**VEMBANAD FISH COUNT 2022**

**REPORT**

**Submitted to**

**STATE WETLAND AUTHORITY, KERALA**



**Submitted By**



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**Background**

Vembanad Lake (Alappuzha, Kerala) and its associated wetlands is the largest tropical wetland ecosystem on the south-west coast of India, covering an area of 1,512 km2 (Ramsar, 2002) and has been designated as a Ramsar site, a wetland of global importance for its biodiversity values. Four rivers - Pampa, Meenachil, Achankovil and Manimala, originates from the Western Ghats confluence to the southern portion of Vembanad bringing the water and rich sediments and draining into the Arabian sea (Padmalal et al. 2008), thus making Vembanad the “inland fish basket” of Kerala(Padmakumar 2003; Mayaja & Srinivasa 2014). The lake is considered to be the largest fishery production unit in the south-western coast of India after the Arabian Sea. Vembanad Lake is not only home to large number of fishes but also to numerous migratory and resident birds (Kumar, 2006; S. P. Narayanan, Thomas, & Sreekumar, 2011).

Since the commissioning of Thanneermukkom barrage there has been a drastic decline in the diversity and population of fishes( Kurup & Samuel, 1985; Kurup, et al. 1993; Padmakumar, 2003). Fishery sector is one sector that has been affected adversely due to the commissioning of Thanneermukkom barrage. The annual landing of fish from the Vembanad Lake is down from about 16,000 tonnes a year in the late seventies to about 7,200 tonnes in 2000 (Unnithan, Bijoy, & Vava, 2001). Kurup et al. (1993) have reported reductions in the marine fish and prawn migration to the lake for breeding. Although the use of fishing gear leads to mass destruction and the premature catching of inland fish are legally banned, such practices continue out of livelihood needs (CERC ATREE, 2013). Even though many of the studies (Kannan 1979; Kurup & Samuel 1985; Laxmilatha & Appukuttan 2002; Krishna Kumar &Rajan 2012) have pointed out the decline in fishery resources, still the government hasn’t taken any major efforts to revive the fishery.

In this existing scenario, Kerala has faced its worst floods in 94 years on August 2018 and is still crawling to normality from its aftermath. Land-slides, land-slips, course change in river flow, etc. severely affected almost all topographic levels of land area which included highland, midland, and lowland. Several organisms in the higher altitudes and from the aquaculture farms got displaced in this course, and many had to face sad demise due to anthropogenic as well as miscellaneous reasons, especially reptiles and fishes. Displacement of fishes during floods from a higher altitude to a lower level is a global reality, and in the case of Vembanad as well, it was no different. The need for this study had been set as fisher folks in the area started coming across exotic fishes in the estuary which was not common in the open and too in very huge amounts. As the discovered ones were freshwater species and also as Vembanad did possess certain areas with freshwater logging at least in some part of every year, the existence of the exotics posed the question of the species’ chance of acclimatization and procreation in the system, which might prove fatal for the native species if invaded. In this background ATREE CERC proposed a post flood fish count to assess the fish stock diversity in Vembanad wetlands. The project was supported by the State Wetland Authority, Kerala (SWAK).

# **Vembanad Fish Count**

Ashoka Trust for Research in Ecology and the Environment (ATREE) initiated the *Vembanad Fish Count* (VFC) as an annual participatory fish assessment in May 2008 to understand the fishery and ecological trends in Vembanad. Several institutions and agencies like the Kerala State Biodiversity Board, Department of Fisheries, Department of Environment and Climate Change, Government of Kerala., Vembanad Nature Club, and Vembanad Lake Protection Forums are the co -organizers of the event. Kerala University of Fisheries and Ocean Sciences (KUFOS, erstwhile Fisheries College, Panangad) and Dept.of Aquatic Biology and fisheries, University of Kerala are providing the necessary technical support for the event. Vembanad Fish Count is a democratic approach in resource monitoring which is different from the conventional top-down approaches. It is a stakeholder driven program where the targeted groups participate in the entire process, learning about the situation, identifying problems, discussing alternatives, seeking solutions, designing and implementing activities, evaluating and disseminating results. In this process, fisher folk of Vembanad share their traditional knowledge to identify problems and solutions, ensuring that the poor and uninformed will not be excluded from decision-making and development opportunities. Such dialogue initiated during the VFC has lead the fisher community here to organize as Lake Protection Forum (LPF). 14 units of LPFs are now registered and are federated as Federation of Lake Protection Forums. LPFs are taking a leading role in organizing several conservation programs at Vembanad. One of the important activities of LPFs is the Matsyathaavalam (fish sanctuaries). Fisher folk have created 23 fish sanctuaries (no-fishing area with breeding supports for fishes) based on their traditional knowledge.

VFC brings together researchers, NGOs, environmentalists, students and media from Southern India. Fishers, local-self-governments, schools from around the lake are participating in this annual event and are very eager to learn about the status of fishery resources of the lake. This event has helped to consolidate views on the issues and convinced the need for immediate interventions in this sector, especially through participation of the stakeholders. The program consists of two modules; namely action &awareness.

# **Objectives**

1. To carry out an extensive survey on the fish diversity of the southern and northern sector of Vembanad Lake with special focus on climate change.
2. Capacity building to focus attention to issues on lake deterioration and biodiversity decline, into public domain.
3. To understand how different types of pollution affects the Lake.

