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# Issues and approaches in aquaculture of rural ponds of Southern West Bengal with introspection over the years

## Abstract

Utilization and aquaculture scenarios of rural ponds of various sizes in West Bengal especially southern West Bengal have been investigated and observed for more than sixty years. These ponds are of various shapes, sizes, and depths, and used by the rural people for domestic, agricultural irrigation, pisciculture, livelihood dependency, firefighting, and community wellbeing. During the post-independence period, these ponds have undergone succession of shifting attention and shared interests towards their service to the rural community and the society. In recent years, these ponds suffer shrinkage due to silt accumulation and waste disposal, becoming increasingly semi-derelict and derelict, and encroachment continued rampant. Productivity as well as aesthetic values has gone down along with the increase in pollution and environmental degradation. Indigenous management option of *Parha* Level Pond Care (PLPC) aqua cultural production with annual management action plan at the village level local unit (*Parha* /Ward/ Neighborhood) in conjunct with local Panchayat is suggested for agri-piscicultural integration with Integrated Area Development Network Programme (IADNP) at the Block Development level.

**Key words**: rural ponds, utilization scenarios, pond care concern, threat perspectives, management issues, West Bengal

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## Introduction

India attains freedom for more than seventy years on 15th August, 1947. And, in the course of time, there has been sea changes in the last sixty years in the aquatic environment of semi-urban and rural sectors in West Bengal. Wetlands especially, rural ponds had earlier continued to receive much attention from local rural population towards care and maintenance of the local ponds in the second half of the twentieth century. During the post-independence period, it was noted that the villagers themselves, whether owners or shareholders, used to engage professional fishermen for pisciculture on 50: 50 shares roughly up to the end of 1970s. Thereafter, up to the end of 1990s carp culture was controlled either by all the shareholders on contribution basis according to the shares or otherwise, or by the local clubs. Subsequently, in the twenty first century, situation had changed, and some sort of care and maintenance, and mostly earth excavation or desilting of bottom mud manually by drying ponds was done from 100 days' work provision under Mahatma Gandhi National Rural Employment Guarantee Act 2005, Ministry of Rural Development, Government of India (MGNREGA) have often been used or arranged by the local administration, mainly for widely used larger waterbodies of shared ownership. Utilization scenarios of rural freshwater ponds of various sizes mostly of southern West Bengal have been observed over the years. Being gained interests and due to official assignment to work on West Bengal wetlands.[1,2] Indian wetlands.[3-6] utilization of wetlands.[7] the present overview of introspection on changing scenarios of rural ponds of West Bengal over years is communicated for future concern and/or action.

### Pond nomenclature

Rural ponds, both temporary and permanent, usually range from two *kathas* to ten *bighas*. Smaller ones are essentially made to raise homestead land and for domestic usage, while the larger ones are excavated for using as reservoir of water, gardening, agriculture, aquaculture, *etc*. Ponds may be both natural and man-made, and are named differently, like *pukur, doba, dighi* as man-made, while *jola, jheel, beel, baor, haor, daha, etc*., usually as natural in origin. Of these terms, *pukur* is deep-rooted and universally well known in West Bengal as well as India. It has been observed that the local people can orally communicate about various pond types appreciably meaningfully all over southern West Bengal based on pond's origin, size, naturalness, vegetation, and other features.[8]

### Utilization scenarios

People of West Bengal have variously been used ponds and lakes.[9] as source water and waterfront amusement. Rural people have their own traditional folk knowledge in the multiple use of ponds. Economic benefits are mainly derived in relation to agriculture and piscicultural usage (Figure 1,2) The farmers' perception and utilization of freshwater ponds of West Bengal have been developed out of necessity and long association with ponds which they consider as an important and useful resource. Multiple use systems (MUS) of ponds have mostly been developed due to domestic usage factors, and in relation to agri-pisciculture. In pisciculture, folk knowledge is used for capture and culture fishery purpose, harvesting fishes, shrimps, and freshwater snails from various ponds as a source of protein. Agricultural farmers and rural folks have also developed innovative approaches in the use of local shallow pond ecosystem for cultivation of crops, using shallow roadside ponds (*nayanjuli*) as paddy nurseries (*bijtala*) or for *hogla*, *paniphal* and lotus cultivation. Jute retting, fish trapping, and silt mining from shallow ponds to raise land or manure the paddy field are some of the interesting usages. Rural people during 1950s to 1970s were seen to dry up local ponds at about three years interval for silt mining for agriculture and to raise bamboo thickets on the bank, though yearly sand or soil mining was made to repair adjacent kutcha road as well as household courtyard; thus, rendering indigenous community level pond management. Ponds of West Bengal are often used for duck keeping and cattle

