

## Need of coastal resource management in Pulicat Lake—challenges ahead

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### Abstract

Coastal zones are currently experiencing intense and sustained environmental pressures from a range of driving forces. Responsible agencies around the globe are seeking ways of better managing the causes and consequences of the environmental change process in coastal areas. The demands on the environment are raising serious concerns from environmentalists, stakeholders, coastal communities and researchers. Pulicat Lake is the second largest lagoon in India has rich natural but at the same time very fragile ecosystem. This lagoon provides nursery and breeding grounds for many species of marine fauna and supports commercial fishing too. This article discusses the current status of the Pulicat Lake biodiversity, the ecological crisis faced by the lake due to lake-mouth closure issues, siltation, shrinkage of the lake, pollution, over fishing, degradation and destruction of natural habitats in the environment. Further it focus on fishermen community socio-economic perspectives of their development towards livelihoods, social organization, literacy, fishing pattern, marketing outlet, income and involvement by NGO's etc. The healthier lake needs integrated policy approaches, which involve scientific disciplines to address the complexity of the interaction between the social and natural systems in the coastal and marine environment.

**Keywords:** Pulicat Lake, fragile ecosystem, siltation, literacy, fishing pattern.

### Introduction

Pulicat Lake is the second largest brackish water lake, lying partly in Tamil Nadu and Andhra Pradesh. In Tamil Nadu, the Pulicat Lake is located in Pulicat village in Thiruvallur district. It is connected with the Bay of Bengal through a deep opening of about 0.8 km width situated about 1.6 kms north of the Pulicat light house. The area of the Pulicat Lake of Tamil Nadu is about 15,367 hec. The lake is subjected to tidal influence having an average diurnal range of one foot. Pulicat Lake is actually a lagoon, adjacent to the Bay of Bengal. It is formed out of the backwater of the sea. The minimum and maximum depth of Pulicat Lake is 0.2 m and 17.5 m respectively. As the water level rises by November each year with monsoon rains the salinity drops considerably the lake has luxuriant stocks of fish, prawn and lime shell deposition underground. Silica sand, gypsum and other minerals are also prominent in the lake side. In Tamil, Pulicat Lake (Fig.1) is called as "Pazhaverkadu" which means "forest of rooted fruit" which specifies the mangroves. It includes 26 fisherman villages that depend the Pulicat Lake for livelihood. The total area of the lake is 600 km<sup>2</sup> with average depth of 1-3 m which favours larval development of fishes and shrimps. These organisms from the sea are migrated to the lake for laying eggs that attract the migratory birds from other countries. Only dry wastelands are lining the roadside to Pulicat Lake. Some of the villages can be reached only by boat. Those villages are located on long sandy stretches with 25 km long and 0.1 to 1 km width. It separates the sea and backwater. Those fishermen of the sand bar are the evicted people from the Sriharikotta rocket launching station area. They lead a tough life and are struggling everyday for fishing. In this perspective,

there is a need to conserve the ecosystem with potential biodiversity resources as well as fishermen community for their livelihood. So there is a necessity to look on to the coastal resource management implications are very much needed in this hour.

### Biodiversity status at Pulicat Lake

Pulicat Lake is one of the good productive ecosystems in India. Several researchers have been reported the biodiversity details from this area. Chacko *et al.* (1953) have given the first exhaustive account of the biodiversity of the Pulicat Lake and it has been classical benchmark for the biodiversity of the Pulicat Lake for a long time (Sanjeeva Raj, 1997, 2003, 2006). Subsequently, from the 1970s up to date several papers have been published as per the exhaustive and useful bibliography by Kathirvel (2003). Chacko *et al.* (1953) have recorded 59 species of phytoplankton and 23 species of zooplankton, but Krishnan and Sampath (1973) have recorded much less, only 16 phytoplankton, but more zooplankton, 35 species. Today, it is still less in numbers. Mid 1970s, when shrimp from the Pulicat Lake started, the White shrimp (*Penaeus indicus*) has literally become the "White Gold" at Pulicat. Although Chacko *et al.* (1953) recorded only 4 species of shrimps from the Pulicat Lake, yet later Paul Raj (1976) recorded 12 species from the lake. Six of them, *Penaeus indicus*, *P. monodon*, *P. semisulcatus*, *Metapenaeus dobsoni*, *M. affinis* and *M. brevicornis* are more common, of which *P. indicus* is the most dominant species in the lake sustaining a major fishery and export trade at Pulicat. The mud crab or green crab, as it is variously called, is reputed from the Pulicat Lake since ancient times (Joel, 1974). Dominance of sub-adults and juveniles alone in

the catches and absence of breeders are clear indications of the decline due to over-exploitation of adults and breeders for export (Mahesh Raj, 1992). Thangavelu and Sanjeeva Raj (1985) have an account of the lime-shell mining and the species of molluscan shells available. The local poor have been mining for several years. Sanjeeva Raj *et al.* (2002) observed that with the loss of the oyster beds in the Pulicat Lake, biodiversity and fisheries at the oyster-beds also was being lost.