# **Study Area**

Vembanad Lake (9° 34’ 60” N, 76° 25’ 0” E), a transitional ecotone between sea and land is the largest humid tropical wetland on the west coast of India with a length of 96 km and a surface area of 252km2. Seven rivers which originate from the Western Ghats Biodiversity Hotspot drain to the lake and eventually join the Arabian Sea. The rich biodiversity and socio-economic importance, of Vembanad lake along with adjacent Kole-lands led to the declaration of the lake as a Ramsar site; a wetland of international importance. The mangrove patches and islands in the lake like *Pathiramanal* also provide habitat for resident and seasonal migratory water fowl, otters, fish, clams, shrimps, crabs, aquatic insects and other aquatic organisms. The lake is also renowned for its live clam resources and sub-fossil shell deposits, large populations of water fowls, besides a high species diversity of finfish and shellfish (WWF 2002). (WWF, 2002). One hundred and fifty species of fishes belonging to hundred genera and fifty-six families are known to occur in Vembanad Lake (Kurup and Samuel,1985). The list also includes vulnerable species such as *Horabagrus brachysoma, Carinotetraodon travancoricus* (Molur and Walker 2001*).* The Thanneermukkom Salt Water Barrage divides the lake into two parts – the perennial brackish water part on the North and the southern freshwater fed by the rivers draining into the lake with seasonal salt water intrusion from high tide during non-rainy seasons. These freshwater regions of the lake are facing ecological problems due to rampant propagations of water hyacinths and eutrophication. Unmanaged and unregulated tourism and unethical fishery practices are also posing serious threats to the Vembanad Lake. (Krishnakumar et. al., 2007).

# **Methodology**

With ninety volunteers from local stakeholders, various colleges, Universities, research institutes and Non-Governmental Agencies participated in Vembanad fish count 2022. The entire team was divided into three cruise groups for both days.

Day 1: The Kumarakom Cruise (East Bank), Kuttanad (Riverine Sector) Cruise and Pathiramanal Cruise (West Bank) with 35 -40 members in each team.

Each cruise team was further subdivided into four in order to assign responsibilities for

1) Experimental fishing,

2) Collecting data from landing centers

3) Collecting data from fisherfolks in the lake and

4) Water quality monitoring. The cruise teams conducted experiments at 15 (5X3) previously identified sampling points.

Day 2:

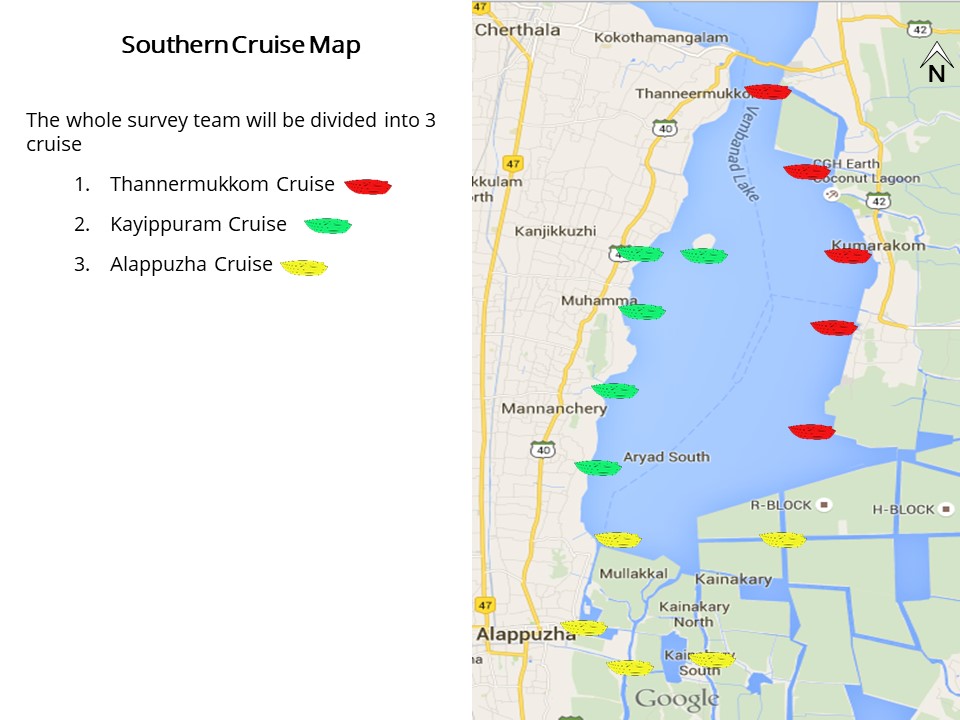
|  |  |  |
| --- | --- | --- |
| **East Bank cruise** | **West Bank cruise** | **‘Riverine cruise** |
| **Ambika Market** | **Kayippuram,** | **Punnamada** |
| **Kumarakom** | **Pathiramanal,** | **Chungam** |
| **Nazreth** | **Muhamma,** | **Kainakary,** |
| **Chithira Kayal** | **Mannancheri** | **Aarayiram Kayal** |
| **R Block.** | **Aryad** | **Sai** |

The program commenced from 6am and extended till 3pm on 27th May 2022.

A week before the survey, an expert team of fish taxonomists explored around the lake for fish landing center inventory and collected the data from Vaikom and Pallom landing center’s during the early morning hours. In addition to this on the day of fish count Ambika Market located near Thanneermukkom bund and Punnamada landing center respectively was also surveyed in the morning by students and experts.

As part of capacity building an orientation workshop (participatory workshop) was arranged on the day before fish count in order to capacitate the participants on their duties and responsibilities and etiquettes to be followed during fish count. A fish identification guide, water quality analysis and collection kit along with GPS were provided to carry out the exercise.

