VEMBANAD FISH COUNT 2008

Report of the Participatory Fish Resources Survey of the Vembanad Lake , Kerala

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VEMBANAD FISH COUNT 2008

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Editors' note

The Vembanad estuarine system, the largest of its kind on the west coast of India is known to be abundantly enriched with diverse fishery resources, providing feeding, spawning and rearing areas for a very large proportion of commercial fish and shellfish. However, ecosystem health of the Vembanad wetlands is alarmingly declining due to a variety of reasons viz., obstruction of river courses, sand mining & habitat destruction, loss of riparian canopy cover, encroachment, pollution and unethical fishing practices. Reduced summer flow due to drying up of rivers and pollution hazards from agro-chemicals and sewage also lead to mass mortality of fishes. Depletion of Fishery resources has changed this 'inland fish basket' to an 'Inland wastebasket', driving the fisher folks, the primary stakeholder of the lake to a livelihood crisis.

Traditionally, conservation and management of the lake resources of Vembanad were vested in the hands of the local communities and hence, local communities were actively involved in the management of the resources they relied on.

One of the hopes of backwater conservation lies in the 'active involvement of the dependent communities'. This can be made possible only by institutionalizing community rights over protection and harvest of the natural resources. To ensure the participation of the communities in conservation, it is necessary to cultivate the ownership feeling among people and they should realize nature conservation as essential for their own existence. In this backdrop Ashoka Trust for Research in Ecology and the Environment (ATREE) is trying to suggest a deliberative democratic conservation strategy for the Vembanad wetland. In the process of deliberative democratic conservation the conservation policies and prioritization are done through consensus evolved through deliberations among various stakeholders and transfer of responsibilities over its harvest and management to them.

With the intention of regaining the participatory methods in lake management and to enhance cooperation between various stakeholders, Govt. departments, NGOs and academic institutions and to create awareness about the state of fishery resources of the lake ATREE in collaboration with the Regional Agricultural Research Station (RARS), Kumarakom, and the Kerala State Biodiversity Board attempted to conduct a participatory fish census as the "Vembanad Fish Count-2008 a participatory fishery resource inventory and monitoring of the Lake, on 30th May 2008, involving scientists, naturalists, students, fishermen, and interested people. Besides inventorisation, it also aimed to create mass awareness among the general public on conservation of Vembanad Lake through more sensible management.

51 species of finfish representing 26 families and 35 genera, as well as 10 species of shell fish belonging to 6 families and 7 genera were recorded during this Fish count. Out of this two species of fishes are listed as 'Critically Endangered', four 'Endangered' and five species are 'Vulnerable' according to IUCN Red data book. The sector around Pathiramanal Island was observed the richest sector surveyed.

This fish count received wider attentions from all walks of life. This report is a summary of our findings and it paves way for future course of action as we plan to make this an annual event, involving more and more interested agencies and people. As a maiden effort this was a great beginning and is expected to become more accurate and relevant in the years to come with more and more active participation of the people, who in turn will take the lead in conserving this great natural heritage.

Dr.Priyadarsanan Dharma Rajan, Principal Investigator

Dr. Latha Bhaskar, Project Coordinator, CERC,ATREE

25th May 2009
Alappuzha

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Dr. V.S. Vijayan
Chairman

25 May 2009

Foreword

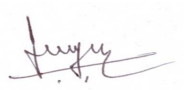
Although wetlands are considered to be the most productive ecosystems of the world, it is ironical that they have often been termed as 'waste lands', and treated accordingly in all practical purposes. This is evident from the recent study of the Wetlands of India conducted by the SACON (Salim Ali Centre for Ornithology and Natural History). It is reported that the country has lost 38% of its wetlands from 1991 to 2001. It is more shocking that most of the remaining wetlands studied were contaminated either by industrial effluents or pesticides or by both. None of the 1700 fishes studied from 140 wetlands spread over 14 states was free from pesticides and industrial effluents; some of the fishes had them at levels even higher than those prescribed for human consumption.

Fish community, in recent times, has also changed drastically in most wetlands due to the market driven fish farming of select species, replacing the local fish diversity. Also, human interventions in wetland ecosystems, especially those tampering with the natural water flow, have not only altered the basic ecology of the wetlands, but also caused serious damages to the fish communities. Thannirmukkam bund in the Vembanad and Kattambally barrage in the Kattambally wetlands are living testimonies to our sheer ignorance of the wetland science and demonstrate that to what extent blissful ignorance can damage wetland ecosystems.

The fish count being coordinated by the ATREE's Regional Station and lead by Dr. Padmakumar of the Regional Agricultural Research Station, Kerala Agricultural University, assumes greater significance in this context. Such an initiative was taken for the first time in the country by Dr. Padmakumar by launching a fish count in the River Meenachil in 2004. Following this, fish count in the Vembanad Lake was launched in 2008 and made it an annual programme to monitor the changes in the fish community.