Chacko *et al.* (1953) recorded 65 species of fish, including three elasmobranchs and 62 teleosts. The exhaustive survey of Selvanathan and Kaliyamurthy (1972) has amazingly added 81 species of fish, as new records of the Pulicat Lake, totaling 146 species. Sanjeeva Raj (2006) has added 22 more species making a total of 168 species. However, today because of the drastic topographical as well as hydrological changes brought about in the lake, several marine species like elasmobranchs and some stenohaline marine species of teleosts are not seen any more in the lake. Even the rest of the species are declining in numbers, perhaps because of the increasing pollution. According to the Forest Department records, about 60 to 80 thousand water birds, belonging to about 50 species visit the lake, every winter. Today about 78-80 species of water birds are counted during the winter, on this lake. Today, there are several ecological problems that these migrant birds are facing on the northern Pulicat Lake, chief among them is the lack of water for a longer duration. Pesticide usage in paddy fields also should be under check. Above all, this wetland, Pulicat Lake should be recognized as a Ramsar Site, for international protection.

### Ecological crises facing the Pulicat Lake

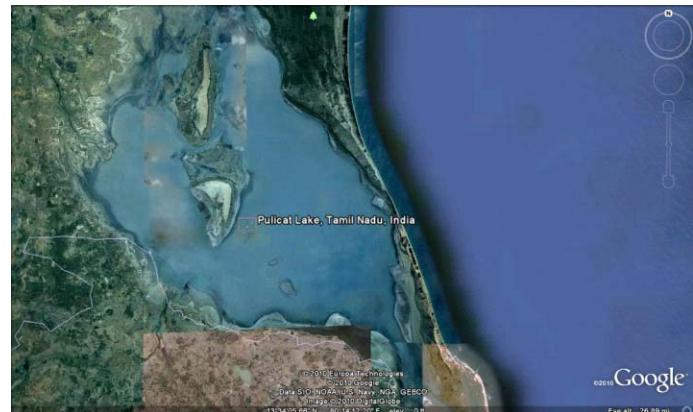
#### *Impact of lake-mouth closure*

The lake-mouth which is such a major determining factor for the hydrology, biodiversity and fisheries in this lake, tends to get narrower and shallower during the post-monsoon months (January to September), chiefly due to the accretion of sand, resulting in the formation of a sand-bar across the lake-mouth. As a result, the impact of the ebb (low) and flow (high) tides in the lake tends to be feeble, in the sense that the ingress of sea water into the lake is less, and hence the depth of the water in the lake tends to decline. This has major consequences on the biodiversity and fisheries in this lake. If the sand-bar closes up the lake-mouth completely, as it happened during some severe summers, the lake water gets impounded, gets subjected to evaporation and reaches hypersaline levels.

#### *Siltation and substratum*

Another major ecological crisis facing by the Pulicat Lake is the rapid rate of siltation of the lake. During the Northeast monsoon (October to December), flood water from all catchment (watershed) areas around the lake flows into the lake, erodes top-soil and brings it into the

lake, as silt. The rivulets and the Buckingham Canal also bring in heavy loads of silt into the lake. According to Caratini (1994), Pulicat Lake has been getting silted up at the rate of about one metre, per each century. Its average depth of about 3.8 metres, prior to the 17th



century.

When Pulicat Lake served as a natural harbour for the Dutch, is today, reduced to less than a metre. In some areas of the lake, during the monsoon, even one-foot depth of silt gets deposited. Such heavy siltation of the lake not only impedes navigation for fishing, but much more seriously, it buries all benthic (bottom) habitats, flora and sessile fauna, resulting in a large-scale or mass-mortality of biodiversity in the lake, during every monsoon. As a chain-reaction, natural food-chains, their reproductive potential and replenishment of stocks are greatly handicapped in this lake ecosystem, ultimately leading to extensive depletion of biodiversity and fisheries in the lake.

*Fig. 2. Padu system operation near Edamani village.*



#### *Shrinkage of the Lake*

Pulicat Lake has been shrinking not only in its area of water spread, but also in its depth simultaneously, so that fishes that prefer deeper waters are rapidly dwindling in the lake. More than about 12 to 15 species of fish and one or two species of shrimps have either vanished from the lake totally, or are fast declining in populations, since the past 20 years. As per Caratini (1994) predictions, Pulicat Lake may totally disappear, within another century, being filled up, by silt.