## Fig 1: Cruise Map (South)



## **Experimental Fishing**

This was facilitated with the help of local fishers who accompanied the cruise at all different stations using three major fishing gears, namely;

1. **Gill Net**: One gill net each was laid at six locations; i.e., at two sites for each cruise. The nets were laid by around 2am and was retrieved by 6am. The collection was ice preserved till each team arrived for inspection. All entries were made on to the survey forms distributed to the participants
2. **Cast Net**: Cast net was thrown at five points each at all five sites of each cruise (total = 5X5X3). Entries were made as mentioned above. The specimens obtained were either left back after successful identification and counting or collected in alcohol/formalin depending upon the use to be carried out later on. Alcohol preservation was preferred in case of DNA analysis and formalin in case of further morphological lab examination.
3. **Scoop Net**: Scoop net was also carried out five times at each at all five sites of each cruise and the following activities were done as the same as above.

The abundance (number of individuals at each sampling point) and diversity (type of each species) data had been recorded on the respective survey forms provided to the participants. An additional replicate data was also collected this year in order to maintain track of the number of individuals obtained per each netting.

## **Inventory made from Fishers**

This was carried out with the due participation of local fishers who allowed us to check the species, which contributed to their catch on the count day. Enquiries were also made on the fishing methods and socio-economic information of the fishers. The obtained information was recorded to the respective survey forms.

## **Inventory made from Landing-centers**

The major landing centers around the sampling sites viz. Punnamada, Pallom and Vaikom were visited on the two consecutive days prior to fish count and the species diversity were recorded. The type of gear used and the percentage of commercially important fishes to the catches were recorded in consultation with the fishers.

## **Water Quality Parameters**

Water quality parameters were tested onsite as well as offsite.

### Onsite***:***

* **pH**: pH is a numeric scale used to specify the acidity or basicity of an aqueous solution. pH was measured using standard pH solution marketed by C.P.R. Environmental Education Centre, Chennai (CPREC). Water samples were collected and analyzed 3 times each to arrive at concordant values. In addition, samples were also taken aboard for confirmatory lab analysis.
* **Transparency**: Transparency of water relates to the depth that light penetrates water. As light penetrates water, it becomes attenuated and altered in its spectral composition. The change that occurs is from predominantly yellow light at the surface to blue-green at depth in clear water or yellow-green in waters having a high concentration of dissolved organic material. Secchi disk is a simple device used to measure the transparency of water bodies. Water clarity is related to amounts of suspended particles (turbidity) as well as amounts of phytoplankton and zooplankton. Seechi readings were carried out at all sites and valued were recorded on to survey forms.
* **Temperature (atmospheric/water)**: Temperature exerts a major influence on the biological activity and growth of aquatic organisms. Both water and atmospheric temperatures were measured at all sites using alcoholbased laboratory thermometers. Results were recorded on to survey forms.
* **Salinity**: Salinity is the amount of dissolved salt substance of the water. Salts are compounds like sodium chloride, magnesium sulfate, potassium nitrate, and sodium bicarbonate which dissolve into ions. Salinity was measured at all sites using a salinometer and the readings were recorded on to survey forms.

Offsite: Water samples were collected in 500ml water bottles to be analyzed at Kerala State Pollution Control Board (KSPCB) affiliated labs. Water samples for estimation of dissolved oxygen was fixed in field using Winkler A and B respectively after which all samples where preserved in ice boxes.

* **Total Hardness**: Total hardness is defined as the sum of calcium and magnesium hardness (Even though Fe2+, Fe3+, Sr2+, Zn2+, and Mn2+ may contribute to water hardness, their levels are typically much less than Ca2+ and Mg2+. Their levels are not usually included in total hardness measurements) in mg/L as CaCO3. Ideal quality water should not contain more than 80 mg/L of total hardness as CaCO3. (Vernier).
* **Dissolved Oxygen (DO)**: Dissolved oxygen (DO) is the amount of oxygen that is present in the water. It is measured in milligrams per liter (mg/L), or the number of milligrams of oxygen dissolved in a liter of water. Samples to be analyzed was collected using Winkler method.
* **Nitrate**: Presence of nitrate in lakes could be from agriculture run-off waters as fertilizers are considerably made of nitrate owing to its high solubility and biodegradability. (Laue et al., 2006). Presence of normal levels of nitrates usually does not have a direct effect on aquatic organisms. Algae and other plants use nitrates as a source of food. If algae have an unlimited source of nitrates, their growth is unchecked. This could lead to “Eutrophication”, anoxia to lake conditions etc. Levels exceeding 50 mg/L (ppm) nitrate-nitrogen are considered unhealthy for lakes.
* **Nitrite**: Nitrites occur in water as an intermediate product in the biological breakdown of organic nitrogen, being produced either through the oxidation of ammonia or the reduction of nitrate. The presence of large quantities of nitrites is indicative of waste water pollution. Levels exceeding 0.55 mg/L (ppm) nitrite-nitrogen can cause 'brown-blood' disease in finfish.
* **Iron**: Concentrations above 1 mg/L will impart a foul taste to the water. High concentrations can indicate runoff from mining operations or industrial effluent and indicate the need for further investigation before prescribing a treatment regimen. Proper lake water limit levels are unavailable.
* **Phosphate**: High phosphate concentrations in surface waters may indicate fertilizer runoff, domestic waste discharge, or the presence of industrial effluents or detergents. If high phosphate levels persist, algae and other aquatic life will flourish, eventually decreasing the level of dissolved oxygen due to the accelerated decay of organic matter. Algae blooms are encouraged by levels of phosphate greater than 25 micrograms/L.
* **Others**: Magnesium, Calcium and Sulphate were the other measured parameters.

