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Community-based Fish Sanctuaries for Fish Conservation in Garo Hills in the North-Eastern Region of India

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Abstract

Fish sanctuaries provide a congenial habitat that supports to fish growth, survival and recruitment. The community-led conservation approach signifies its community participations for conserving fish resources through locally enforced regulations. Evidence from the protected stretches of the River Simsang, Meghalaya shows that the consistent community observations and societal regulations can efficiently restore the declined fish stocks at *Wachi-Wari* fish sanctuary. The collective decision making and indigenous knowledge systems have contributed significantly to the recovery of ecologically important hill stream fishes (*e.g*., mahseers), while simultaneously enhancing local livelihood security. The community managed fish sanctuaries in the Garo Hills, Meghalaya illustrates a suitable example of conservation approach for '*mahseer*' which is relevant to the other parts of the Northeast India and comparability to the other tropical river systems.

Keywords: Community-managed, Conservation, Fish, Sanctuary

Introduction

Fish sanctuaries provide a congenial habitat for enhancing fish biodiversity and improving inland fisheries productivity. Fish sanctuaries are generally established in deep-water pools to act as refuges for fish in the dry season. The fish sanctuary zones support both sedentary and migratory species. There are fishing restrictions for some or all fishing activities around the year or in particular seasons in the designated water stretch which acts as the sanctuary that might be defined by the local communities or by the Government. The concept of fish sanctuary existed in India historically as many local fishing and non-fishing communities have looked after aquatic biodiversity conservation through localized governance systems. The reasons for formation of fish sanctuaries were religious, societal welfare, provisioning services such as food and water, aesthetic views and cultural heritage. A review report on fish sanctuary in India by Jumani *et al.* (2023) stated that "community-based fish sanctuary is as a specific waterbody, its associated fish resources and other biotic and abiotic habitat elements that are managed by one or more local communities through formal or informal governance mechanisms. These sanctuaries have existed across India for centuries and usually comprise a river reach (ranging from 50 m to 20 km) or pond protected by local communities from destructive activities such as fishing, sand mining, water abstraction and removal of riparian vegetation". Hilsa fish sanctuaries in river Bhagirathi are an example of Government-led initiative in West Bengal for protection of Hilsa and facilitation of spawning. In the Southeast Asian Region, fish sanctuaries are commonly found at Lao PDR in river Mekong, which is governed either by local communities or the Government or by both.

The extensive growth of industrialization, rapid urbanisation and hydrological interventions has significantly modified many river ecosystems, which directly reflects considerable stress on these flowing ecosystems. Traditional methods in fisheries management such as controlling the size of fish harvested, controlling the amounts of fish harvested, gear restrictions, ban in fishing seasons, limited entry and temporary area closures have proved to be ineffective in many cases. Even though fish sanctuaries are crucial in view of their ecological and conservational objectives, there is little documentation about how they function in rivers, streams and wetlands because of which they are over-looked in adopting strategies in managing inland fisheries. Since fish sanctuaries act as a balance ecosystem

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by safeguarding the fish breeding and nursery grounds, it does conserve the endangered and resident fish species. Furthermore, it ensures increase biodiversity and sustainable use of its resources, thereby support the livelihood of the locality. Therefore, a well-managed fish sanctuary plays its role for *in-situ* conservation of freshwater fish and its cultural and societal benefits of the local populace. The present communication highlights the role of community led initiatives in conserving fish diversity and ecotourism within the river ecosystem through their traditional ecological knowledge and collective efforts in the Garo Hills of Meghalaya.

Fish Species Diversity of Meghalaya

The state of Meghalaya bestowed with extensive open water resources including rivers (5600 km), reservoirs (650 ha), floodplain wetlands and swamps (500 ha) and lakes (50 ha) (Das *et al.*, 2022). Previous study by Mahapatra *et al.* (2004) enlisted 175 fish species belonging to 86 genera, 32 families and 9 orders from the state of Meghalaya. Recently, Snaitang *et al.* (2023) reported 102 fish species dominated by Cypriniformes (53 species) and Siluriformes (24) from the state.

Govt. of Meghalaya (National Database Wildlife Cell) enlisted five major protected areas are declared in Meghalaya which served as home of variety of flora and fauna (Table 1).

