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Lacustrine Fisheries of Kerala

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Abstract

Kerala is bequeathed with inland lakes and wetlands of international and national importance. Vembanad Lake spreads over an area of 2033 square kilometres covering three districts. The wetland is an ecologically sensitive habitat, famous as a Ramsar site and a critically vulnerable area. Anthropogenic activities such as illegal fishing gears, fishery aggregation devices, land reclamation, manmade interferences, pollution and natural influences of lake have led to deterioration of natural habitat as well as became a threat to aquatic diversity. Therefore, taking ameliorative strategies such as policy development, strict implementation of laws, awareness and conservative programmes as well as initiating mitigation strategies like CRPS, mangrove restoration programmes, analysing the livelihood status of fishers of the lake pertains to relieving the adverse impacts and enhances health status of the lake.

Introduction

India is bestowed with diverse array of water resources and lakes are one such aquatic system widely recognized for their multiple attributes. Lakes play a significant role to mankind being a valuable natural resource. Kerala is bequeathed with many such inland lakes and wetlands of international and national importance.

Lacustrine Resources

The state is blessed with many lakes distributed across 14 districts as represented in Figure 1.

The status of major lakes is represented in Table 1 indicating the impact of anthropogenic activities on these water bodies. Since not much research has been done on these lakes data about the lacustrine resources of the lake provided is not complete.

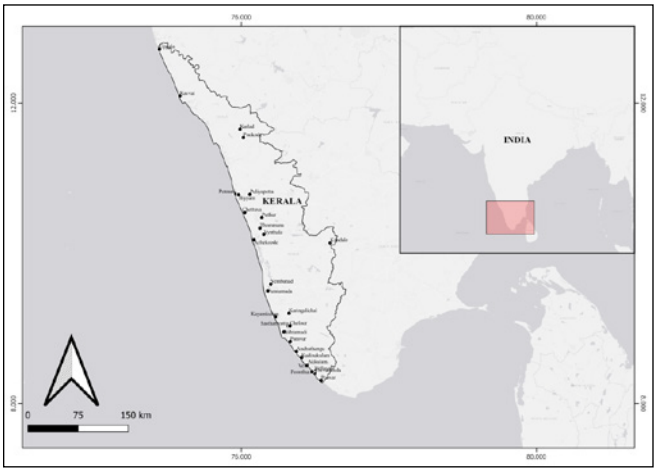

Figure 1: Lakes of Kerala

Table 1: Major Lakes of Kerala and Its Fisheries

Sl. No.	District	Lake	Type of lake	Status of lake	Status of water quality	Fisheries of the lake
1	Alappuzha, Kottayam, and Ernakulam	Vembanad	Freshwater	Polluted	-do-	150 fish species
2	Kollam	Ashtamudi	Backwater	Polluted	-do-	97 fish species
3	Alappuzha	Punnamada	Freshwater	Polluted	-do-	43 fish species
4	Trivandrum	Vellayani	Freshwater	Under threat of pollution	No significant variation from BIS	42 fish species
5	Kollam	Paravur Kayal	Backwater	Polluted	Below drinking standards	24 fish species
6	Kollam	Sasthamkotta	Freshwater	Polluted	Below drinking standards	27 fish species of freshwater
7	Wayanad	Pookode	Freshwater	Polluted	No significant variation from BIS	-

Vembanad Lake

The wetland which spreads over an area of 2033 square kilometres covers the districts Ernakulam, Kottayam and Alappuzha. The wetland is an ecologically sensitive habitat, famous as a Ramsar site and a critically vulnerable area (CVA) since November 2002. The lake has vivid freshwater and perennial brackish water zones separated by Thanneermukkom barrage built across the lake to prevent saltwater intrusion harming the agricultural fields on the freshwater zone of the reservoir. The lake is a major source of livelihood options such as fishing, agriculture, tourism, coir retting, inland navigation and lime shell collection.