**Orientation Workshop**

Orientation workshop for the participants was conducted 0n 26th May 2022 at Karmasadhan Pastoral centre, Alappuzha. Shri. Jojo T. D (Project Manager ATREE-CERC) delivered the welcome address. Dr. K V Jayachandran inaugurated the workshop. Dr. Priyadarsanan Dharma Rajan (Senior Fellow II, ATREE-Bangalore) gave the presidential address. The orientation for 90 volunteers of Vembanad fish count was given by Mr. Anu Radhakrishnan (Research Associate, ATREE-Bangalore) where he discussed a brief history of Vembanad and CERC’s activities, and the objectives of Vembanad Fish Count. Methodology used for data collection and the basic etiquettes and discipline/safety measures to be followed during the cruise. Participants for the program were divided into three teams for both days. For each team, a cruise leader was selected, who were assigned the task of making the organizational groups and functional groups for effective conduct of the survey. Fishing gears, resource materials and survey forms were distributed to each team before dispersing for dinner.East bank (Starting from Kumarakom), West Bank (Kayippuram) and Riverine (Starting from Alappuzha). Mr. Anu Radhakrishnan (Research Associate, ATREE-Bangalore), Dr. Biju Kumar, Professor, Dept. of Aquatic Biology and Fisheries and Dr. S M Raffi, Assistant Professor Dr. Sajeevan, Associate Professor, KUFOS were the resource persons for all three cruises.

# **Vembanad Fish Count – 2022 Report**

On 27nd May, the 15th edition of Fish Count was flagged off by Dr. Biju Kumar, Professor and the cruise started from Matha jetty, Alappuzha. The cruise boats moved towards each site where the team halted for approximately 35-45mins and conducted experimental fishing with the help of different gears; viz. gill net, cast net and scoop net. Onsite water quality data and water for offsite analysis were also collected along with data pertaining to fish habitats including primary visual data. The team members of each cruise also discussed and compiled the data collected, to make a rough presentation in the concluding session.

All teams returned to the KTDC, Thanneermukkom, the collectibles and data were compiled together to provide with the necessary conclusions. The Honorable Vice Chancellor of KUFOS, Dr. Riji John inaugurated the valedictory function. Team captains presented the cruise wise report and finally Dr. Biju Kumar presented the consolidated report of VFC 2022.

# **Results and Discussion**

The Vembanad fish count 2022 recorded 43 fin fishes and five shell fishes from the southern side of the estuary. The diversity and availability of brackish water fish species has drastically declined compared to the previous years. The last fifteen years of VFC is a proof of how much climate change and human encroachment have affected the Vembanad wetland ecosystem. These fifteen years of data shows that the natural ecosystem of the lake has undergone several detrimental changes. The market and landing center data collections prior to the fish count and the experimental fishing conducted on the VFC day figuratively indicates the trend of fish availability and diversity during this period. The data collected from the fisherfolks along with this exercise helps to identify even the slightest changes in the system. Considering the saline nature of the backwater, availability of freshwater fishes is mostly restricted to the river mouth areas. But contrary to the norm, the VFC 2022 showed an unusual presence of freshwater fishes throughout the southern parts including Thaneermukkom, Kumarakom, and Ambika market. The fish species of the genus Chela found by the western cruise indicates that the water quality has shifted purely to freshwater. This might be due to the heavy summer rains during April and May 2022 which might have completely turned the southern areas of the lake into a freshwater zone (however, more investigation required). The water quality parameters tested from fifteen sites at the southern region of the lake, the salinity of the water recorded 1-2 ppt. In previous years it was in the range of 5 to 12 ppt. The operation of the shutters was decided to be close from the month of December until March every year. But this year during the summer rains from 7th to12th of May the shutters of barrage were opened many times to protect agriculture in Kuttanad which adversely affected the water quality of the lake.

Saltwater intrusion from the northern regions could not reach the southern regions due to the strong north flowing undercurrents. This affected the breeding of black clam (*Villorita cyprinoides*) and giant prawn (*Macrobrachium rosenbergii*) and the livelihoods of people depending on them. The post flood fish count conducted by ATREE after the 2018 flood recorded the presence of Exotic fish species in the lake and that was evident in the markets and landing centers. There was no scientific evidence of breeding of these fishes in the backwater habitat, but this year's fish count recorded Nile tilapia (*Oreochromis niloticus*) and their fingerlings from Chungam and Vattakayal areas at the southern region of the backwater. These invasive fishes breeding and propagating in the wild habitat will pose serious challenges to the native fish species in the estuary. Therefore, urgent scientific studies need to be conducted on this subject. The fish species of the genus Chela found on the western bank of the estuary are completely fresh water. Changes in climate and human interference may adversely affect the depletion of inland fish resources and the existence of millions of people who depend on them as a means of livelihood. Therefore, the Vembanad fish count points to the need for continuous scientific studies on the socio-ecological changes occurring in the Vembanad wetlands and biodiversity.