Table 1: Protected areas of Meghalaya, Meghalaya Biodiversity Board

Name of the Protected areas	Area (Sq. Km)	Year of establishment	Districts covered
Balphakram National Park (NP)	220.00	1985	South Garo Hills
Nokrek Ridge NP	47.48	1986	East, West and South Garo hills
Baghmara Pitcher Plant Wildlife Sanctuary (WLS)	0.02	1984	South Garo Hills
Nongkhyllem WLS	29.00	1981	Ri - Bhoi
Siju WLS	5.18	1979	South Garo Hills

Evolution of Fish Sanctuaries in Meghalaya

According to the Gazette of Meghalaya (No. 199; published on 28 October 2024), fish sanctuary "includes certain sections of rivers and reservoirs where fishing is prohibited for a certain period or all year round on account of cultural significance or on account of conservation and propagation of indigenous and endemic species of fish and aquatic fauna or for any other reasons as may be notified by the Executive Committee". In Meghalaya, where rivers are intricately linked to community livelihoods and customary rights, local governance systems have historically regulated access to aquatic resources. The conservation efforts began in 1955 in the *Amalayee* River by the local people when fishing was prohibited after overexploitation of resources basically for utilitarian purposes. Literatures (IBDLP-MSAM, 2012; Aquaculture Mission; In Conversion with People of Meghalaya) stated that fishing, undertaken both for subsistence and recreational purposes. In addition, community fishing was traditionally practiced during the winter months (November/December), locally referred to as '*Shoh-kha-ru*'. Sometimes, the traditional disputes occur between the villages.

According to a historical report, there was a dispute between the two hamlets (*Nongbareh-Rim* and *Nongbareh-Iyntiar*) situated in the bank of the *Amalayee* River due to their fishing rights and ownership of the shared river stretches in their community fishing practices. In response to their rising disputes, the village head (*Lyngdoh*) issued a decree on prohibiting fishing in the river and imposed strict regulations (penalties to the violators) with the purpose of conserving fish populations (*Tor* spp.) and ensuring sustainable benefits for both villagers. Hence, evolution of conservation concepts of *Amalayee* fish sanctuary, Jaintia Hills, Meghalaya had already been recognized prior to 1955. Later, all infrastructures have been developed for promoting ecotourism in the sanctuary under the Meghalaya State Aquaculture Mission (MSAM).

Over the past decade, the state of Meghalaya has addressed issues of habitat loss and overexploitation of fishery resources through the community-managed fish sanctuaries and majority of them are in Garo Hills. Department of Fisheries, Govt of Meghalaya reported the establishment of 79 fish sanctuaries since 2021 and most of those sanctuaries were recognized and established after the initiatives taken by the MSAM. Dash *et al.* (2020) enlisted 54 fish sanctuaries throughout the state, with the maximum Mahseer sanctuaries (13 nos.) established in East Khasi Hills. Former authors also listed the distribution of Mahseer sanctuaries in the other districts of Meghalaya represented as South Garo Hills (12), East Garo Hills (8), Jaintia Hills (7), West Garo Hills and West Khasi Hills (5 nos. each) and Ri-Bhoi district (4).

Group hunting of fish in river is the common practice for the indigenous hilly tribes, lead to 'community fishing'. Various types of tuberous roots, tree leaves and fruits are used for poisoning of fish. By a community-led resolution, they are excited to go 'community fishing' on a particular date, especially in the winter months (December/January). At the same time, they are equally concern about the conservation of fish species and its sustainability at those small/ pocket fish sanctuaries. Therefore, community decisions extend the overall management of fish sanctuaries by passing various rules for the villagers, such as prohibition of fishing at the designated stretch for round the year, major penalties to the violators as well as involvement of protectors (watch and ward) for the conservation sites. While communities lead day-to-day management, MSAM provided start-up

support (*e.g.*, fencing, signboards, awareness), explicitly encouraging 'pocket fish sanctuaries' in naturally favourable pools (*Waris*) and runs.

Community Managed Fish Sanctuaries in Garo Hills

According the Govt of Meghalaya, the Garo Hills region included five districts of Meghalaya namely North Garo Hills, South Garo Hills, South-West Garo Hills, West Garo Hills and East Garo Hills. The region is encompassing by two mountain range (Arabela Range and Tura range).

The rivers of Garo hills mainly include Simsang (Figure 1), Ganol, Jinjiram, Bandra, Daring, Dareng, Chibok and many other non-navigable streams are home to rich floral faunal resources. River Simsang, the longest river in Garo hills, originated from the Nokrek hill. The river and its tributaries hold several mahseer congregation sites which are rarely found in other parts of the country.