Kerala State Biodiversity Board was only happy to join the programme since its beginning in 2008 in Vembanad, as such data collected annually will go a long way in the management of wetlands. The Board also do support monitoring of waterfowl and heronries in the State to get a better picture of the changes in the wetland ecosystems and also to assess the changes in the population of individual species.

Dr. Latha Bhasker (Project Coordinator, ATREE, Alleppey) and Dr.Padmakumar deserve to be congratulated for their efforts in coordinating and leading the programme.



Dr. V. S. Vijayan

Background

On the south west coast of India, there is an extensive estuarine system of backwaters, of which Vembanad Lake is the largest. These backwaters support as much biological productivity and diversity as tropical rainforests and are responsible for the rich fisheries potential of the state (Menon et al 2000). The ichthyofauna of Vembanad Lake in comparison with those of other brackish water lakes and estuaries of the country is known to be rich and diversified. Small-scale artisanal fisheries are an important component to the subsistence and to the economy of the people around Vembanad. Many thousands of fishers have earned their livelihood from catching and selling fish from this ecosystem for hundreds, if not thousands of years. This scenario is changing, as the fish and fisheries of Vembanad is highly vulnerable to threats such as declining populations of most important species, overcapacity of the fishery, ecosystem changes and habitat alterations, high degrees of water pollution and reclamation of wetlands.

Past economic, agricultural and industrial development in Vembanad has overlooked the importance and necessity of resource conservation and management. It was generally thought to be a luxury, to be associated with such matters in the face of prevalent poverty and hunger, and the more pressing need to meet the basic needs of a rapidly amplifying population. This failure to protect the resources has led to the current situation where the management of Vembanad fisheries has become an enormous challenge with few alternatives to fishing for food and income and very few data to formulate management strategies.

Objective

The purpose of '*Vembanad Fish count 2008*', a participatory resource survey was to document the fish species in the region lying south of the Thaneermukkom salt water barrage of Vembanad – Kole wetland, a designated Ramsar site.

1. To carry out an inventory on the fish diversity of southern sector of Vembanad lake.

2. Awareness building to focus attention to issues on lake deterioration and biodiversity decline, into public domain.

The Program

The program – Vembanad fish Count 2008, which was first of its kind in a lake in South Asia was precautiously carried out involving three steps, *viz*; a preliminary workshop, participatory workshop and the fish count.

Preliminary workshop

A workshop for the participants was conducted at the seminar hall of Regional Agricultural Research Station (RARS), Kumarakom, Kerala Agricultural University on the 23rd of May 2008. Dr. K. G Padmakumar, Associate

Professor, RARS detailed the programme schedule and methodology for the fish count. Opinions of the participants were also recorded. All of them appreciated ATREE for organizing such a programme.

Preparatory workshop

All survey participants numbering 56 assembled at the seminar hall of RARS, Kumarakom on 29th May 2008 at 6PM for a preparatory session. Participants for the program were divided into three teams. For each team cruise leaders were selected, who were assigned the task of making the organizational groups and functional groups for effective conduct of the survey. The functional group comprised of a Technical team (9-10 members), Fishing team (4 members – two on board the vessel and two on canoes), Naturalist team (20 members) and a facilitator (1). The functional groups were assigned the task of landing centre inventory, fishing ground inventory, experimental fishing, Fish habitat inventory and resource use inventory. Each team collected fishing gears, resource materials and survey forms and disbursed for dinner. Two teams (east bank and west bank) which were to start the cruise from Kumarakom stayed at RARS, while the riverine team camped at the CERC-ATREE at Alleppey.

Vembanad Fish Count 2008

On 30th of May, teams from RARS assembled at the boat jetty near RARS at 6AM. The program was flagged-off by Mr. Rajappan, President of the Fishermen cooperative society of Pallichira, Kumarakom. Two motorized cruise boat commenced the journey from Kavanattinkara and the riverine cruise boat commenced the journey from Punnamada, Alappuzha. The teams that were assigned the duty of monitoring the fish landings were taken to the respective landing centers on a speed boat. They later returned to join their respective cruise boats after collecting required information from the landing centers.

