



## FRESHWATER FISH KILLS IN KERALA- A STATUS REPORT

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**Abstract:** The recurring fish kills occurring in the freshwater bodies due to anthropogenic interventions have become the primary reason for the decline of fish population. This paper deals with the fish kills that were occurred during the period from 1995-2014 in the rivers of Kerala and analyse the reasons.

**Keywords:** Pesticides, pollution, ichthyotoxin, industrial effluent, fish mortality

### INTRODUCTION

The large scale fish kills are a frequent phenomenon in the high latitudes often referred as winter kills (Hurst, 2007). Several reasons have been postulated for the large scale fish kills in this region including thermal stress, starvation, predation, parasites and pathogens. An internet source revealed the history of the episodic fish kills in the Prince Edward Island during the period 1962-2011 (<http://www.macphailwoods.org>) and explicitly mentioned that 50 fish kills occurred during the period and concluded that one fish kill occurred per year on an average. The tabulated data of the fish kills provided the reasons for the fish kill. The pesticides like nabam, endrin, dithane, endosulfan, carbofuran, azinphos methyl and a series of pesticide spill played significant role in the mass mortality of fishes.

In the tropical latitudes also fish kills are common due to natural and anthropogenic disturbances. The natural sources include the sudden change in temperature, weather pattern, increase in the parasitic organisms and fish diseases. The sources of anthropogenic origin were the disposal of waste materials into the aquatic ecosystems, increased discharge of pesticides and fertilizers, low levels or flow of water in waterways and the consequent poor quality water, such as low oxygen, high temperatures or high nutrients.

The natural fish population of the Kerala inhabits

the rivers, lakes, kole wetlands and paddy fields are under a severe stress due to multitude of factors. The increasing population, fastening urbanization, encroachment of the river basins, reduced run offs during the post monsoon periods and high level of application of the pesticides are some of the reasons. The freshwater fishes including the secondary freshwater fished are under a severe stress and the most potential threat at present is found to be the fish kills which became frequent phenomenon during the last three years. Most of them remain unnoticed while some massive kills have got the attention of both the print and visual media. Most of the fish kills got been seriously investigated and the reasons were not analysed. The present paper aims to detail the fish kills reported from Kerala.

### METHODS

Data on the fish kills were collected by personal visits to the affected areas and based on the reports from the media reports and information collected from the local fishers. The authors visited several spots where fish deaths and attempted to estimate the quantum of fish affected. The pieces of information on the source of pollution, species affected, extent of affected area, reasons of fish kills were collected. Water samples were collected and interviews were conducted among the local communities to understand sources of fish death.

## RESULTS

The Table 1 provides the synopsis of the fish kills reported from Kerala since the year 1994. Of these, some reports are based on the reports that appeared in the various print media of Kerala.

During 1994 only one case of fish kill has been reported and which was due to an advertent poisoning to sedate the fishes for easy fishing by the local inhabitants. Small scale poisoning using ichthyotoxins of plant origin in small tributaries of Chaliyar basin is quite common in inhabited areas. However, in most of the cases, the fish deaths were not so extensive and the areas affected were usually small. As a safety measure, the fishers separate a small stretch of river by bunds and limit the poisoning to this isolated zone. The fish catch through this poisoning never exceeded 10 Kg.

During, 2012, three incidents of fish kills were reported and in 2013, the number of fish kills increased eight fold to 24. In 2014, up to the month of September, two fish kills were reported.

Most of the fish death were reported during the months of May (21 instances), followed by June (6) and February (3). There were three instances of fish kills during the onset of monsoon (June), which coincided with the breeding migration of fishes (Shaji, 2013). An examination of the dead fishes from the Chalakudy River on 29 May to 1, June revealed that most of the dead fishes were *Horabagrus brachysoma*, *Puntius* sp., *Wallago attu*, were with fully matured ova ready to spawn.

From the study of the dead fishes collected from the sites, it was found that the most of the affected species are economically important which play a pivotal role in the inland fish production and in the livelihood of local communities (Table 2). *Etroplus suratensis*, *Wallago attu*, *Channa striata*, *C. pseudomarusius* and *Horabagrus brachysoma* fetch an exorbitant prize in the domestic market but were the dominant among the dead fishes in almost all cases studied (Fig. 1).

Most of the fish kills are reported from the lowland plains of the Kerala below an altitude of 5m. The fishes use the monsoon floodplains during the southwest monsoon for breeding and larval growth and on recession of the monsoon, as the water level come down, the fishes migrate down to the rivers.

