3. DESCRIPTION OF THE STUDY AREA

Pulicat lake is the second largest brackish water lake in India and located between 13°26’ and 13°43’ N latitudes and 80°03’ and 80°18’ E longitudes. The dried parts of the lake extend up to 13°60’ N latitude. The lake is reported to be evolved around 6000 years ago at the peak of Holocene sea level rise by the growth of coastal sand barrier across river plain (Vaz and Banerjee, 1997). The lake is lying almost parallel to the Bay of Bengal. The lake extends to about 59 km from North to South direction with a maximum width of 19 km in East - West direction in the Northern sector of the lake. It opens into the Bay of Bengal at the South-Eastern margin near the Pulicat village which is narrow region of the lake measuring about 250 M. The average depth of the lake is about 1.5 M and the minimum and maximum depth varies from 0.5 to 6 M. The location of the Pulicat lagoon has been shown in the figure 1. The monsoon rain fed rivulets such as Swaranamukhi, Kalangi, Arani are flowing into Pulicat lake (Nanda Kumar, 2000) as fresh water inputs during the North East monsoon (October to December). The annual rain fall is 1200 mm.

The lake is connected to the sea through three tidal inlet, each one at Tupilipalem, Rayadoruvu and Pulicat respectively. Although, Tupilipalem and Rayadoruvu tidal inlet are seasonal and are not prominent in the Northern part of lake and there are two large islands viz., Venadu and Irukkam and a smaller one called Kuruvithittu, all of which have deposits of sub-fossilized clam shells. Lake has 16 island villages and a total of 97 other villages adjoining lake, which are directly or indirectly dependent on the lake for their livelihood. The Northern sector of the lake is
shallower than the southern sector. Several smaller mud-flats, developed into uninhabited islands. On the eastern side, the Sriharikota Island extends North to South all along as a narrow strip of sand bar between the lake and Bay of Bengal with an maximum width of 2 km considered as bigger island.

The hydrodynamic characteristics of the lake are restricted to lagoon-ocean water exchange and seasonal positional switching of the tidal entrance channel. Comparing with the past data, the total water spread area of the Pulicat Lake is around 481 sq.km in 1700 AD, but the present area is 281 sq.km. It shows that the lake area is shrinking by 200 sq.km in 300 years. Tidal fluctuation within the lake is 0.6 M. The comparative analysis of depth data showed that the depth reduction by 4 M to 1 M in 300 years. The shrinking of area was noticed in the North of the lake. Within the lagoon, sediment may be transported by wind-induced waves and currents directed predominantly towards the Northeast and West direction. Deposits in lagoons also include materials of organic origin such as shells, guano peat, chemically precipitated salt, calcite and dolomite (Ramesh, 2008). On occasional years, the lagoon sand bar extends and closes the bar mouth causing the lake to become completely isolated from the sea. Inconsistent monsoon rainfall and a lack of fresh water runoff, coupled with a complete bar mouth closure, result in extreme salinity and temperature levels (Rao, 1973; Angell, 1998) in the lake which are intolerable to most species of shrimp and fish (Cooper, 1994; Roy et al., 2001; Krishnamurthy and Ramakrishna, 2002) and the lagoon may acts as a negative estuary (Coulthard, 2006; Shalini et al., 2006), where salinity levels exceed those in the sea. Furthermore, lagoon separation from the sea can result in disrupted shrimp and fish larvae recruitment and migration patterns.
(Sanjeevaraj, 1996; Albertoni et al., 1999) and increased vulnerability of the lagoon to pollution. When the bar mouth has been completely closed are referred to, locally, as “black years (Fig. 2). Often, only a cyclone can be powerful enough to breach a sandbar and reopen a lagoon (Nott, 2005) and while breaching can be catastrophic for settlements nearby (Tuan et al., 2006) and there is wide spread relief among Pulicat fishers that a cyclone will precede good fish catches. The closer of tidal inlet can cause great havoc to resources and dependent livelihood in Pulicat.