The cruise boats then moved to reach the fishermen who were entrusted to set the nets and wait for the cruise team to pull the nets. The team involved in experimental fishing operated various gears including gill net, drag net, cast net and scoop net that are appropriate to littoral and pelagic zones. The resource inventory team gathered information on the number of sand and shell mining units, house boats, fishing birds, weed cover etc, operating in the lake, viewing it from their respective cruise. The habitat inventory team collected data pertaining to fish habitats including water and plankton samples. Water Quality testing is also carried out by the team members. 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 finishing point at Kerala Tourism Development Corporation, Thaneermukkom by 3 PM and handed over the data sheets, fish samples and sampling equipments to the organizers. The concluding session was inaugurated by the Honorable Member of Parliament, Alappuzha, Dr. K. S. Manoj. The meeting was presided over by Mr. Chellappan, President, Thaneermukkom Grama Panchayath. Dr. V.S. Vijayan, Chairman of the Kerala State

Biodiversity Board, Dr. K.G. Padmakumar, Associate Professor, RARS, Kumarakom Dr. Priyadarsanan Dharmarajan, ATREE, Dr. Latha Bhaskar, ATREE and Dr. Gopalakrishnan, National Bureau of Fish Genetic Resources spoke on the occasion. The team leaders presented their findings in the reporting session. A fleet of media teams from Print and electronic media were there to report the event, which is the first of its kind in south Asia.

A brief report of the Vembanad Fish Count 2008 is furnished below.

Location

Vembanad Lake (9° 34' 60 N, 76° 25' 0 E) is the largest humid tropical wetland on the west coast of India with a length of 96 km and a surface area of 1512 km^2. Based on the rich biodiversity and socio-economic importance, Vembanad Lake along with adjacent kole lands was declared as Ramsar site - a wetland of international importance (Ramsar, 2002). Vembanad kole wetland and its ten associated drainage basins are characterized by continuous chain of backwaters. Vembanad Lake is ecologically significant due to its mangrove patches and habitat for resident and seasonal migratory water fowl. The lake is renowned for its live clam resources and sub-fossil deposits, as a habitat for the vulnerable spot billed pelican *Pelicanus philippensis*, large bird population especially water fowls, besides a high species diversity of finfish and shellfish (WWF 2002). One hundred and fifty species of fish belonging to 100 genera and 56 families are known to occur in Vembanad Lake (Kurup and Samuel 1985). The list also includes threatened species such as *Horabagrus brachysoma, Labeo dussumieri, Carinotetraodon travancoricus* and *Heteropneustes fossilis* (Molur and Walker 2001). An important characteristic of the lake is the location of the Thaneermukkom salt water barrier. This barrier essentially divides the lake into two parts - one with brackish water perennially and the other half with freshwater fed by the rivers draining in to the lake. These freshwater regions of the lake are facing ecological problems due to rampant propagation of water hyacinths and eutrophication.

The wetlands of Vembanad have been widely acclaimed as the 'Inland fish basket' of the State from time immemorial. However habitat alteration, eutrophication and other anthropogenic stressors in the recent decades has tainted the name of the region to 'Inland waste basket'. Fish production in the entire wetland has been quantified to 7,200 tons per annum consequent to various ecosystem alterations like Thannermukkom salt water barrier and destruction of mangroves. Exploited catches on the southern stretches of the lake has been found to be only 584 tons per annum, a mere seven percent of the total, which obviously indicates the extent of fishery decline (Padmakumar, 2003). Unmanaged and unregulated fishery is also posing a serious threat to various threatened fish species of Vembanad Lake (Krishna Kumar *et al*., 2007; Sreeraj et al 2007). The southern sector of Vembanad (the

location for the *Vembanad Fish Count*) is the worst affected part due to the construction of the Thannermukkom bund.

Methodology

The participants of the Fish count numbering around 130 were divided into three Teams , each one targeting three regions of the lake *viz* 'west bank sector', 'riverine sector' and 'east bank sector'. Each team comprised of about 40 to 50 members, drawn from various universities, colleges, nature clubs, societies and NGO's. 'East bank' sector team cruised through the route from Kavanattinkara, Kumarakom, Nazareth and Pallom. 'Riverine sector' team cruised through the route starting from Punnamada, Pallathuruthy, Kainakary, Nedumudy and Pullincunnu. 'West bank' team cruised through the route starting from Kavanattinkara, Vechoor, Ambika Market, Thaneermukkom, Pathiramanal and Muhamma.

Each cruise team was further divided into four organizational groups and 5 functional groups as described in the previous chapter. The program continued from 6 AM to 3 PM on 30th of May 2008. For fish sampling and inventory of species was the methodology described earlier and standardized for the Meeenachil Fish count, 2004 (Padmakumar et al., 2006) was adopted with modifications to suit to the estuarine system.

Experimental fishing (undertaken by local fishers) was carried out from 4 AM to 12 PM on 30th May 2008 at the various sampling sites (FIG 1) using variety of gears including gill net, cast net, drag net and scoop net.

Fishing ground inventory was carried out with the due participation of local fishers who allowed us to check the species, which contributed to their catch on that day. An *Identification key prepared for fish count* was referred to identify the fish. Enquiries were also made on the fishing methods and socio-economic information of the fishers.