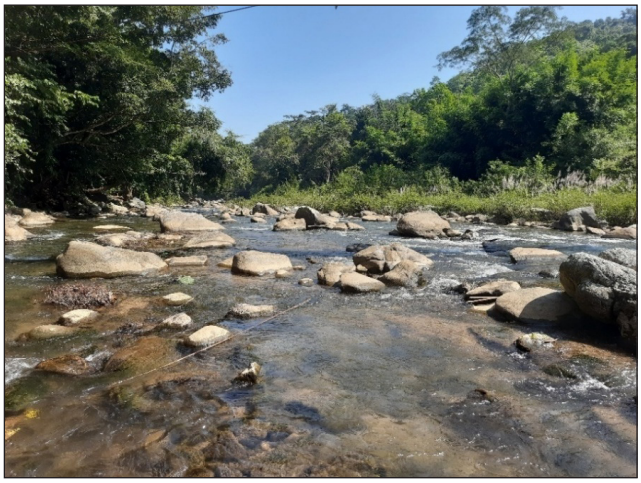

Figure 1: Simsang River at Rombagre, West Garo Hills, Meghalaya

A total of 25 fish sanctuaries or '*waris*' (pool) has been established in Garo hills, mainly designated as 'mahseer' sanctuaries (Dash *et al.*, 2020). A significant recovery of fish populations also documented following the establishment of fish sanctuaries in Bangladesh, demonstrating the positive ecological impact of such conservation interventions. Therefore, local fishermen believed that the establishment of fish sanctuaries in deep pools enhances fish productivity and diversity and thereby contributing to the improvement of socio-economic benefits of the local people.

Institutional Arrangements and Governance

The institutional arrangements of two fish sanctuaries of Garo hills namely, *Wachi-Wari* on Simsang River, *Rombagre* village (West Garo hills) and *Nengmandalgre* fish sanctuary on *Chibok* River (East Garo hills) are discussed, collected from the site respondents at both the sanctuaries. Most sanctuaries are declared and run by village institutions (*Nokmas/dorbar shnong*) through Fish Sanctuary Management Committees (FSMCs) that set site-specific rules, maintain curbs and conduct patrolling.

Wachi-Wari is one of the oldest fish sanctuaries that has been run by *Rombagre* village Development committee since 1965, near *Songkal-Wari* fish sanctuary. Department of Fisheries, Govt. of Meghalaya boosted up the sanctuary under the MSAM during 2012-2013. With the dominance of Chocolate mahseer (*Neolissochilus hexagonolepis*) in the shoals, the sanctuary has been well recognized as tourist spot as equal importance of *Sangkal-Wari*. The area of the *wari* is 0.1 ha with 2.5 m depth with transparent water (Figure 2). The detail physicochemical parameters of *Wachi-Wari* fish sanctuary are depicted in table 2 (during observation in the month of October). The water quality in the *Wachi-Wari* observed to be slightly acidic in nature with well oxygenated environment. Total alkalinity recorded to be comparatively low with higher silicate-Si content. Concurrently, phosphate-P was slightly lower than the nitrate-N content in the sanctuary water (Table 2).

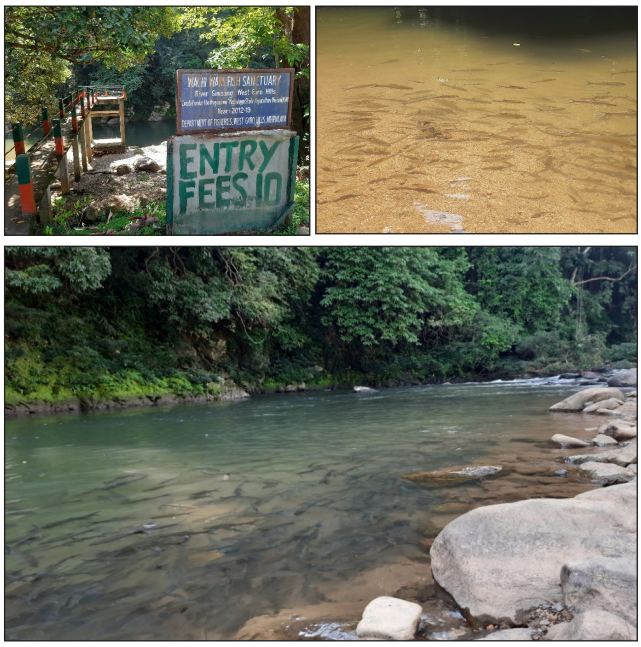

Figure 2: *Wachi-Wari* fish sanctuary at Rombagre, West Garo hills, Meghalaya (a shoal of mahseer, *N. hexagonolepis* in the sanctuary)

Table 2: Water quality variables in *Wachi-Wari* fish sanctuary, West Garo hills during winter

Water variables	Mean values
pH	6.8
Transparency (cm)	bottom visible
Dissolved oxygen (mg L^{-1})	8.4
Total alkalinity (mg L^{-1})	19.0
Specific Conductivity (µS cm^{-1})	48.8
Total dissolved solids (mg L^{-1})	35.1
Total hardness (mg L^{-1})	47.2
Ca^{2+} (mg L^{-1})	7.2
Mg^{2+} (mg L^{-1})	6.9
Nitrate - N (mg L^{-1})	0.068
Phosphate - P (mg L^{-1})	0.004
Silicate-Si (mg L^{-1})	21.08

The *Nengmandalgre* fish sanctuary on *Chibok* River (a tributary of river Simsang) was established in 2015

