeding and biotechnological tools.
- Better fish health management practices.

Governance and Policy

A plethora of policies and acts cover natural resource use in the high ranges of Himalayan region. Of these, the most prevalent act is the Indian Forest Act, 1927 and Indian Forest Policy, 1988. A number of acts and policies exist in various sectors, which include agriculture, livestock husbandry, water and environmental protection and biodiversity conservation. Wildlife (Protection) Act, 1972, Forest Conservation Act, 1980, the Environment (Protection) Act, 1986 and National Environmental Policy, 2006 are some important Policies and Acts catering the to the conservation, sustainability and sustainability of aquatic ecosystems. A summary of issues and gaps in major policies/legislations is presented in Table 2.

The following are some of the relevant policies catering the governance and policy of the IHR:

- Institutional approaches and existing policy to offer a comprehensive framework for good fisheries governance.
- Enhancing the capacity to mitigate climate change impacts, which is a critical challenge.

Key policy issues identified for sustainable mountain development

We need to take action on prioirity on the following identified plan for sustainable development of fisheries and aquaculture in the mountain region:

1. Strengthening of knowledge about the mountain eco-systems

2. Capacity building of mountain fisher folk communities

3. Maintenance and development of cultural diversity

4.Holistic and inter-disciplinary management strategies for environmental conservation and sustainable fishery development

5. Dissemination of more, realistic and accurate scientific information on fisheries and aquaculture

6. Attention to create urban aspects of mountain fisheries

7. Empowerment of local communities including women

8. Attention towards conflicts and resulting destruction of mountain aquatic ecosystems

9. Promoting integrated watershed development and alternative livelihood opportunities through fisheries

10. Review of policies and legal frameworks for fishery resource management in the high Indian Himalayan waters

Recent Policy Formulations

Recent endeavor has invited attention on policy formulation in India

- National Inland Fishery and Aquaculture Policy (NIFAF), Department of Animal Husbandry, Dairying and Fisheries, Ministry of Agriculture and Farmers Welfare
- Mainstream biodiversity concerns into the National Inland Fisheries and Aquaculture Policy, 2018 developed by Centre for Biodiversity Policy and Law (CEBPOL) under NBA
- Policy on Mahseer and Hilsa Conservation (NAAS Publication March 2019)

Constitutional Provisions related to Climate Change

It is also found that there is a lack of policy and strategy to promote climate resilient water management practice and the distribution of governing power across various levels of governance is also imbalanced and is often incompatible with sustainable management of natural resources. Mainstreaming climate change in the development policies should be ensured so that climate change is better integrated in the planning, budgeting and implementation. There are following climate change relevant provisions, which need be developed to mitigate the adversities of climate change:

1. International boundary rivers

2. Policies relating to conservation and multiple use of water resources

3. National and international environment management, national parks, wildlife reserves, and wetland, national inland fishery policies, carbon services

4. Land use policies, human settlement, development policies, tourism policies, environmental adaptation.

Global Partnership

Following issues related to global partnership should be built up:

- Trade
- Systemic Issues
- Policy and Institutional Coherence

Conclusion

The aquatic resources in hills are quite valuable for the development of fishery both for food, sport, recreation and employment but scientific management of these resources is necessary to achieve the objectives. In order to manage these ecosystems, it is necessary to take up appropriate strategic plans and action so that hill aquatic resources and aquaculture activities may contribute to fishery and aquaculture substantially in remote hilly regions on a sustainable basis. The mountain fish resources and their promotion for better aquaculture and fisheries are of great relevance in the national context for which different technological approach and support services have been carried out. Such resources along with our endeavour to promote them have to be properly utilized on sustainable basis for increasing fish production for national basket and rural upliftment in hills. However, emerging anthropogenic pressure, flow regimes of streams, and climate change are adversely affecting cold-water resources and their fisheries; lead to reduce overall productivity.

References

Sehgal K. L. 1999. Coldwater fish and fisheries in the Indian Himalayas: rivers and streams. p. 41-63. IN T. Petr (ed.) Fish and fisheries at higher altitudes: Asia. FAO Fisheries Technical Paper 385. FAO, Rome. 304 p.

S. Debajit, Singh A. K and Barua D. 2018. Checklist of endemic ichthyofauna of North-east India. Ind. J Fisheries 65: 1-15.

Singh A. K. 2018. Breeding and propagation of Himalayan golden mahseer in India Issues, policies and consilience. IN: Reaching the Unreached: Newer approaches in Animal Sciences for Socio-economic upliftment (Eds) P. Nagarajrao, A. K. Saxena, Vijai Luxmi Saxena and G. K. Kulkarni) Today and Tomorrow, Printers and Publishers New Delhi Pp 47-53.

Singh A. K. and Sarma D. 2017. Aquatic resources and fish diversity of the Himalaya, Narendra Publishing House, New Delhi.

Singh G. and Agarwal N. K. 2017. Impact of hydropower project (RoR) on the ichthyofaunal diversity of river Birahiganga in Central Himalaya (India). J. Fisheries 5: 507–512.

Singh A. K. and Akhtar M. S. 2015. Coldwater fish diversity of India and its sustainable development. Biodiversity for Sustainable development (ed.) Pratibha Singh. UP Biodiversity Board, Lucknow. pp 97-105.

Singh A. K., P. Kumar and Ali S. 2014. Ichthyofaunal Diversity of the Ganges River System in Central Himalayas, India: Conservation Status and Priorities. IN Sinha R. K. and Ahmed B. (eds.) Rivers for Life - Proceedings of the International Symposium on River Biodiversity: Ganges-Brahmaputra-Meghna River System, Ecosystems for Life, A Bangladesh-India Initiative, IUCN, International Union for Conservation of Nature, pp. 208-214.

Zaidi S. G. S, Singh A. K and Sarma D. 2018. Breeding, seed production and rearing of coldwater ornamental fishes in Aquarium. Published by ICAR-DCFR Bulletin No 27, 43 pp.