Landing centre inventory **-** The major landing centers around the sampling sites were also visited and the species diversity of the catches 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 tested includes parameters like pH, transparency, temperature, D.O, Alkalinity and salinity. pH was determined using pH paper, Transparency using Seechi Disc and Temperature using Mercury Thermometer , Dissolved Oxygen, Alkalinity as $CaCo_3$, salinity were determined using standard procedures at the sampling sites. And the parameters like Chloride, Alkalinity, Hardness, Calcium, Magnesium, Phosphate, Sulphate and Iron was determined by using the water quality analysis kit made by CPR Environment Education Centre.

Resource use inventory was carried out wherein the number of sand mining units, shell mining units, house boats , number of fishing units, encroachments, waste dumping activities and extent of weed cover was observed

and assessed using detailed observation schedule (annexure)

Results

Vembanad Fish Count 2008 resulted in the observation of 51 species of finfish representing 26 families and 35 genera, as well as 11 species of shell fish belonging to 7 families and 8 genera (Table 1,2).

SECTOR WISE ANALYSIS

East bank

Assessment of the catches from the fishers engaged in fishing at five sites (Kumarakom fish sanctuary, two sites at R block and two sites in MRF) recorded ten species of fish and one crustacean – the giant fresh water prawn, *Macrobrachium rosenbergii*. Species diversity in Kumarakom was high when compared with R block where eight fish species were recorded. Fishers in these regions especially at R block caught more quantities of fish when compared to other areas although the number of species was reduced to six. Two landing centers (Kumarakom and Pallom) were also sampled where twelve species of fish and one crustacean was recorded. The landing centers only received 5-6 kg of fishes which was considered to be rather low. Pearl spot, *Etroplus suratensis* which is a high value species distributed in Vembanad was the major catch in this location. A total of 29 species of finfishes and 7 species of shell fishes were recorded from the east bank cruise.(table 1)

The experimental fishing carried out by the survey team recorded seventeen species of fish. The water quality parameters of these regions are provided in table 3. Water at this site was slightly basic and the dissolved oxygen recorded at Kumarakom was 4.0ppm.

A total of fifteen sand mining units were observed near Kumarakom bird sanctuary (3), MRF (2), Nazareth (4) and R-Block (6). There were 29 manual shell mining units widely distributed at Kumarakom bird sanctuary (5), MRF (7), Nazareth (4) and R-Block (13). A total of 54 house boats were observed at four sites - Kumarakom bird sanctuary (8), MRF (22), Nazareth (11) and R-Block (13) and one speed boat each were observed at Ambika Market and KTDC. Floating weed covers were seen at Kumarakom bird sanctuary (40%), MRF (20%), Nazareth (10%) and R-Block (20%). These region have got considerable amount of submerged weeds at Kumarakom bird sanctuary (4.2%), MRF (4%), Nazareth (3%) and R-Block (5%). A total of 131 cormorants were sighted at Kumarakom Bird sanctuary (21), MRF (31), Nazareth (45) and R-Block (34). The water quality parameters at three sampling sites are shown in table 3.

West bank

Assessments of the landings from fishing operation carried out by local fishers at Ambika market, Thaneermukkom and Kannankara recorded the occurrence of eight species of finfish and one crustacean of which six were commercially important. The drastic reduction of fish

species in this area was noted to be a major area of concern as local knowledge indicated that catches of commercial species were going down with a potential to adversely affect the livelihoods of the fishers. These regions were previously renowned for the landing of a large diversity of finfish species. Currently, a fisherman spending 10 hours of his effort gets only 1 -3 kg of fishes where as during earlier times they use to get more than 10kg which clearly indicates the decline of resources. The experimental fishing carried out by the team members of *Vembanad Fish Count* resulted in the capture of thirty five species of finfish and three species of crustaceans from four sampling sites (Table 1). A total of 38 fin fishes and 3 shell fishes were recorded by the team in this cruise. The water quality parameters at three sampling sites are shown in table 4. The general trends in the results of the water quality analyses of these regions show that the water is slightly basic in nature. A total of fifteen sand mining units were observed at Ambika market (14) and Thannermukkom (1). There were 113 manual shell mining units widely distributed in Ambika market (37), Thanneermukkom (7), KTDC (23), Kannankara (29) Pathiramanal (17). A total of 30 house boats were observed at the three sites viz Ambika market (2), Kannankara (4) Pathiramanal (24) and one speed boat each were observed at Ambika Market and KTDC. Floating weed cover at Ambika Market was observed to be 30%, Thannermukkom 26%, KTDC 29%, Kannankara 24%, and Pathiramanal 52%. A total of 300 cormorants were sighted at Ambika market alone.

Riverine sector

The experimental fishing carried out at four sites in this region yielded around 23 species of finfish, three species of crustaceans and one species of mollusc. Whereas, the fisher catches in three sites in the region comprised of around 18 species of finfish, three crustaceans. A total of 41 species of fin fishes and 7 species of shell fishes were seen. Fishers in this area tend to get more fishes when compared with East and West Bank regions (table 1). One reason may be because of the limited number of fishers operating in these areas. Also, during the sampling many weak fishes were encountered which were seen to have symptoms of various diseases. The water quality parameters at different sites are provided in table5. At the sampling sites, the water was a bit turbid. The highest water temperature for any site in Vembanad (assessed during the survey) was recorded at Vattakayal in this sector which was 32.5^{o} C .