During summer months, low water level coupled with poor run off in the rivers of Kerala drive the fishes to assemble in particular localities, where usually the fish kills are frequent. This making many migratory species vulnerable to fish kill.

The last among the reported of fish kill was from Kodakara in Thrissur district. The first author visited the site and collected the dead fish samples and carried out preliminary studies. The pesticide load was high in the tissue samples of the fishes (Sreerag, Per. Comm.). The change in the land use pattern was attributed to the sudden fish kills in Kodakara. The farmers use the paddy land alternatively for paddy cultivation and plantain cultivation and the cultivation requires heavy input of pesticides like Furadan and fertilizers. After the plantain cultivation, the land is ploughed for paddy and water is drained to the adjoining canals. The undigested pesticides applied earlier mix well with water during trilling and the heavy load of pesticides is found to be the reason for the fish kills in Kodakara.

In most of the cases the fish kill has been remain unreported, especially that occurs in small and remote village areas. The fish death in Karikkattu chaal, a kole-like wetland extended in 22 hectares in Annamanada Panchayat of Thrissur district has not yet been reported in media or other avenues.

In most of the cases, fish kills were not seriously investigated. An exception to this may be the fish kill in Periyar in 2012. The Kerala State Pollution Control Board is the premier agency responsible to investigate and report such incidents. Being dissented on their first report on the fish death in Periyar during 2012, the Human Rights Commission directed to reinvestigate and report on the fish death. This may be the sole case of involvement of judiciary in fish kills. Quite similar to this, the Aquaculture Development Agency, Kerala (ADAK) was entrusted to look in to the fish death in Varapuzha, Chambakkara and Thevara area of Periyar river on May 23, 2002

The reasons for the sudden death are still a *Quaero Quaero*. In most of the cases, the causes of fish kills were under investigated and generalized reasons were given. The hypoxia (drop in the oxygen level in the water), pollution, waste dumping were the reasons reported through the media. In most cases, the mass

**Table 1.** A synopsis of fish death reported from Kerala

<b>Date</b>	<b>Location/River</b>	<b>Reason (Reported)</b>
February, 1994	Chalikkal river, tributary of Chaliyar river	Application of fish poisoning using ichthyotoxins for fishing. Dead fishes were found at a stretch of 3 Km of the river course.
May 1995 –June 1998	Kanjirapuzha, Cherumanpuzha, Kurumanpuzha.	Fish poisoning by the locals using ichthyotoxins of plant origin,
March, 1998	Bhavali river, Tributary of Kabini	Fish poisoning by the locals using ichthyotoxins
May 23, 2002	Varapuzha, Chambakkara and Thevara area of Periyar river.	Flow of contaminated water into the river.
Feb 10, 2008	Canoly canal, Kozhikode District,	Release of effluents and dumping of wastes from hospitals, hotels and abattoirs in the city. Biological Oxygen Deficiency was one of the reasons for the sudden death of the fish.
May 4, 2011	Muttar puzha, tributary of the Periyar.	Waste tankers dumped excreta into the river. Slaughter waste was also disposed into the Periyar.
May 03, 2012 There have been over 18 instances of large-scale fish death in the Periyar.	Periyar	Lack of dissolved oxygen in river water and by entry of polluted water containing decayed waste into the river.
May 7, 2012	Pathalam belt in river Periyar	Lack of dissolved oxygen, entry of polluted water containing decayed waste into the river.
June 9, 2012	Tirur river in Tirur municipality and neighbouring grama panchayats Pariyapuram, Vettam, Tirur, Pachattiri, and Cheriyaundam	Sudden increase of pollutants, Dead fish were found a stretch of more than 12 km from Mangalam to Thalakkalathur. Sudden gush of water after several months could have stirred up the pollutants in the water and caused the harm.
Jun 11, 2012	Chovva canal, also called Kanam puzha Kannur town	Dumping of waste in the canal
February 10, 2013	Periyar river in Pathalam	Dissolved oxygen level at Pathalam bund was 1.6 mg/litre.

