

Impacts of water hyacinth in flood plain wetland on aquatic production and livelihoods of fishing people



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The Dooma wetland, locally known as Dooma baor, is a well-known floodplain wetland of West Bengal, in the lower Gangetic basin. This is one of the largest wetlands in Asia, with a water area of 257 ha and a depth of 8-17 ft. This seasonally open wetland is located near the border town of Bangaon of West Bengal, India, along the Bangladesh international border. The Dooma Fishermens' Cooperative Society Ltd. mainly governs this wetland. The society is constituted of 1,081 members, including 30 fisherwomen, and is governed by the cooperative law of the Government of India. The wetland fisheries of Dooma baor provide the lion's share of livelihood and income generation for the fisherfolk families of the nine surrounding villages (Anonymous, 2022). Recognizing the fishing opportunities, the culture-based fishery has been adopted in this wetland since 2021, with the support of Indian Council of Agricultural Research – Central Inland Fisheries Research Institute (ICAR-CIFRI). The pen culture or enclosed culture-based fish rearing of Indian Major Carps (IMCs) seed has been practised to enhance the fish production by simultaneously minimizing the seed cost and predation mortality of fish seeds. Through this initiative, the cooperative was able to generate INR ₹ 7.0 million during the period of 2022-23. However, the rapid growth of the macrophyte water hyacinth (*Eichhornia crassipes*) is causing impediments to wetland governance. While fishing is difficult in areas of the wetland where macrophyte grows, not all areas are equally affected, which can lead to tensions between fishers who fish in different wetland zones. Moreover, the water hyacinth covers around 20-25% of the wetland, which needs to be regularly cleared for fish production. At the moment, community members clean the water hyacinth on an annual basis, which represents a substantial burden to the fishers of Dooma. It is argued that an additional INR ₹ 0.2-0.3 million allocation is required every year to reclaim this wetland as the water hyacinth has to be removed manually due to a lack of mechanical measures.

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Location:
Dooma wetland, West Bengal, India

Ecosystem type:
Freshwater

Main gear:
Cast net, Lift net and Traps

Target species:
Snakehead murrel (*Channa striata*), Catla (*Labeo catla*), Rohu (*Labeo rohita*), Mrigal (*Cirrhinus mrigala*), Mola (*Amblypharyngodon mola*), glass fish (*Chanda* sp.)

Vessel type:
Small wooden boats

No. of small-scale fishers:
1081

Justice in context

Types of justice:

- **Distributive**
- **Social**
- **Economic**
- Market
- Infrastructure/wellbeing
- **Regulatory**
- Procedural
- **Environmental**
- COVID-19 related

” ... The huge amount of money involved in cleaning of water hyacinths is an added burden for the fishers of the wetland, in addition to other anthropogenic pressures, including climate change, pollution, and depletion of water resources on fish production. “

Wetlands are areas of immense importance for biodiversity and places in which multiple stakeholders have vested interests. Wetlands are an important resource of water, fish, and timber, and are a fertile ground for growing crops and vegetables, and keeping animal husbandry. They also provide non-timber resources and services like groundwater recharge, biodiversity conservation, flood regulation, carbon sequestration, nutrient recycling, and wastewater treatment (Prasad et al. 2002; Jogo & Hassan 2010). However, this ecosystem is threatened by unsustainable utilization practices, along with a superabundance of obstructive macrophytes like water hyacinth. This species is also considered to be invasive to many freshwater ecosystems of Asia, Europe, Australia, and North America. According to the climate models, its distribution may expand to higher latitudes due to the rise of temperature in the future (Hellmann et al. 2008; Rahel & Olden 2008). In favourable environmental conditions, it may double up its biomass by reproducing from stolons (slender horizontal branches through which the plant propagates) in a span of 5 to 15 days.

The high nutrient load, including the high temperature and eutrophic status of the wetlands, facilitates the rapid growth of water hyacinths (Harun et al. 2021). In return, the massive growth affects the water quality and reduces the available space for fish to grow. Its bushy shelter provides habitat to many fish, including predator fishes like Channa sp., which often consume fish seeds, resulting in lower fish production. The dense growth of water hyacinths reduces the oxygen levels in the water bodies for fish and other aquatic animals and provides a habitat for malaria and dengue vectors like mosquitoes. Besides, water hyacinth's dense growth causes barriers to fishing, reduces light penetration, and decreases the concentration of phytoplankton. On a positive note, its high growth absorbs the nutrients (nitrogen and phosphorous), heavy metals, and other contaminants like arsenic, cyanide, etc.

The socio-economic effects of water hyacinth are related to the proportion of the area covered by the macrophyte, the utility of the impacted waterbody, control mechanisms, and its responses (Villamagna & Murphy 2010). The manual cleaning of these macrophytes causes an additional monetary burden of INR ₹ 0.2-0.3 million to the poor fishers, and extra labour is often hired for cleaning of aquatic weeds. Additionally, the cleaned and piled biomass takes a long time to decompose, emitting greenhouse gases such as methane during the decomposition.

Definition of small-scale fisheries

As per the definition by FAO, the small-scale fisheries are defined as a category of capture fishery that generally present (some of) the following characteristics: (i) low capital investment, (ii) high labour activities often family or community-based, (iii) no vessel or small size (iv) relatively low production, which is household consumed or locally and directly sold. The Dooma wetland fishery is a community-based fishery, characterized by the use of small wooden boats and low capital investment. The fish captured is either used for personal consumption or destined for direct sale.

Dealing with justice

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Considering water hyacinth's efficient utilization in terms of its value-added products and bioactive molecules, this species holds great opportunities. Water hyacinth has been considered a potential source of bioenergy or biomass energy (Carreño Sayago & Rodríguez 2018), such as biogas production (Chen et al. 2007) and biofertilizers (Manyuchi et al. 2019). Traditionally, the plant is used to cure gastrointestinal disorders and the beans are useful for proper spleen functioning (Sharma et al. 2020). It is also a great source of cellulosic material and can be utilized as natural fiber (Sari et al. 2023) and this environmentally friendly fiber can be used as raw materials for handicraft products and garments (Afzal et al. 2021). Owing to these opportunities, the fishers can be trained through various skill-development programs that focus on preparing different value-added products like handicraft material and fiber for making clothes and sarees. This can eventually empower the marginalized fishers, as the 'waste to wealth' approach would provide additional income and improve their livelihood.

Moreover, water hyacinth is a renowned phyto-remediating agent that can reduce the nutrient and contaminant load in the wetland water if the water runoff into the wetland can be channelized and filtered before entering into the system. With reference to India's governmental schemes and cultural scenarios, the periodical cleaning and removal of this macrophyte can be facilitated by executing this macrophyte cleaning work through the Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS).

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