According to Vembanad Fish count data conducted by Ashoka Trust for Research in Ecology and the Environment (ATREE, 2019), 98 fish species were recorded out of which 50 species were found in the northern part of Thanneermukkom bund and 48 species were seen in the southern part. The major fish species found in the lake were *Etroplus maculatus*, *E. suratensis*, *Amblypharyngodon melettinus* and *Stolephorus indicus* along with black clam (*Villorita cyprinoides*), a bivalve resource depended on by the traditional fishing community in the Vembanad Lake.

Table 2: Fisheries of Vembanad Lake

Species	Catch (1995)	Catch (1996)	Catch (1998)	Catch (2013)
Mugil cephalus	-	-	-	61.5% (n)
Metapenaeus dobsoni	29.8%	30.75%	33.06%	77.86%
Macrobrachium rosenbergii	47.0%	35.55%	-	6.01%
Metapenaeus monoceros	0.9%	1.16%	6.53%	14.7%
Hemiramphus sp.	6.3%	6.68%	0.26%	-
Penaeus monodon	-	-	1.22%	0.84%
Fenneropenaeus indicus	-	-	-	5.99%
Etroplus suratensis	46.9 %	52.77%	5.68 %	36.18%
Labeo dussumieri	-	-	-	18.86%
Puntius sp.	-	8.25%	-	9.64%
Hyporhamphus xanthopterus	-	-	-	6%
Amblypharyngodon microlepis	-	-	-	6.5%
Etroplus maculatus	-	-	-	5.4%
Channa sp.	-	-	-	3.6%
Mullets	1.3%	1.16%	6.07%	29.9%
Ariidae	-	2.97%	3.2%	9.1%
Chanos chanos	0.6%	0.36%	-	-

Table 2 represents fisheries of Vembanad Lake indicated a decrease in annual fish production over the years from 7202.12 tonnes in 1990 to 4387.31 tonnes in 2014 due to various anthropogenic influences.

Anthropogenic Influences on the Lake

1. Use of Illegal Fishing Gears

Stake Nets

Stake nets locally known as Oonnivala, are broadly operated in all coastal districts of Kerala. These gears with smallest mesh size are commonly operated by the fishermen in the downstream areas of Astamudi and Vembanad backwaters. However, the narrow size of the mesh leads to juvenile fish catch weighing less than two grams.

Gillnets

Small Meshed Gill Net (adakkamkoli)

Small meshed gill nets include traditional peruvala/ kettu vala/ Adakkamkolli Valaa . These are long gears (length of 50-75 m) with a mesh size of 4mm which are used to catch juvenile fishes. The major fishes exploited by these gears are *Etroplus suratensis*, *Wallago attu*, *Horabagrus brachysoma*, *Labeo dussumeiri*, *Mystus cavasius*, *Amblypharyngodon mellitinus*, *Puntius sarana*, *P. filamentosus*, *Ompok malabaricus*, *O. bimaculatus*, *E. maculatus*, *Pristolepis marginata* and *Nandus nandus*.

Despite banning these gears by the Government of India, the continuous use of these illegal fishing gears inadvertently promote recruitment and growth overfishing, thereby threatening the biodiversity of the lake. Use of illegal fishing gear for exclusively juvenile fishing is mostly observed during the post monsoon season when a large number of juvenile catches are found.

Instances of Growth Overfishing

Growth overfishing is observed in stakenets installed across various regions in Vembanad Lake. Major species caught in these gears include juveniles of *Etroplus suratensis*, mullets, and prawns.

2. Use of Fishery Aggregation Devices

Even though the use of fish aggregating devices in the southern reaches of the Vembanad Lake beyond the Thanneermukkam bund is restricted, destructive fishing methods such as laying of Padal and Ettamkettu are still practised.