(Figure 3) with an area of >0.5 hac. The *Nengmandalgre* Village Development Council (NVDC) is responsible for the management of *Nengmadalgre* fish sanctuary. The management initiative also includes the establishment of an Eco-Park to promote eco-tourism in the sites. Recognized as a mahseer (*N. hexagonolepis*, *Tor* spp.) recovery site and a centre for eco-tourism, the committee has introduced a nominal entry fee for visitors to both the fish sanctuary and the Eco-Park. The revenue generated from the ecotourism in the sanctuary is primarily utilized for various sanctuary developmental and management activities. The governing community has implemented several strict measures to prevent illegal fishing within the sanctuary areas and its adjoining catchments. While visiting the *Nengmadalgre* and *Wachi-Wari* fish sanctuary in Garo hills, author experienced its scenic beauty of the dense shoals/congregation of mahseer (fingerlings to large size mahseers) and habituation of fish to have puffed-rice fed by the tourists. The nominal entry fee of Rs. 10.00 to the visitors for both the sanctuaries make affordable to all groups of tourists/ students, boosting its visitors from local as well as from outside of the state.

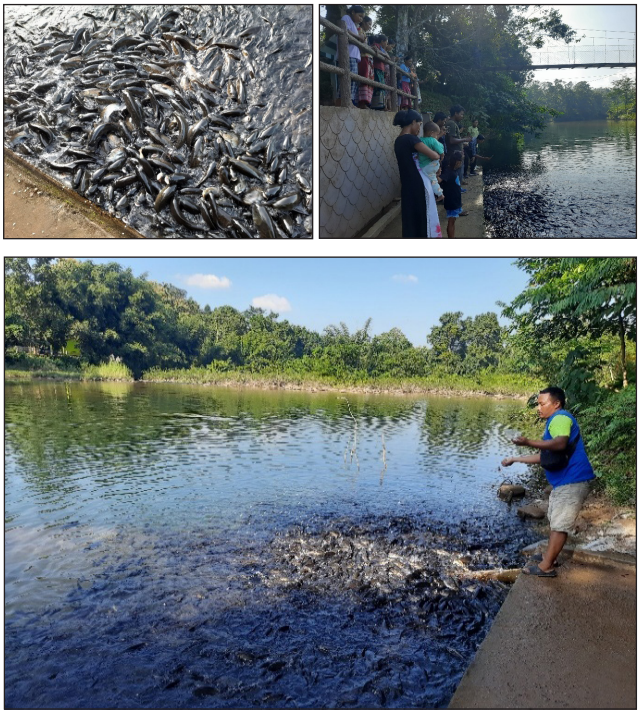

Figure 3: *Nengmandalgre* fish sanctuary on *Chibok* River, a tributary of river Simsang, East Garo hills; a shoal of mahseer, aquatourism and puffed rice feeding of fishes

Several other significant sites namely, *Chiphot Bibra, Rabdikwari, Miteramabata, Maktrakigol, Degasia, Mandrang Wari, Ringpleng Wari, Kalbong, Dinran Wari, Rongguang* and *Jakpigok* are also located along the *Chibok* River in proximity to the *Nengmandalgre* fish sanctuary.

In fish sanctuaries, fishing has more effect on fish abundance than habitat and other environmental factors. The community-led management can be surmised as:

i) No fish zone: Ban on all type of fishing practices with all type of fishing gears in the sanctuary core.

ii) Penalty: A penalty of up to Rs. 30,000.00 may be imposed on individuals found in violation of the rules in *Wachi-Wari* and Rs. 10,000.00 in *Nengmandalgre* fish sanctuary.

iii) Local protectors: A designated member of the village committee is assigned for guarding/oversee the sanctuary core (pools) and to manage the collection of entry fee from the daily visitors.

iv) No washing, bathing, detergents, or littering at the pool; awareness emphasizes keeping the water pristine for fish and clean water (allowed at down-stream of the designated sites).

v) Livelihood: Vending of local produce and retail outlets contribute to strengthening their household's income of local community. Visitors often use puffed rice as common attractants for aggregation of fishes within the sanctuary, which also acts as supplementary food source for the fish.

Conclusion

The Garo Hills shows an effective community-led management model for conservation of fish resources through traditional ecological knowledge and collective enforcement of localized strict regulations by the local people. It also shows the strength of participatory approach for governing and safeguarding the fish diversity while simultaneously improving of socio-economic condition in the locality. Reports further indicate that such conservation initiatives lead to recovery of mahseer shoals throughout the year in the *Wachi-Wari* fish sanctuary, demonstrating a fruitful result of community driven conservation approach, which could be replicated to other parts of northeast India and similar tropical river ecosystems. In addition, the implementation of a sustainable fishing plan will increase fish catches in designated fishing areas, thereby contributing to the overall enhancement of fish abundance in the river and act as 'safety net' for the local populace.

Acknowledgements

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