A total of twenty four sand mining units were observed at Lake Palace (1), Pallathuruthy (2) and Vattakayal (21). There were 7 manual shell mining units which were seen only at Vattakayal (7). A total of 540 house boats were observed in four sites viz Punnamada(137), Lake palace (104), Pallathuruthy (13) and Vattakayal (286) and eighty four motor boats each were observed at Punnamada(24), Lake palace (20), Pallathuruthy(18) and Vattakayal(22). Floating weed cover at Punnamada (20%), Lake palace (12%), Pallathuruthy (6%) and Vattakayal (48%) was also recorded. This area has got considerable amount of floating

weeds with about 10% of the total area being covered by water hyacinths. A total of 319 cormorants was sighted at Punnamada (10), Lake palace (100), Pallathuruthy (9) and Vattakayal (200). Detailed water quality results are given in Table 5.

Discussion

The overall results of the *Vembanad Fish Count2008* indicates that there is a good species diversity of fishes in southern sector, but the stocks of many of these are declining drastically. Earlier surveys in these regions have recorded 60 species of finfish and 6 species of crustaceans. During the sampling we also collected two species of 'Critically Endangered', four species of 'Endangered' and five species of 'Vulnerable' fish. We also observed some unethical fishing practices like use of small meshed nets and use of poison in order to catch fish. The migratory fishermen from Karnataka was seen fishing using bamboo boats (kotta vallam) and the local fisherman says that they use poisons in order to catch fishes.

Around 23 species of fishes were observed in the entire cruise which includes many commercially important ones like channa and pearl spot. Two exotics were observed by the group one at riverine stretch Catla (*Catla catla*) and one at the west bank Tilapia (Oreochromis mossmbicus). Some fishes like *Pseudosphronemus dayi*(paradise fish), *Amblypharyngodon melettinus* (carplet) and *Wallago attu*(fresh water shark) was found only at the riverine sector, *Chela dadyburjori* was found only at the east bank cruise and Two ariidae cat fish , Chanos chanos(milk fish), Mullets was found only at the west bank cruise. Detailed list is provided on Table 1

Assessing the water quality parameters, we observed that pH was always on the higher side i.e. slightly alkaline throughout the sampling sites. Transparency of water was very low in Alappuzha region which indicates that those areas have either high algal blooms or suspended sediments. Salinity was less even though the Thaneermukham bund was open and ranged between 0.13 to 5.529 ppt.

Recommendations

1) In addition to the support offered through central and state welfare schemes to fishing communities and other subsidies for purchasing boats, net and marketing, the state Government should also put efforts to sustain the fisheries sector through a holistic approach which includes habitat protection, enforcement of regulations and adoption of co-management strategies with a bottom-up line. This will lead to improving the livelihoods of fishers and avoiding further degradation and deterioration of habitat quality of the lake ecosystem.

2) Assistance of fisheries institutes and other research organizations should be sought for large scale seed production and ranching programs of commercially important indigenous fish species. Participation from

fishing communities can also be used through self help groups for rearing fingerlings.

3) Existing natural habitats and native vegetation like those surrounding Pathiramanal islands, the reclaimed portions of lake at Chithira and Rani Block of kayals, Lake Portion adjoining the Kerala Agricultural University at Kumarakom should also be protected for the purpose of fish spawning and recruitment.

4) Strict enforcement of existing fishing laws should be carried out by the concerned agencies.