Padal Fishing/ Bush Park Fishing

Bush park fishing/ Padal fishing is an indigenous fishing method commonly used in Ashtamudi and Vembanad lakes for catching fish from an artificial habitat made for fish to breed. However, both adults and juveniles are caught during this operation (growth and recruitment overfishing) and it also obstructs the breeding process resulting in a considerable dip in the population of juveniles. Despite banning this practice by the State Department of Fisheries, still Padal fishing is commonly operated. Alternative fishing methods should be provided to fishermen depending on Padal fishery.

EttamKettu

Ettamkettu or trapping of fish in the landward side during high tides have also been observed in the lake. According to the scientific reports, use of 10 mm codend mesh size net which is deleterious to the shrimp resources is used for this activity.

3. Land Reclamation

Land reclamation for developmental work in and around the lake has led to shrinkage of lake leading to steep decline in fish catch. As per the report, the lake lost almost a water area of 12.28 km^2 and 2.3 m of depth from 1972 to 2015. The depth of the lake also declined from 6.7 to 4.4 m which is attributed to decrease in its water holding capacity from 2.4 km^3 to 0.6 km^3 that is around 40% decrease in water holding capacity.

4. Manmade Interferences or Habitat Destruction

Health status of Vembanad Lake has been capriciously deteriorating due to anthropogenic activities such as intrusion of pollution from industries and tourism. In addition, manmade interferences such as Thanneermukkom barrier as well as Thottapilly spillway also add to habitat destruction.

Thottapilly Spillway

This manmade spillway was built to prevent floods and to prevent the intrusion of salt water from seaward side of the lake. However, due to structural limitations and changes made in the original design, the expected discharge of 19,500 cu. m could not be attained and the water level rises up to 2 m in the upper reaches of Kuttanad and by 5 m in Kol lands during the rainy season, destroying the crops. Further, the standing paddy crop is also damaged many times due to the breaching of bunds of the approach channel to the spillway.

Thaneermukkom Barrier

Lack of maintenance and unscientific operation of the Thannermukkam regulator led saline water to intrude into several parts of the lake during pre-monsoon. Subsequently, the physical and biological continuity of the lake was disrupted, resulting in decline in fish production and species diversity. Reports suggest that the Thannermukkam barrier has hindered the catch of prawn *Macrobrachium rosenbergii* which has dwindled from 429 to 27 tonnes/year during 2000-2001.

5. Pollution

Vembanad Lake is highly contaminated due to heavy metals and pesticide posing a threat to aquatic as well as human life through trophic level transfer. The presence of coliform bacteria and micro-plastics were also reported to be increasing at an alarming rate that led Vembanad Lake to be under the most polluted lake category.

Tourism

Bloom of houseboat tourism in Vembanad Lake also caused a surge in water pollution. According to Kerala State Pollution Control board, houseboat generates 200 to 1,000 litre waste per day. The increase in BOD to 8-9 ppm indicated the highly polluted status of the lake affecting the fish wealth each year. As per the reports, the waste generation in the houseboat per head is 15 to 45 L, which indicated a need for treatment of the same every 3 days. Unfortunately, majority of them directly dump waste into the lake. The shutting down of sewage treatment plant for upgradation also led to a rapid rise in sewage pollution. Thus the paper emphasises that the promotion of ecotourism should not be compromised with the amount of pollution generated.

Industrial Pollution

A study conducted by Mohan *et al*. (2014) reported high mercury levels in bottom sediments of Vembanad Lake due to the release of untreated industrial wastes. Similarly, high concentrations of Zinc, Cadmium and Nickel were reported in the sediment of the lake. High consumption of water by industries situated in and around the lake for their processing affect the aquatic life of the region and further discharge of untreated/ partially treated toxic effluents daily to the tune of 260 million litres poses a major threat to aquatic systems.

Plastic Pollution

A study conducted by KUFOS (2019) reported that almost 4276 tons of plastic garbage was found in the bottom sediments of Vembanad Lake which will affect the survival of fish population.