**Fig.2 Historical analysis of rich and lean fishing years (black years) at Pulicat Lake (Coulthard, 2008).**
Pulicat Lake has rich natural resources but very fragile ecosystem. It provides nursery and breeding grounds for many species of marine fauna and supports fishing. The Pulicat land use, land cover maps necessary to evaluate the resources and its utilization (Fig. 4). The land cover comprises of forest area (0.9 sq. km), mud flat (162 sq. km), mangrove vegetation / plantation (92.7 sq. km), sandy beach (17.7 sq. km), salt pan (0.07 sq. km), water holding area (139 sq. km). The vast mudflat spreads where seaweeds and sea grasses are luxuriously grown is an ideal feeding ground around the lake attracts large congregations of greater and lesser flamingos, grey pelicans, painted storks, grey herons, ducks, teals, terns, herons, gulls and a number of waders for their feed on wide varieties of benthos (Nagarjuna, 2010). The water holding benthic bottom habitat is classified into three zones. The Southern zone is characterized by dominance of sand with little mud, Northern zone is highly deposited by mud and middle zone deposited with partial mixer of sand and mud caused overgrown patches of weeds and this zone reported to be rich in benthic array and diversity (Krishnamurthy, 1971). Soil of the lake, varies from sandy and clayey to fine alluvial. The floor or the substratum of the lake is chiefly clayey, due to the deposition of silt, brought by the monsoon floods (Sanjeevaraj, 2011).

Pulicat Lake is well-known feeding and breeding ground for many commercial important species of finfish and shellfish (Kathirvel, 2003; Anon, 2006; Nammalwar, 2007; Sanjeevaraj, 2006). It supports a rich biodiversity of high biomass of fishes, crustaceans, benthic fauna and planktons. “Padu”, which in the local language of Tamil means “fishing place”, is a traditional method for managing stake net fishing in the lagoon’s rich fishing grounds. Padu system is defined as “a traditional system of
granting entitlements to eligible members of a particular community for undertaking specified fishing activities in certain designated fishing grounds in the lagoon” (Mathew, 1991). The seasonal fishing trends have important ramifications for the lagoon fishery, which is largely focused around white prawn *Penaeus indicus* and tiger prawn *Penaeus monodon*. During the summer months, prawn catches are low, whereas the monsoon rainfalls in November stimulate extensive prawn migration resulting in high catches (Coulthard, 2006).

**Fig. 3 Stake net (Padu Valai) in Pulicat Coastal Lake**
Chapter 3. Description of the Study Area
Chapter 3. Description of the Study Area
Twenty sampling stations were located in the Pulicat coastal lake with help of GPS (Garmin 72). All stations are precisely located in the entire lake to be sampled including all resourced area such as mudflat, seagrass and weeds, sandy bottom, shell mining region and mangrove muddy habitat with a distance of 2.7 to 4 km each other.

The stations 1 and 2 are closer to mudflats of Northeastern side of the lake. Stations 1, 8, 9, 15 and 19 are placed parallel to Sriharikota Island with the distance of 0.6 – 1.6 km to Sriharikota Island. These stretches are occupied by luxuriant sea grasses initiated careful markings of the stations. The dominant seagrasses are *Halophila ovalis*, *Halophila officinalis* and *Syringodium* sp and seaweed *Gracillaria verrucosa*. Stations such as St.3, St.6, St.7, St.10, St.13, St.14, St.18 occupies the middle of the lake. The stations such as St.3, St.6, St.7 and St.16 lie adjacent to islands in the lake. Station 16 closer to Kuruvithittu and other three stations are neighbouring to Irukkam Island. Shell deposits are enormous and shell mining activity goes on around the Irukkam Island. Venadu Island located in Northern part found to have vast mudflat usually exposed and dried during summer.

As the Pulicat Lake is a tropical brackishwater lake ecosystem, Pulicat Lake found to have rich biodiversity and fisheries since ancient times. However, in the recent years, lake has been subjected to a variety of ecological crises, both natural as well as man-made. As a result not only the biodiversity but also fishing has been declining swiftly that the livelihoods of the poor dependent on this lake are seriously threatened. Shell mining is an another serious threat to the resources and alteration of habitat in the lagoon of Pulicat.