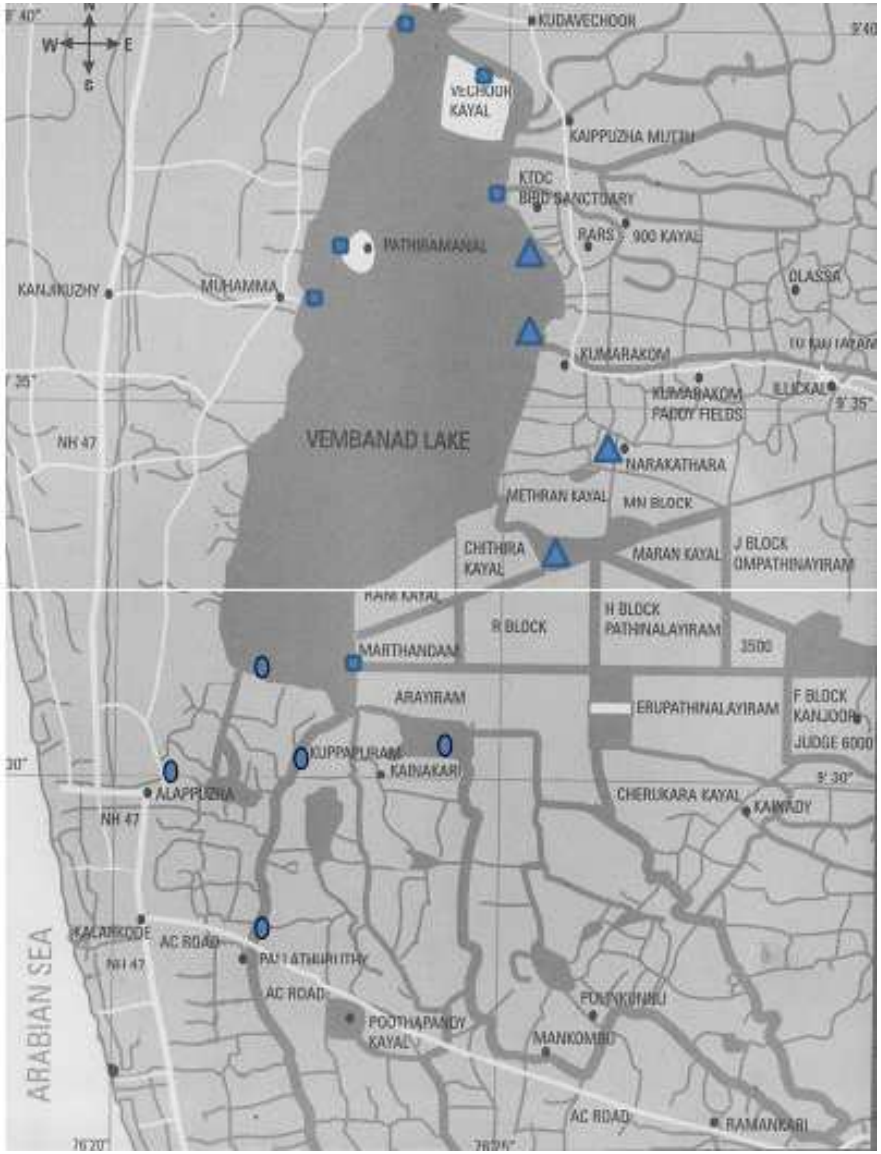
5) Evolving a co-management system should be a top priority for fisheries planners in the region. This should be based on a bottom-up strategy rather than the conventional top-down schemes which have been largely unsuccessful.

6) Long term monitoring mechanism on population dynamics of various fish species which are thought to be declining should be taken up through collaborative projects involving various research organizations.

7) Collaborations between various central and state government organizations, research institutes, universities, colleges, non-governmental organizations and cooperatives 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.

Appendices

Figure 1 Map with survey routes
Table 1-Species list sector wise
Table 2- Species list family
Table 3- Water quality results (East Bank)
Table 4- Water quality results (West Bank)
Table 5- Water quality results (Riverine)



East Bank Cruise **West Bank Cruise** **Riverine Sector Cruise**

Table 1- LIST OF FISHES (SECTOR WISE)

FISH SPECIES	EAST BANK	WEST BANK	RIVERINE
1. Ambassis ambassis	√	√	√
2. Parambassis ranga	√	√	√
3. Parambassis dayi	√	√	√
4. Parambassis thomassi	√	√	√
5. Amblypharyngodon melettinus			√
6. Amblypharyngodon mola	√	√	√
7. Catla catla			√
8. Chela dadyburjori	√		
9. Labeo dussumieri	√	√	√
10. Puntius sarana	√	√	√
11. Puntius filamentosus	√	√	√
12. Puntius vittatus		√	√
13. Puntius amphibius	√	√	√
14. Rasbora daniconius			√
15. Anabas testudineus		√	√
16. Aplocheilus panchax		√	√
17. Aplocheilus lineatus	√	√	√
18. Aplocheilus blockii			√
19. Arius maculates		√	
20. Arius subrostratus		√	

21.	***Glossogobius giuris***	√	√	√
22.	***Channa striata***	√	√	√
23.	***Channa marulius***	√	√	√
24.	***Chanos chanos***		√	
25.	***Dayella malabarica***			√
26.	***Etroplus suratensis***	√	√	√
27.	***Etroplus maculates***	√	√	√
28.	***Oreochromis mossambicus***		√	
29.	***Gerres setifer***	√	√	
30.	***G. filamentosus***		√	
31.	***Horabagrus brachysoma***	√	√	√
32.	***Eubleekeria splendens***		√	√
33.	***Photopectoralis bindus***		√	√
34.	***Liza tade***		√	
35.	***Mugil cephalus***		√	
36.	***Heteropneustes fossilis***	√	√	√
37.	***Mystus gulio***	√	√	√
38.	***Mystus armatus***		√	√
39.	***Mystus vittatus***	√	√	√
40.	***Mastacembelus armatus***	√	√	√
41.	***Pseudosphromenus cupanus***	√	√	√
42.	***Pseudosphromenus dayi***			√
43.	***Stolephorus indicus***		√	√
44.	***Ompok malabaricus***	√		√