**Suggestions**

* The state and central Governments should put efforts to sustain the fisheries sector through a holistic approach which includes habitat protection, enforcement of regulations and adoption of co-management strategies. This will lead to improving the livelihoods of fishers and avoiding further degradation and deterioration of habitat quality of the ecosystem.
* Regular Fish survey and water quality analysis should be conducted during all three seasons viz. Monsoon (June-August), Post-Monsoon (October-November) and Pre-Monsoon (March-April) may be carried out for at least 3 years to make better estimation on fish diversity and ecosystem health of the lake. Long term monitoring mechanism on population dynamics of various fish species which are thought to be declining and study the effect of Thanneermukkom Bund on migratory fishes Vembanad should be taken up through collaborative projects involving various research organizations.
* Develop an Index for lake conservation like Index of Biotic Integrity (IBI) for Vembanad Lake ecosystem (standards for water quality and the organisms inhabiting the lake indicating ecosystem health) and regular monitoring to ensure its sustainable health.
* Awareness programs should be conducted within the community inhabiting around the lake and tourists visiting the ecosystem regarding its global importance in sustainable living and existence of all living organisms and the bigger role it could play in mitigating global climate change and ecological vulnerability if developed as a conservation model.
* Whenever wherever possible undisturbed areas of Vembanad Lake/Kole should be maintained as such to retain its pristine nature to set itself as control and scale up the health levels of the rest of the areas to a standard point possible.
* Strict pollution control policies should be developed and implemented in compliance with Wetland and Paddy Conservation Act 2008.
* A strict fishing policy should be formulated by analyzing various methods currently used in the ecosystem so that only the most sustainable ones are selected for practice in lake.
* Existing natural habitats and native vegetation like those surrounding Pathiramanal islands, the reclaimed portions of lake at Chithira and Rani Block of kayals should be declared as No Take Zones.
* Develop breeding and hatchery protocols for fishes that are used in ranching and stock enhancements.
* Measures should be taken to protect riparian and indigenous macrophytes inhabiting the lake.
* Ban monsoon flood plain fishery (Ootha piditham) when spawning individuals are largely targeted.
* Stablishing a democratic-management system should be a top priority for fisheries planners in the Vembanad. This should be based on a bottom-up strategy rather than the conventional top-down schemes which have been a failure.
* Collaborations between various central and state government organizations, research institutes, universities, colleges, non-governmental organizations and cooperatives with due participation of local stake holders should be made and efficient programs for protecting the lake, its resources and the livelihoods of the fishers depending on the ecosystem should be adapted.
* Municipal drains should empty to the lake only after proper treatments and the water disposed henceforth should meet the ideal standards of estuarine lake water or freshwater system.
* Revisit India’s quarantine policies and revamp in such a manner that illegal fish or for that matter any kinds of species exotic in nature to India or that specific land area shall be strictly controlled so as to prevent any outbreak that might result in future.
* Handy books or field guides to identify already available exotics species in different landscapes of India, especially that Vembanad should be prepared so that layman could also be advised about alarming situations in systems.

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**Annexure – 1 (List)**

## Fin-Fish Species List of VFC – 2022

|  |
| --- |
| **SOUTHERN REGION** |
| 1. ***Ambassis ambassis*** |
| 1. ***Amblypharyngodon melettinus*** |
| 1. ***Amblypharyngodon mola*** |
| 1. ***Anodontostoma chacunda*** |
| 1. ***Aplocheilus blochii*** |
| 1. ***Aplocheilus panchax*** |
| 1. ***Arius subrostratus*** |
| 1. ***Brachirus orientalis*** |
| 1. ***Caranx ignobilis*** |
| 1. ***Carinotetraodon travancoricus*** |
| 1. ***Channa diplogramma*** |
| 1. ***Channa pseudomarulius*** |
| 1. ***Channa striata*** |
| 1. ***Chela fasciata*** |
| 1. ***Dawkinsia filamentosa*** |
| 1. ***Dayella malabarica*** |
| 1. ***Etroplus suratensis*** |
| 1. ***Glossogobius giuris*** |
| 1. ***Heteropneustes fossilis*** |
| 1. ***Horadandia britani*** |
| 1. ***Horbagrus brachysoma*** |
| 1. ***Hyporamphus xanthopterus*** |
| 1. ***Labeo dussumieri*** |
| 1. ***Macrognathus guentheri*** |
| 1. ***Mystus armatus*** |
| 1. ***Mystus gulio*** |
| 1. ***Mystus occulatus*** |
| 1. ***Parambassis dayi*** |
| 1. ***Parambassis thomassi*** |
| 1. ***Pethia punctata*** |
| 1. ***Pseudetroplus maculatus*** |
| 1. ***Pseudosphromenus cupanus*** |
| 1. ***Pseudosphromenus dayi*** |
| 1. ***Psodonophis boro*** |
| 1. ***Puntius amphibius*** |
| 1. ***Puntius parrah*** |
| 1. ***Puntius vittatus*** |
| 1. ***Puntius vittatus*** |
| 1. ***Scatophagus argus*** |
| 1. ***Stenogobius sps.*** |
| 1. ***Systomus sarana*** |
| 1. ***Xenentodon cancila*** |
| 1. ***Xenentodon cancila*** |
| ***Shell- Fishes species*** |
| 1. ***Caridina sps*** |
| 1. ***Macrobrachium idella*** |
| 1. ***Macrobrachium rosenbergii*** |
| 1. ***Peneaus monodon*** |
| 1. ***Villorita cyprinoides*** |