May 7, 2013	Karamana river, near the Thiruvallam and Pallathukadavu	An abrupt dip in the dissolved oxygen in water. Rise in temperature and reduction in water flow coincided with the summer. The heavy sewage pollution from the Parvathy Puthanar canal have aggravated the conditions
May 29 to June 01, 2013	Chalakupuzha at Annamanada	The reason for the fish mortality is yet to be ascertained. Fishes worth Rs. 30-40 lakh
May, 2013	Karikkattu chaal, a kole wetland in Thrissur district	No investigations carried out.
June, 03, 2013	Mala canal, Thrissur district	Dumping of wastes
25-Jun-13	Chathanchaal, Thrissur District	Unknown reason
05-Jul-13	Chathanchaal, Thrissur District	Unknown reason
21-Aug-14	Unknown reason	Unknown reason
05 September, 2014.	Perumthode, Irinjalakuda, Thrissur District	Unknown reason



**Fig. 1.** Fish kill in Annamanada (Chalakupuzha River) from May 29 to June 01, 2013

**Table 2.** Dominant fish species encountered in the fish kills in the rivers.

Location and river basin, Time	Fish species
Chalikkal river, tributary of Chaliyar river (Direct observation)	<i>Systomus subnasutus</i> , <i>Sahyadria denisonii</i> , <i>Puntius mahecola</i> , <i>Pethia punctata</i> , <i>Puntius vittatus</i> , <i>Pseudoetroplus maculatus</i> , <i>Etroplus suratensis</i> , <i>Awaous gutum</i> , <i>Osteobrama bakeri</i> , <i>Aplocheilus lineatus</i> , <i>Pseudosiphonemus cupanus</i> , <i>Mastacembelus armatus</i> , <i>Mesonoemacheilus triangularis</i> , <i>Mesonoemacheilus guentheri</i> , <i>Lepidocephalichthys thermalis</i> , <i>Ompok bimaculatus</i> , <i>Rasbora dandia</i> , <i>Pangio goensis</i> , <i>Batasio travancoria</i>
Periyar river, various months of 2012 (From the images given by the fishers)	<i>Ophisternon bengalensis</i> , <i>E. suratensis</i> , <i>Pseudoetroplus maculatus</i> , <i>Anguilla bicolor</i> , <i>Glossogobius giuris</i> , <i>A. gutum</i> , <i>Wallago attu</i> , <i>O. bimaculatus</i> , <i>Channa striata</i> , <i>Xenentodon cancila</i> , <i>Hemiramphus</i> sp.
Tirur river (Based on the reports and images)	<i>Horabagrus brachysoma</i> , <i>Pseudoetroplus maculatus</i> , <i>E. suratensis</i> , <i>Ompok bimaculatus</i> , <i>Mulletts</i> , <i>G. giuris</i> , <i>M. armatus</i> , <i>S. subnasutus</i>
Chalakupuzha at Annamanada (Direct observation)	<i>Wallago attu</i> , <i>S. subnasutus</i> , <i>Channa pseudomaruilius</i> , <i>C. striatus</i> , <i>Glossogobius giuris</i> , <i>Ompok bimaculatus</i> , <i>Mastacembelus armatus</i> , <i>Horabagrus brachysoma</i> , <i>Anguilla bicolor</i> , <i>Aplocheilus lineatus</i> , <i>Pseudoetroplus maculatus</i> , <i>E. suratensis</i> , <i>Rasbora dandia</i> , <i>Xenentodon cancila</i> , <i>Puntius mahecola</i> , <i>Pethia punctata</i> , <i>Puntius vittatus</i> , <i>Puntius parrah</i>
Karikkattu chaal, a kole wetland in Thrissur district (Direct observation)	<i>S. subnasutus</i> , <i>Channa striata</i> , <i>Puntius mahecola</i> , <i>Pseudoetroplus maculatus</i> , <i>Heteropneustes fossilis</i> , <i>Puntius parrah</i>
Mala canal, Thrissur district	<i>Pseudoetroplus maculatus</i> , <i>E. suratensis</i> and various estuarine species
Chathanchaal, Thrissur District (interview with local people)	<i>Channa</i> sp., <i>Puntius</i> sp., <i>Rasbora</i> , <i>Aplocheilus</i> sp., <i>Lepidocephalichthys</i> sp.
Kodakara, Thrissur district (Direct observation)	<i>Pseudoetroplus maculatus</i> , <i>E. suratensis</i> , <i>M. armatus</i> , <i>S. subnasutus</i> , <i>Dawkinsia filamentosus</i> , <i>Pethia punctata</i> , <i>Puntius parrah</i> , <i>Rasbora dandia</i> , <i>O. bimaculatus</i> , <i>Mystus oculatus</i> , <i>Carinotetraodon travancoricus</i>
Perumthode, Irinjalakuda, Thrissur District (Form the image)	<i>Wallago attu</i> , <i>Pseudoetroplus maculatus</i> , <i>E. suratensis</i> , <i>O. bimaculatus</i>
Kanjirapuzha, Cherumanpuzha, Kurumanpuzha (Chaliyar basin)	<i>Mesonoemacheilus triangularis</i> , <i>Rasbora dandia</i> , <i>Devario aequipinnatus</i> , <i>Lepidocephalichthys thermalis</i> , <i>Bhavana australis</i> , <i>Batasio travancoria</i> , <i>Channa gachua</i> , <i>Mastacembelus armatus</i>
Bhavali river (Kabini basin)	<i>Schistura denisoni</i> , <i>Balitora mysorensis</i> , <i>Glyptothorax madraspatanus</i> , <i>Esomus</i> sp., <i>Devario aequipinnatus</i> , <i>Channa gachua</i> , <i>Puntius</i> sp.