### *Damages in the environment*

Pulicat Lake is one of the most beautiful location and visitors throng the area and cause utmost pollution and thrown away the waste near the shore areas where the fishes and other organisms get accumulated with plastic wastes and they die due to some toxic chemicals present in the plastics. Sustainable fishing is the need of the hour and the fisherfolk have to be conscientised about it.

### *Pollution*

The Arani and Kalangi rivers carry runoff from agricultural fields in the drainage basin which result in pollution load from fertilizers and pesticides into the lake. Shrimp and crab culture ponds situated along the shore of Pulicat, also pollute the lake by discharge of untreated effluent waters from the culture ponds. Such polluted effluent water may even incorporate toxic pollutants and pathogenic organisms into the biodiversity, food-chains and into locally consumed and exported seafood like shrimps, crabs and fishes. The North Chennai power station (NCTPS) is another major source of pollution as it lets in slurry containing toxic fly ash which causes a variety of effects on the ecosystem.

### *Fishing pressures*

Reliable data on the population of fisherfolk on the Pulicat Lake, for the past 50 years, has been difficult to procure, since the fisherfolk keep migrating, or their villages get splitting up or getting shifted by the governments. However, the few villages for which the figures are available and as per the survey by Chacko *et al.* (1953), as a baseline as per Sebastian (1991) estimate of 28,000 in 50 villages, and comparing them with a survey conducted by a NGO, it shows that during the past 50 years, the total fisherfolk population on the Pulicat Lake has gone up by about 200 to 350% and the number of active fishermen has gone up by about 166%. As the total population of the fisherfolk increases, active fishermen among them are obliged to catch more and more fish, in order to feed the growing population at home. Add to this growth in the traditional fisherfolk population, there is almost an equal number of non-fishermen who, in recent times, have swooped on to the lake, to catch shrimp, for export. Therefore, it might be surmised that the total fishing pressures on the Pulicat Lake could have gone up by about 600 to 700% than the 1950 levels. This boom in fishing pressures has resulted in heavy over-fishing and the consequent depletion of fisheries, leading to unprecedented competition, frustration and fishing conflicts.

### *Unmanned location*

Location were no fishing activities and the habitat of fishermen were not

been established in many sites and people from neighbouring villages visit the unmanned locations and they try to collect the shells and hiding it in unmanned location which is most useful in the cement industry and been exported widely. One of the village i.e., Sathan kuppam nearer to the sea shore which affected by Tsunami waves, has been shifted next to the Edamani village. The old Sathan kuppam looks like an unmanned location, and few other villages which affected by Tsunami also shifted to the other neighbouring places.

### *Depletion due to construction*

Depletion of the lake mainly due to urbanization activity. The present activity going in the Pulicat i.e., construction of bridge in the lake, which destroys the flora and fauna habitat and also which affects food chain in the Pulicat Lake, but most of the islands and nearby villages they depend on that over bridge.

### *Socio-economics of the Pulicat Lake*

The term socio-economic refers to "Indicators which pertain to the human-dimensions side of marine resource management; relates to the distribution of benefits and income, livelihoods and local culture, and social organization and local culture".

### *Padu system*

Fishermen practice 'Padu system' of fishing in the lake region. In this system, the individual villages are fixed for a particular area of operation inside the lake and duration of their activity is also restricted. This gives all the villagers equal amount of share on the resources available from the lake. The southern part of the lagoon in Tamil Nadu in which fishing is highly productive, closer to Ennore and 5 kms from the estuary and bar (where the sea water & lagoon water coalesce) is controlled by fishermen of three main Pulicat Lagoon villages namely, Kottai Kuppam, Chuistain Kuppam and Audi Kuppam. The system under which fishing is controlled by these three villages is called Paadu system. It is an ancient system practiced in the Pulicat lagoon and is also practiced in coastal regions of Sri Lanka and other coasts of Tamil Nadu. Paadu is a traditional system of getting

entitlements to eligible members of a particular community for undertaking specified fishing activity in certain designated areas. The fishing grounds fall within a radius of 5 kms from the mouth of the lake with a salinity well maintained without much drying even during low tides. However, this traditional practice is based on caste control of the access rights to the high productive areas but is not respected by most of the eastern fishermen. Ocean-side villages also challenge this system.

*Fig. 3. Hand-Picking by tribal women.*



As a result, conflicts leading to violence have been reported.