**Species recorded from the Landing Centre Pallom**

|  |  |
| --- | --- |
| **PALLOM** | |
| **Sl No** | **FIN FISHES** |
|  | [***Channa diplogramma (Day, 1865)***](http://www.fishbase.us/Summary/SpeciesSummary.php?ID=55109&genusname=Channa&speciesname=diplogramma) |
|  | ***Channa marulius* (Hamilton 1822)** |
|  | ***Channa striata* (Bloch 1793)** |
|  | ***Etroplus suratensis* (Bloch 1790)** |
|  | ***Heteropneustes fossilis* (Bloch 1794)** |
|  | ***Horabagrus brachysoma* (Günther 1864)** |
|  | ***Hyporhamphus xanthopterus* (Valenciennes 1847)** |
|  | ***Labeo dussumieri* (Valenciennes 1842)** |
|  | ***Macrognathus guentheri* (Day 1865)** |
|  | ***Megalops cyprinoides* (Broussonet 1782)** |
|  | ***Mystus armatus* (Day 1865)** |
|  | ***Mystus gulio* (Hamilton 1822)** |
|  | ***Pseudetroplus maculatus(Bloch 1795)*** |
|  | ***Puntius filamentosus* (Valenciennes 1844)** |
|  | ***Systomus sarana* (Hamilton 1822)** |

**Species recorded from Thanneermukkom Market.**

|  |  |
| --- | --- |
| **Thanneermukkom Market Survey** | |
| **SL No** | **Species** |
|  | ***Anabas testudineus* (Bloch 1792)** |
|  | ***Anodontostoma chacunda* (Hamilton 1822)** |
|  | ***Arius subrostratus* Valenciennes 1840** |
|  | ***Brachirus orientalis* (Bloch & Schneider 1801)** |
|  | ***Channa marulius* (Hamilton 1822)** |
|  | ***Channa striata* (Bloch 1793)** |
|  | ***Clarias dussumieri* Valenciennes 1840** |
|  | ***Elops machnata* (Forsskål 1775)** |
|  | ***Gerres filamentosus* Cuvier 1829** |
|  | ***Heteropneustes fossilis* (Bloch 1794)** |
|  | ***Horabagrus brachysoma* (Günther 1864)** |
|  | ***Labeo dussumieri* (Valenciennes 1842)** |
|  | ***Leiognathus equula* (Forsskål 1775)** |
|  | ***Macrognathus guentheri* (Day 1865)** |
|  | ***Megalops cyprinoides* (Broussonet 1782)** |
|  | ***Mystus armatus* (Day 1865)** |
|  | ***Mystus gulio* (Hamilton 1822)** |
|  | ***Nematalosa nasus* (Bloch 1795)** |
|  | ***Pseudetroplus maculatus(Bloch 1795)*** |
|  | ***Puntius filamentosus* (Valenciennes 1844)** |
|  | ***Saurida tumbil* (Bloch 1795)** |
|  | ***Siganus javus* (Linnaeus 1766)** |
|  | ***Sillago sihama* (Forsskål 1775)** |
|  | ***Systomus sarana* (Hamilton 1822)** |
|  | ***Terapon jarbua* (Forsskål 1775)** |
|  | ***Thryssa dussumieri* (Valenciennes 1848)** |