mortalities of fishes take place in spur of a moment but in some case, it is episodic and last for 2-3 days. Except two cases, there were no attempts to estimate the economic loss due to the fish death. Fish species worth about Rs 88 lakh had been reported lost due to the fish death on May 23, 2002 in Varapuzha, Chambakkara and Thevara area in Periyar river. The estimated loss due to fish kill in Chalakudy was around 40 lakh rupees.

It is also worth mentioning that the invertebrate species dead along with the fish species were unnoticed and poorly documented. Crabs, prawns, molluscs are also wiped out along with the fishes during each fish kill (Fig. 1).

It deserves special mention that protests from the people are rather rare and if had, it was weak. However, a severe protest from local community has been reported in Annamanada during 30, May, 2013.

People collected the dead fishes from the river and marched with it to the Local Panchayat Office.

Since August 1991, sporadic fish kills have been a frequent phenomenon in the freshwater of Kerala due to, Epizootic Ulcerative Syndrome (EUS). The disease has been reported for the first time in Kuttanad and later spread to different parts of Kerala (CMFRI, 1991; Thampuran *et al*, 1995). The disease is still prevalent in several parts of Kerala and voluminous fish resources are being removed from the state. The fish kills due to the EUS has been reported from Pooyamkutty, Ernakulam district in 2013 and the frequency of incidence is high during May-June months.

None of the above fish kills detailed above are due to natural source and obviously the sources of the fish kills are anthropogenic in origin. Industrial effluents, discharge of the pollutants

## DISCUSSION

The perusal of the literature shows that there had been little information available on studies on the fish kill in south India and Kerala in particular. Recurring blooms of algae, including true algae, dinoflagellates, and cyanobacteria or blue-green algae have been reported in marine and freshwater bodies throughout the world (Anderson, 1994). Proliferations of freshwater toxin-producing cyanobacteria are simply called “cyanobacterial blooms” or “toxic algal blooms are frequent in temperate regime.”

Fish kills due to physical processes like rapid fluctuations in temperature, hydrological changes like sudden drop in oxygen level and in the pH, or of biological reasons like stress from spawning activity, viruses, bacterial infection and parasites were reported from Florida (Anon, 2003). Fish kills as result of a sudden drop in air, and consequent drop in water temperature were reported. The cold intolerant species like *Tilapia* introduced from tropical countries to temperate conditions could not fare well at the low temperature and stopped feeding resulting mass death were reported from Florida (Anon, 2003).

The mass kills in the marine environment and coastal water are frequent due to the harmful algal bloom (HAB). Hallegraeff *et al.* (1998) reported the economic loss and pollution due to the bluefin tuna

(*Thunnus maccoyii*) in South Australia. *Chattonella marina* is one of the major toxic phytoplankton species, which is highly toxic to fish especially to yellowtail *Seriola quinqueradiata* and caused serious damage to fish farming in Japan (Okaichi, 1989). Quite similar to this, mass mortality of fishes were reported from the Kollam of Kerala coast due to red tide bloom of toxic dinoflagellate plankton, *Coccolodoneum* during September, 2004.

There were no algal blooms or drop in the temperature to extreme in the freshwaters reported from Kerala and no natural reasons can be attributed for the recurring fish kills. Adverent poisoning, waste disposal, industrial effluents, etc are the primary factors responsible for the fish kills. The poor documentation and systematic scientific investigations are obvious in most of the cases. The poor public response highlights the lack of awareness among the public.

Freshwater fishes, key elements of the aquatic ecosystem which play pivotal role in the economy of local communities, are under severe stress due to habitat degradation due to sand mining, pollution, over harvesting and imprudent, lackadaisical and non judicious interventions by human beings in the system will pave the way for their extermination.

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