#### *Village population*

There are 52 fishing villages located around the Pulicat Lake, harbouring about 30 to 40 thousand fisherfolk, who have been survive for generations, exclusively on fishing in this lake. Their population has naturally been growing, but the fishery resources in the lake have been inversely dwindling rapidly, so that there is a severe competition between the escalating fishing pressures and the depleting fishery resources, on this lake.

#### *Resources in each village*

In most villages they depend only on fishing and their entire work on fishing grounds by making nets and doing some repair works with the boats and with the nets. Fishermen are actually gone for fishing in their prescribed fishing grounds and catch. They stay for rest in the home after catching. Fisherwomen taking with the catch and sell in the market to the consumers or to the middleman and also to the export companies who buying the fishes store it in the freezers and they export it to the processing plants in Chennai. Apart from that fisherwomen involved in self help groups and obtaining loan from the government and they do the small scale industries and work with the manufacture of candles, match sticks and doing the dry fish preservation and few other different works and coordinating the women's in the villages.

#### *Non-fishermen*

Being lured by the lucrative trade in shrimp exports, several non-fishermen from the distant villages around the Pulicat Lake also have started fishing for shrimps on this lake. They come late in the evening, after their farm labour is over, and fish throughout the night, on the lake. More than adding to the already prevailing fishing pressures from the traditional fishermen on this lake, these non-fishermen practice destructive fishing gear and methods, like drag-nets (konda-valai), which destroy both the bottom habitats on which they tread and the fishery stocks, by catching even tiny juveniles.

#### *Hand-picking by tribal women*

Tribal women (*Irulas Yanadies*), living in five hamlets at the southern end of the Pulicat Lake, have been traditionally picking juvenile shrimps and mud-crabs, with their hands, while they tread on the lake-bed, in shallow waters. This method, unfortunately, disturbs and destroys the lake bottom habitats, and also it destroys the juvenile shrimps and crabs, without giving them a chance to grow.

#### *Obstructing migratory fisheries*

In a nursery like Pulicat Lake, growing-juveniles need to migrate, but fishermen in the northern regions of the

Pulicat Lake, lay fine-meshed stake-nets (kattu-valai & ara-valai), right across the whole width of the lake, and retain such nets continuously for days together, day in and day out, so that not only all shrimp, small or large, are totally filtered, but also, these juveniles are not given a chance to migrate south, along with the tides, to grow, thus practicing a very unscientific and unethical method of shrimp fishing on this lake.

#### *Management objectives*

All the above and several other such issues on the Pulicat Lake are escalating both the habitat as well as species destruction in the lake, so that biodiversity in the Pulicat Lake has been dwindling rapidly in the Lake, almost to a vanishing point. Under these formidable ecological and human threats to the Pulicat Lake ecosystem, unless local fishermen are conscientised about these crises facing the lake, and unless they are mobilised by their NGOs, to restore and conserve the habitats and biodiversity, in the lake, assisted by research scientists, students and teachers also, the rich and rare biodiversity of the Pulicat Lake may be totally lost, for our posterity. This inventory of biodiversity could be used to press forward the demand to get the Pulicat Lake declared as a 'Ramsar Site' for international protection. Promoting eco-tourism on this fascinating Pulicat Lake would provide some alternate livelihoods for traditional fishermen and dalits, through punting tourist boats, setting up petty shops, restaurant, souvenir sale, renting out camping sites and tents and through helping as guides for bird-watchers and tourists.

#### *Possible implications to conserve the ecosystem*

1. To maintain and enhance the diversity and distinctive nature of flora and fauna population in Pulicat sanctuary.
2. To study the habits and needs of the winter visitors especially flamingoes, pintail, garganey, Caspian tern, avocets and other species so as to provide them the suitable habitats.
3. To maintain the status of forests and favourable conditions for the main occupation of the people namely fishing and agriculture etc.
4. To regulate tourism with an aim to promote interest, and awareness for water birds and faunal conservation.
5. To maintain and enhance the diversity and distinctive nature of flora and fauna population in Pulicat Lake.
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7. Enhance Mangrove diversity & enhance fin and shell fish seed resources.
8. Impart awareness of responsible fishing.
9. Knowledge on culture activity for seaweeds, mud crabs, etc.
10. Arrangement of bank loans with less formality.

11. Development on fishermen, women, child & youth communities.
12. Provision of shallow-bottomed boats to enable sanctuary staff to patrol the lagoon.
13. Preparation of a management plan and conservation strategy for the entire area.
14. More involvement by NGOs & SHGs (Self help Groups)
15. Find alternate employment avenues & upliftment of the community.

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