**Species recorded from Varapuzha Market.**

|  |  |
| --- | --- |
| **Varapuzha Market Survey** | |
| **SL No** | **Species** |
|  | ***Ambassis sps*** |
|  | [***Anguilla***](http://researcharchive.calacademy.org/research/ichthyology/catalog/fishcatget.asp?genid=9279)[***bicolor***](http://researcharchive.calacademy.org/research/ichthyology/catalog/fishcatget.asp?spid=58323)[**McClelland**](http://en.wikipedia.org/wiki/John_McClelland_(doctor))**,**[**1844**](http://researcharchive.calacademy.org/research/ichthyology/catalog/getref.asp?id=2928) |
|  | ***Anodontostoma chacunda* (Hamilton 1822)** |
|  | ***Arius subrostratus* Valenciennes 1840** |
|  | [***Arius***](http://researcharchive.calacademy.org/research/ichthyology/catalog/fishcatget.asp?genid=1682)***[arius](http://researcharchive.calacademy.org/research/ichthyology/catalog/fishcatget.asp?spid=5508" \t "_blank" \o "Catalog of Fishes - Species)* (**[**Hamilton**](http://en.wikipedia.org/wiki/Francis_Buchanan-Hamilton)**,**[**1822**](http://researcharchive.calacademy.org/research/ichthyology/catalog/getref.asp?id=2031)**)** |
|  | ***Brachirus orientalis* (Bloch & Schneider 1801)** |
|  | ***Channa striata* (Bloch 1793)** |
|  | [***Chanos***](http://researcharchive.calacademy.org/research/ichthyology/catalog/fishcatget.asp?genid=558)***[chanos](http://researcharchive.calacademy.org/research/ichthyology/catalog/fishcatget.asp?spid=27660" \t "_blank" \o "Catalog of Fishes - Species)* ([Forsskål](http://en.wikipedia.org/wiki/Peter_Forssk%C3%A5l" \t "_blank" \o "Wiki),**[**1775**](http://researcharchive.calacademy.org/research/ichthyology/catalog/getref.asp?id=1351)**)** |
|  | [***Cynoglossus***](http://researcharchive.calacademy.org/research/ichthyology/catalog/fishcatget.asp?genid=1026)***[macrostomus](http://researcharchive.calacademy.org/research/ichthyology/catalog/fishcatget.asp?spid=54582" \t "_blank" \o "Catalog of Fishes - Species)***[**Norman**](http://fr.wikipedia.org/wiki/John_Roxborough_Norman)**,**[**1928**](http://researcharchive.calacademy.org/research/ichthyology/catalog/getref.asp?id=15867) |
|  | [***Daysciaena***](http://researcharchive.calacademy.org/research/ichthyology/catalog/fishcatget.asp?genid=9389)[***albida***](http://researcharchive.calacademy.org/research/ichthyology/catalog/fishcatget.asp?spid=22400)**(**[**Cuvier**](http://en.wikipedia.org/wiki/Georges_Cuvier)**,**[**1830**](http://researcharchive.calacademy.org/research/ichthyology/catalog/getref.asp?id=999)**)** |
|  | [***Ehirava***](http://researcharchive.calacademy.org/research/ichthyology/catalog/fishcatget.asp?genid=6461)***[fluviatilis](http://researcharchive.calacademy.org/research/ichthyology/catalog/fishcatget.asp?spid=1231" \t "_blank" \o "Catalog of Fishes - Species)* Deraniyagala,**[**1929**](http://researcharchive.calacademy.org/research/ichthyology/catalog/getref.asp?id=1115) |
|  | ***Elops machnata* (Forsskål 1775)** |
|  | [***Etroplus***](http://researcharchive.calacademy.org/research/ichthyology/catalog/fishcatget.asp?genid=1238)***[suratensis](http://researcharchive.calacademy.org/research/ichthyology/catalog/fishcatget.asp?spid=19905" \t "_blank" \o "Catalog of Fishes - Species)* (**[**Bloch**](http://en.wikipedia.org/wiki/Marcus_Elieser_Bloch)**,**[**1790**](http://researcharchive.calacademy.org/research/ichthyology/catalog/getref.asp?id=469)**)** |
|  | ***Gerres filamentosus* Cuvier 1829** |
|  | **Gerres setifer (Hamilton, 1822)** |
|  | [***Glossogobius***](http://researcharchive.calacademy.org/research/ichthyology/catalog/fishcatget.asp?genid=2603)***[giuris](http://researcharchive.calacademy.org/research/ichthyology/catalog/fishcatget.asp?spid=18735" \t "_blank" \o "Catalog of Fishes - Species)* (**[**Hamilton**](http://en.wikipedia.org/wiki/Francis_Buchanan-Hamilton)**,**[**1822**](http://researcharchive.calacademy.org/research/ichthyology/catalog/getref.asp?id=2031)**)** |
|  | [***Lates***](http://researcharchive.calacademy.org/research/ichthyology/catalog/fishcatget.asp?genid=1113)[***calcarifer***](http://researcharchive.calacademy.org/research/ichthyology/catalog/fishcatget.asp?spid=15805)**(**[**Bloch**](http://en.wikipedia.org/wiki/Marcus_Elieser_Bloch)**,**[**1790**](http://researcharchive.calacademy.org/research/ichthyology/catalog/getref.asp?id=469)**)** |
|  | [***Lutjanus***](http://researcharchive.calacademy.org/research/ichthyology/catalog/fishcatget.asp?genid=357)***[argentimaculatus](http://researcharchive.calacademy.org/research/ichthyology/catalog/fishcatget.asp?spid=15550" \t "_blank" \o "Catalog of Fishes - Species)* ([Forsskål](http://en.wikipedia.org/wiki/Peter_Forssk%C3%A5l" \t "_blank" \o "Wiki),**[**1775**](http://researcharchive.calacademy.org/research/ichthyology/catalog/getref.asp?id=1351)**)** |
|  | ***Megalops cyprinoides* (Broussonet 1782)** |
|  | [***Megalops***](http://researcharchive.calacademy.org/research/ichthyology/catalog/fishcatget.asp?genid=544)***[cyprinoides](http://researcharchive.calacademy.org/research/ichthyology/catalog/fishcatget.asp?spid=52948" \t "_blank" \o "Catalog of Fishes - Species)* (Broussonet,**[**1782**](http://researcharchive.calacademy.org/research/ichthyology/catalog/getref.asp?id=17287)**)** |
|  | [***Mugil***](http://researcharchive.calacademy.org/research/ichthyology/catalog/fishcatget.asp?genid=152)***[cephalus](http://researcharchive.calacademy.org/research/ichthyology/catalog/fishcatget.asp?spid=19549" \t "_blank" \o "Catalog of Fishes - Species)***[**Linnaeus**](http://en.wikipedia.org/wiki/Carl_Linnaeus)**,**[**1758**](http://researcharchive.calacademy.org/research/ichthyology/catalog/getref.asp?id=2787) |
|  | ***Nematalosa nasus* (Bloch 1795)** |
|  | **Nuchequula nuchalis (Temminck & Schlegel, 1845)** |
|  | [***Platycephalus***](http://researcharchive.calacademy.org/research/ichthyology/catalog/fishcatget.asp?genid=387)[***indicus***](http://researcharchive.calacademy.org/research/ichthyology/catalog/fishcatget.asp?spid=42921)**(**[**Linnaeus**](http://en.wikipedia.org/wiki/Carl_Linnaeus)**,**[**1758**](http://researcharchive.calacademy.org/research/ichthyology/catalog/getref.asp?id=2787)**)** |
|  | ***Pseudetroplus maculatus(Bloch 1795)*** |
|  | [***Scatophagus***](http://researcharchive.calacademy.org/research/ichthyology/catalog/fishcatget.asp?genid=1242)[***argus***](http://researcharchive.calacademy.org/research/ichthyology/catalog/fishcatget.asp?spid=19833)**(**[**Linnaeus**](http://en.wikipedia.org/wiki/Carl_Linnaeus)**,**[**1766**](http://researcharchive.calacademy.org/research/ichthyology/catalog/getref.asp?id=2786)**)** |
|  | ***Siganus javus* (Linnaeus 1766)** |
|  | ***Sillago sihama* (Forsskål 1775)** |
|  | ***SHELL FISHES*** |
|  | ***Fenneropenaeus indicus*** |
|  | ***M. rosenbergii*** |
|  | ***Macrobrachium idella*** |
|  | ***Metapeneaus sps*** |
|  | ***Peneaus monodon*** |
|  | ***Scylla serrate*** |