grazing, and to collect amaranths, *viz*., *kachu*, *kalmi*, *hincha*, *sushni*, *shaluk,* etc., for domestic consumption and sale in the local markets. In post monsoon season, it was noticed that *kalmi shak* (*Ipomoea aquatica*) is separately grown in shallow waters by the shareholders in ponds. It was found that various hydrophytic vegetation like pith plant (*shola* for marketing), macrophytes (as fodder for domestic cattle), and *phumdi*-like compact and thicket mass of floating aquatic weeds (locally called *dal* to dry up in the sun and used as fuel for paddy steaming). It was a common sight that ponds were found to use in erecting for kitchen garden overhanging the small pond (*doba*) in homestead land. However, a comprehensive understanding and economic evaluation of various functions of rural ponds is needed to develop a database and formulate strategies for conservation and management action in West Bengal.

**Figure 1** Netting in a rural pond.

**Figure 2** Fish harvest from a rural pond.

## Biodiversity sustenance

Floral components of pond ecosystem consist of seven major categories including algae, floating and submerged hydrophytes as well as amphibious and facultative forms.[10] Macrophytes include *Pistia*, *Ipomea*, *Lemna*, *Azolla*, *Hydrilla*, *Vallisneria*, *Ceratophyllum*, *Sagittaria*, *Alternanthera*, *Commelina*, *Panicum*, *Paspalum*, *Nelumbo*, *Cyperus*, *Marselia, Ludwigia, etc.* Faunal diversity, pond dependent, pond associated, and pond bank fauna may represent more than 200 species in a larger pond or *jheels*, including vertebrates and invertebrates as revealed from wetland faunal resources survey in West Bengal.[1,2] West Bengal is rich in biodiversity.[11] However, sustenance of biodiversity in freshwater ponds of West Bengal suggest sustenance of rural livelihood and community wellbeing.

## Livelihood support and community wellbeing

Ponds of various sizes, derelict, semi-derelict or abandoned, predominate in the State of West Bengal, especially in rural West Bengal. These ponds support livelihood to the local farmers in agricultural production through irrigating of pond water and offer livelihood support to fishermen community as well as local households through fish, shrimp, and edible snail production. Food plant production and sale by the local community is an added livelihood support. In fact, indigenous rural folk receive immense livelihood support due to bioproduction from pond ecosystems. Besides bioproduction of food, fodder, fish, *etc*., rural ponds serve the purpose to local community in their day-to-day domestic use, even as drinking water source in twentieth century.[12] Agricultural production is ensured from local ponds; water use in firefighting is of immense benefit to the local households in pre- and post-monsoon seasons. Thus, rural ponds and *nullahs* have their vital role in serving the local community with fish protein demand, vegetable source, fodder for cattle, and as a whole for community wellbeing, including daily domestic use of water for more than fifty years in post-independence period.

## Shifting scenarios and community care

Local rural folks, earlier in 1950s to 1970s, used pond water for bathing, washing clothes, cooking of rice, pulses, and vegetables as well as for washing of utensils. Some of these ponds were then observed also to serve as drinking water source. In this early post-independence period fisherfolk belonging to *Jele, Dule, Bagdi, etc*., depend on these rural ponds for fishing and culture of major carp species, while fisherwomen and local housewives' resort to fishing of small indigenous fish species and food plants for household needs. During the second phase of 1980s and 1990s, in the multi shareholding ponds entry of local clubs into pisciculture was noted. Besides, shareholders themselves resort to pisciculture and keep control of these ponds for gains and development of fund for various religio-cultural activities. In the third phase of twenty-first century, government level supply of drinking water and increasing use underground water through bore wells (deep or shallow) were observed in the domestic as well as agricultural sectors, resulting in less dependency on rural ponds. As such, these ponds are degraded and become increasingly derelict, even turning into damping grounds. Moreover, improvement of tap water supply from Public Health Engineering (PHE) in four-five points in each '*parha*' or village level small units or even sub-units, where people resort to washing, bathing, etc., ushering in less dependency on rural ponds. An overall qualitative assessment of usages of rural ponds perceived over the year is presented in Table 1 which indicates gradual neglect and abuse of rural ponds towards their care and maintenance.