6. Natural Influences on the Lake

Climate Change (Rainfall and Temperature)

Past reports suggest that surface water temperature does not have a marked difference when comparing data from 1988 (23.3-31 °C) to 2012 (29-33 °C), whereas, rainfall pattern showed a decreasing trend of about 0.8% per year from 1987–2018.

Carbon Sequestration

In India, coastal wetlands play a significant role in carbon sequestration. Vembanad covers almost 5% of the total land area of Kerala, thus making it the largest blue carbon sink in India.

Methane Gas Emissions

Vembanad Lake is a source for methane gas emission indicating the voluminous amount of gas released into the atmosphere, due to elevated temperature and increased rate of organic matter decomposition. The increasing day time temperature also positively influenced CH_4 emission. Vembanad Lake was found to be releasing up to 193.2 mg/m^2/h of methane. Anthropogenic activities also play a great role in rising methane emission from Vembanad Lake.

Ameliorative Strategies

1. Policy Development

Government should develop policies for construction and development activities in Vembanad Lake and its premises, without hampering the natural environment of the lake by polluted substances or chemicals. Though policies exist, the government should have a closer look at them as most of them are not followed.

2. Strict Implementation of Laws

Government should implement strict policies to restrict overfishing and usage of disparaging fishing gears which prevents the catch of juveniles and threatened species. Strict implementation of laws against polluting the lake from backwater tourism should be done. Stringent measures against sources that release untreated sewage waste into the lake may be ensured. Operation of stake nets should be restrained and minimum codend mesh size should be maintained to curb overfishing.

3. Awareness Programmes

Awareness programs for the fishermen community on ethical fishing practices may be initiated. Awareness programmes were conducted by NGOs such as ATREE on the usage of plastic straw, which is seen as a major threat to aquatic organisms. Such campaigns and initiatives can make great change in the society towards adoption of ethical fishing practices among fishers and localities.

4. Conservative Programmes

Introduce fish conservation centres/ fish sanctuaries for augmenting the fish production with the help of the fishermen community of Vembanad Lake. The Fisheries department has initiated fish sanctuaries for conservation and management of fisheries of the lake. A total of 60 sanctuaries for conservation and protection of fish, black clam and mangroves were established by the state across various lacustrine bodies. Several projects put forth ranching of indigenous fishes as an additional option to augment fish diversity of the aquatic system.

Mitigative Measures

1. CRPS (Climate Resilient Pen System)

Climate resilient pen culture is a successful method to increase the fish production of the lake in an era of global warming. Cultivating in CRPS is considered to be a better method to cope with changing climate scenarios by diversifying the livelihood system. Central Inland Fisheries Research Institute (CIFRI) has successfully harvested black clams in CRPS in Vembanad Lake. Further this technique helped farmers to switch between farming in CRPS and fishing in response to seasonal and inter-annual variation in black clam fisheries.

2. Mangrove Restoration Programmes

The mangroves around the Cochin backwaters are exposed to various developmental projects such as International Container Trans-shipment Terminal (ICTT) Vallarpadam, LNG Petronet Terminal and residential projects in suburban areas. Demarcation of mangroves and its restoration followed by conducting awareness programmes among private land-owners of the pilot areas should be given a priority.

3. Livelihood Status of Fishers of the Lake

Nearly 20,000 fishermen are dependent on it for livelihood and an average of 32,000 tonnes of clamshells is annually harvested from Vembanad Lake. As per reports 4387.31 tonnes of fish production is estimated from Vembanad Lake. However, Climate Resilient Pen System introduced by ICAR-CIFRI has emerged as an alternative to clam fishers during the off seasons.

Conclusion

Overfishing, usage of destructive gears, disruption of migratory grounds due to barriers, land recovery for expansion and rising pollution from tourism have contributed to the loss of biodiversity of the lake. The suggested amelioration strategies will enhance the biodiversity and fish production of Vembanad Lake.

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