# Annexure – 3 (Water quality)

T1: Thannermukkom 1

T2: Thannermukkom 2

T3: Thannermukkom 3

T4: Thannermukkom 4

T5: Thannermukkom 5

W1: West 1

W2: West 2

W3: West 3

W4: West 4

W5: West 5

R1: Riverine 1

R2: Riverine 2

R3: Riverine 3

R4: Riverine 4

R5: Riverine 5

**Legend**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **SITE** | **Temperature** | **pH** | **SALINITY** | **DO** | **PHOSPHATE** | **NITRATE** |  |  |  |
| T1 | 29 | 6.85 | 1 ppt | 2.81 mg/L | 0.01 μM/L | 5.52 μM/L |  |  |  |
| T2 | 28.5 | 6.41 | 2 ppt | 4.02 mg/L | 0.03 μM/L | 3.82 μM/L |  |  |  |
| T3 | 29 | 6.65 | 1 ppt | 3.62 mg/L | 0.01 μM/L | 5.11 μM/L |  |  |  |
| T4 | 29 | 6.43 | 1 ppt | 3.22 mg/L | 0 μM/L | 5.62 μM/L |  |  |  |
| T5 | 29.5 | 6.99 | 1 ppt | 3.22 mg/L | 0 μM/L | 5.52 μM/L |  |  |  |
| R1 | 28.5 | 6.54 | 0 ppt | 6.44 mg/L | 0.03 μM/L | 4.08 μM/L |  |  |  |
| R2 | 28.5 | 6.87 | 0 ppt | 1.61 mg/L | 0.03 μM/L | 5.03 μM/L |  |  |  |
| R3 | 29 | 7.02 | 0 ppt | 5.63 mg/L | 0.02 μM/L | 4.06 μM/L |  |  |  |
| R4 | 29 | 6.78 | 0 ppt | 5.63 mg/L | 0.01 μM/L | 4.33μM/L |  |  |  |
| R5 | 29 | 7.21 | 0 ppt | 4.02 mg/L | 0.03 μM/L | 4.88 μM/L |  |  |  |
| WS1 | 28 | 6.89 | 1 ppt | 3.62 mg/L | 0.02 μM/L | 5.52 μM/L |  |  |  |
| WS2 | 29 | 6.77 | 1 ppt | 3.22 mg/L | 0.04 μM/L | 5.75 μM/L |  |  |  |
| WS3 | 29 | 6.88 | 1 ppt | 4.02 mg/L | 0.06 μM/L | 5.12 μM/L |  |  |  |
| WS4 | 29 | 6.99 | 1 ppt | 6.84 mg/L | 0.04 μM/L | 5.88 μM/L |  |  |  |
| WS5 | 29 | 7.11 | 1 ppt | 5.63 mg/L | 0 μM/L | 4.82 μM/L |  |  |  |

# Annexure – 4 (Photos)

Market Survey



Vembanad Fish Count 2022

**Annexure 5. Press report**

[**https://www.thehindu.com/news/national/kerala/vembanad-fish-count-records-48-species/article65470131.ece**](https://www.thehindu.com/news/national/kerala/vembanad-fish-count-records-48-species/article65470131.ece)

[**KERALA**](https://www.thehindu.com/news/national/kerala/)

# **Vembanad fish count records 48 species**

STAFF REPORTER

**MAY 28, 2022 19:25 IST**

UPDATED: MAY 28, 2022 19:25 IST

**SHARE ARTICLE**

ALAPPUZHA The annual fish count to evaluate fish varieties in Vembanad Lake has recorded 48 species.

The Vembanad fish count, 15th in a series of surveys, has been conducted in the southern (riverine), eastern and western parts of the lake under the aegis of the Community Environment Resource Centre (CERC), a field academic unit of the Ashoka Trust for Research in Ecology and Environment (ATREE).

A team consisting of members of ATREE, academics researchers and fishermen from across the country recorded 43 finfish species and five shellfish species in the survey conducted on May 27. Last year, the survey recorded 100 species.

In a statement here on Saturday, Maneeja Murali, senior programme officer, said unlike the previous fish counts, of the 48 species recorded this year, the majority was freshwater species. Chela fasciata, a purely freshwater species, was recorded for the first time from the lake by a team led by Bijukumar.

The survey identified the presence of *Oreochromis nitoticus*(Nile tilapia), a species in the Global Invasive Species Database, in the southern part of the lake. As the invasive species is likely to pose a threat to traditional fish varieties, the survey has called for more studies.

The fish count was conducted in association with the Kerala University of Fisheries and Ocean Studies, Panangad, Department of Fisheries and Aquatic Biology (University of Kerala), Department of Fisheries, Vemaband Lake Protection Committee, Thomson Hospitality Private Ltd and Sarojini Damodar Foundation.

<https://newspaper.mathrubhumi.com/alappuzha/news/alappuzha-1.7558078>