45. Wallago attu			√
46. Nandus nandus	√		√
47. Carinotetraodon travancoricus	√	√	√
48. Xenentodon cancilla	√		√
49. Scatophagus argus	√		
50. Brachirus orientalis	√		√
51. Hyporamphus xanthopterus		√	√
Shell Fishes			
1. Metapenaeus dobsonii	√	√	√
2. Penaeus monodon	√		√
3. Fenneropenaeus indicus	√		
4. Macrobrachium rosenbergii	√		√
5. M.idella	√		√
6. Leptocarpus potamiscus			√
7. Caridina naderjoni	√		√
8. Scylla serrata	√		
9. Villorita cyprinoides		√	
10. Lamelliden marginalis			√
11. Pila globosa		√	

Table 2 -Species list Vembanad Fish Count

SPECIES LIST	THREAT STATUS
Ambassidae	
1. ***Ambassis ambassis***	**DD**
2. ***Parambassis ranga***	**DD**
3. ***Parambassis dayi***	**EN**
4. ***Parambassis thomassi***	**VU**
Cyprinidae	
5. ***Amblypharyngodon melettinus***	**LR**
6. ***A mola***	**LR**
7. ***Catla catla***	**VU**
8. ***Chela dadyburjori***	**DD**
9. ***Labeo dussumieri***	**EN**
10. ***Puntius sarana***	**LR**
11. ***Puntius filamentosus***	**LR**
12. ***Puntius vittatus***	**LR**
13. ***Puntius amphibius***	**LR**
14. ***Rasbora daniconius***	**LR**
Anabantidae	
15. ***Anabas testudineus***	**VU**
Aplocheilidae	
16. ***Aplocheilus panchax***	**LR**
17. ***Aplocheilus lineatus***	**LR**
18. ***Aplocheilus blockii***	**LR**
Ariidae	
19. ***Arius maculatus***	**NA**
20. ***Arius subrostratus***	**NA**

Gobiidae ***21. Glossogobius giuris***	 **LR**
Channidae ***22. Channa striata*** ***23. Channa marulius***	 **LR** **LR**
Chanidae ***24. Chanos chanos***	 **NA**
CLUPEIDAE ***25. Dayella malabarica***	 ***LR***
Cichlidae ***26. Etroplus suratensis*** ***27. Etroplus maculatus*** ***28. Oreochromis mossambicus***	 **LR** **LR** **Intr**
Gerreidae ***29. Gerres setifer*** ***30. G. filamentosus***	
Horabagridae ***31. Horabagrus brachysoma***	 ***EN***
Leiognathidae ***32. Eubleekeria splendens*** ***33. Photopectoralis bindus***	
Mugilidae ***34. Liza Liza tade*** ***35. Mugil cephalus***	 **DD** **DD**

Heteropneustidae ***36. Heteropneustes fossilis***	**VU**
Bagridae ***37. Mystus gulio*** ***38. Mystus armatus*** ***39. Mystus vittatus***	 ***LR*** ***LR*** ***VU***
Mastacembelidae ***40. Mastacembelus armatus***	 **LR**
Osphronemidae ***41.Pseudosphromenus cupanus*** ***42.Pseudosphromenus cupanus***	**LR**
Engraulidae ***43. Stolephorus indicus***	
Siluridae ***44. Ompok malabaricus*** ***45. Wallago attu***	 ***CR*** ***LR***
Nandidae ***46. Nandus nandus***	 **LR**
Tetraodontidae ***47. Carinotetraodon travancoricus***	 **EN**
Belonidae **48.*Xenentodon cancilla***	**LR**
Scatophagidae ***49. Scatophagus argus***	 **DD**

Soleidae ***50. Brachirus orientalis***	**DD**
Hemiramphidae ***51. Hyporamphus xanthopterus***	**CR**
Penaeidae ***52. Metapenaeus dobsonii*** ***53. Penaeus monodon*** ***54. Fenneropenaeus indicus***	NA NA NA
Palaemonidae ***55. Macrobrachium rosenbergii*** ***56. M.idella*** ***57. Leptocarpus potamiscus***	NA NA NA
Atyidae ***58. Caridina naderjoni***	NA
Portunidae *59.* ***Scylla serrata***	NA
Corbiculidae ***60. Villorita cyprinoides***	NA
Unionidae ***61. Lamelliden marginalis***	NA
Ampullariidae ***62 .Pila globosa***	NA

DD- Data deficient, LR- Low Risk, VU- Vulnerable, EN – Endangered, CR- Critically Endangered Threat status based on CAMP workshop 1998