**Table 1** Activity and usage of rural ponds in West Bengal (perception/ qualitative assessment)

| Sl. No. | Activity and usage parameters of rural ponds in West Bengal | Post-independence periods | | |
|---|---|---|---|---|
| | | 1950s, 1960s and 1970s | 1980s and 1900s | 2000 onwards |
| 1. | Water usage for agriculture | High | Medium | Low |
| 2. | Water usage for kitchen garden | High | Medium | Low |
| 3. | Domestic use of water | High | Medium | Low |
| 4. | Bathing in pond | High | Medium | Negligible |
| 5. | Pisciculture in ponds | High | Medium | Low |
| 6. | Household fish catching by nets / traps | High | Restricted | Negligible |
| 7. | Shrimp catching by traps (*Kurojali*) | Moderate | Nil | Nil |
| 8. | Snail/ mussel catching by hands | Moderate | Negligible | Negligible |
| 9. | Water usage for fire fighting | Moderate | Low | Low |
| 10. | Silt mining for Agri field manuring | High | Low | Nil |
| 11. | Sand/ soil mining for road repair, etc. | Yearly | Negligible | Nil |
| 12. | Professional fishermen for pisciculture | Usual | Negligible | Nil |
| 13. | Silt excavation under MGNREGA | Nil | Nil | Initiated |
| 14. | Encroachment and waste disposal | Negligible | Medium | High |
| 15. | Weed infestation removal | Regular | Medium | Low |

## Threat perspectives

Threats to aquaculture in rural and suburban pond ecosystems are mainly due to weed and algal infestation (Figure 3) and also from abuse and pollution. Biodiversity components of rural pond ecosystems in West Bengal were always subjected to threats like encroachment, reclamation, habitat destruction, habitat alteration, siltation, shrinkage, urbanization, industrialization, over-exploitation of water, weed infestation, eutrophication, and pollution. Illegal and unauthorized reclamation of small ponds and marshes are rampant in rural as well suburban locations. The rapid spread of a highly invasive species of water hyacinth, *Eichhornia crassipes*, has always been a serious threat to ponds in West Bengal due to hyper infestation. There had been frequent newspaper headlines on this issue of water hyacinth infestation. Many waterbodies in West Bengal, rural and urban, are often found overcast with floating vegetation, sometimes exclusively of *Microcystis, Lemna*, *Pistia*, *Salvinia*, *etc*., appearing as 'green carpet' over the ponds, suffocating the very existence of aquatic life particularly in post monsoon season. In 1900s the Calcutta University lecture series entitled "The Changing Face of Bengal – A study of Riverine Economy by Radhakamal Mukherjee.[13] states that marsh (*bils*) and depressions were ideal breeding sites for mosquitoes. In 2020s, somewhat similar situations continued with high level of solid waste disposal, both biodegradable and non-biodegradable wastes, surface floating and damping on the littoral region of ponds, promoting pollution, bad smell, filthy environment, hampering aesthetics of useful freshwater ponds. Increased human activities for agriculture, pisciculture, sand and soil mining for brick industries, pose a high-level threat to bio-productivity, food, and fodder productivity as well as in community wellbeing and rural economy.

## Management modality

Temporary and permanent rural ponds, usually used in the second half of twentieth century for extensive fish culture and day to day domestic needs. In the twenty first century rural ponds become defunct for domestic needs as potable water supply from Public Health Engineering (PHE) Department has almost been ensured to several villages, thereby utility of rural ponds becomes obsolete for domestic purposes, so also care and maintenance. In this context, besides pond care from MGNERGA food for works scheme, rural people need to be encouraged for need based year-round pond care and maintenance at the ward or neighbourhood (*Parha*) level towards sustainable use, quality bio-productivity and augmenting rural economy, livelihood, and community wellbeing. In broader perspective, Parha Level Pond Care (PLPC) for pond management approaches may be merged with Integrated Area Development Network Programme (IADNP) at the Block Development level.[6,10,14]

**Figure 3** Floating algal infestation of a suburban pond.

# Future directions

Parha Level Pond Care (PLPC) may be useful for sustainable yearly pond care (voluntary service or *Shramdan*) attaching incentive to individual volunteer for personal prospect and to local bodies towards community development fund for socio-cultural common goals. This may be under the care of local Panchayat, specifically in the care of the local councilor of Panchayat administration; the certification of benevolent service by the local volunteers to be made for authentication of community service.

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## Conflict of interest

Author declares there are no conflicts of interests.

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