Table -3- VEMBANAD FISH COUNT 2008 WATER QUALITY RESULTS-EAST BANK CRUISE

SL No	Parameters	R- Block	Nazrath	Kumarakom	Pallom
1	pH	7	7	7.5	7
2	Chloride (ppm)	60	70	70	50
3	Alkalinity (ppm)	60	30	40	40
4	Hardness (ppm)	30	30	40	20
5	Calcium (ppm)	30	30	40	40
6	Magnesium(ppm)	0	0	0	0
7	Phosphate(ppm)	<1 ppm	<1 ppm	<1 ppm	<1 ppm
8	Sulphate(ppm)	< 200ppm	< 200ppm	< 200ppm	< 200ppm
9	Iron(ppm)	< 1ppm	< 1ppm	< 1ppm	< 1ppm
10	Transparency(cm)	181	136.5	197	176
11	Rainfall(cm)	0	0	0	0
12	Tidal Phase	Low Tide	Low Tide	Low Tide	Low Tide
13	Dissolved Oxygen (mg/l))	7.6	7.6	4	6.8
14	Salinity (ppt)	0.142	0.155	0.192	0.135
15	Alkalinity (mg CaCO3/litre)	2.5	2.8	2.5	2.3
16	Temperature (Water) ^{0}c	31	31.5	28	31
17	Temperature (Air) ^{0}c	32	32	28	32

Table- 4 -VEMBANAD FISH COUNT 2008 WATER QUALITY RESULTS – WEST BANK CRUISE

Sl No	Parameters	Ambika market	Vechoor	Muhamma	Thanneermukkom	Pathiramanal
1	pH	7	7	7.5	7	7.5
2	Chloride (ppm)	60	35	150	Very high	Very high
3	Alkalinity (ppm)	30	40	Very high	30	Very high
4	Hardness (ppm)	650	600	500	640	Very high
5	Calcium (ppm)	60	70	40	150	30
6	Magnesium(ppm	590	560	0	90	0
7	Phosphate(ppm)	<1 ppm	<1 ppm	<1 ppm	<1 ppm	<1 ppm
8	Sulphate(ppm)	< 200ppm	< 200ppm	< 200ppm	< 200ppm	< 200ppm
9	Iron(ppm)	< 1ppm	< 1ppm	< 1ppm	< 1ppm	< 1ppm
10	Transparency (cm)	173.5	168	160	174.5	153
11	Rainfall(cm	0	0	0	0	0
12	Tidal Phase	Low Tide	Low Tide	High Tide	High Tide	High Tide
13	Dissolved Oxygen (mg/l))	8.8	7.9	7.2	6.8	7.2
14	Salinity (ppt)	5.154	4.325	2	5.529	2
15	Alkalinity (mg CaCO3/litre)	1.8	1.7	1.9	3	2
16	Temperature (Water) ^{0}c	29	30	32	29	30
17	Temperature (Air) ^{0}c	30	30	30	30	30

Table -5 -VEMBANAD FISH COUNT 2008 WATER QUALITY RESULTS – RIVERINE SECTOR CRUISE

SI No	Parameters	Sai Punnamada	Punnamada Chandy's Resort	Pallathuruthy	Vattakayal
1	**pH**	**7.5**	**7.5**	**7.5**	**7.5**
2	**Chloride (ppm)**	**350**	**100**	**70**	**60**
3	**Alkalinity (ppm)**	**40**	**40**	**40**	**40**
4	**Hardness (ppm)**	**30**	**40**	**30**	**40**
5	**Calcium (ppm)**	**30**	**40**	**30**	**30**
6	**Magnesium(ppm)**	**0**	**0**	**0**	**10**
7	**Phosphate(ppm)**	**<1 ppm**	**<1 ppm**	**<1 ppm**	**<1 ppm**
8	**Sulphate(ppm)**	**<200ppm**	**< 200ppm**	**<2 00ppm**	**< 200ppm**
9	**Iron(ppm)**	**< 1ppm**	**< 1ppm**	**< 1ppm**	**< 1ppm**
10	**Transparency(cm)**	**77.5**	**67**	**73.5**	**61**
11	**Rainfall(cm)**	**0**	**0**	**0**	**0**
12	**Tidal Phase**	**Low Tide**	**Low Tide**	**Low Tide**	**Low Tide**
13	**Dissolved Oxygen (mg/l)**	**5.6**	**5.9**	**8.6**	**9.2**
14	**Salinity (ppt)**	**0.917**	**0.857**	**0.142**	**0.13**
15	**Alkalinity (mg CaCO3/litre)**	**4**	**4**	**2.8**	**3.8**
16	**Temperature (Water) ^{0}c**	**31.5**	**32**	**32**	**33**
17	**Temperature (Air) ^{0}c**	**29**	**32**	**32.5**	**31.5**

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