

Satellite remote sensing and field studies on a sea mouth in the northern part of Pulicat Lake

The Pulicat lagoon extending between $13^{\circ}20' - 13^{\circ}40'N$ lat. and $80^{\circ}14' - 80^{\circ}15'E$ long., and formed out of backwaters of the Bay of Bengal^{1,2}, is the second largest brackish water lagoon having an area of approximately 600 km^2 . The river waters of Kalangi, Uppativagu, Pamulakalva and other rainfed freshwater streams^{3,4} drain into the lagoon, making it rich in biodiversity. Pulicat lagoon is the feeding ground for local and long-distance migrant bird species. Long-distance migrants like the pelican, flamingo, painted stork, spoon-billed stork, snake bird and sand piper, and a variety of bird species³ feed on aquatic flora and fauna of the Pulicat Lake waters. Besides, several species of crustaceans, brachiopods, edible and non-edible fishes, and mollusks are present in the Pulicat Lake, providing food for secondary and tertiary consumers of the food chain, namely migrant birds^{3,5,6}. About 50,000 fishermen are also dependent on the Pulicat Lake. The sea mouth is important as sea water flows into the lake during high tide and lake water flows into the sea during low tide. Satellite data and field work undertaken showed shrinking of one of the three sea mouths, namely that at Tupilipalem on the northern most side of the Pulicat lagoon located in Nellore District, Andhra Pradesh, which might pose a threat to the lake biodiversity. The sea-mouth width retrospective data were retrieved by satellite remote sensing, whereas direct observation data in the field were collected for 2007 and 2008. Future ecoremedial measures for conservation are discussed and presented here.

IRS P6 LISS III satellite data pertaining to sea-mouth width of Pulicat Lake for the northern part, i.e. Tupilipalem, $80^{\circ}8'44''E$, $14^{\circ}2'N$, Vakadu Mandal, Nellore District for November 2000, January and April 2006 were obtained from Andhra Pradesh State Remote Sensing Applications Centre, Hyderabad. Field work at the ground level was conducted by proceeding to the sea mouth near Tupilipalem using a mechanized boat. The sea-mouth width was measured and photographs were taken for the period January 2007–January 2008. The sea mouth is located approximately 0.80 km from Tupilipalem Jetty (landing pier).



Figure 1. Satellite remote sensing imagery of the northern part of the sea mouth of Pulicat Lake near Tupilipalem for (a) November 2000, (b) January 2006 and (c) April 2006. Location: $80^{\circ}8'44''E$, $14^{\circ}2'N$.

SCIENTIFIC CORRESPONDENCE

Table 1. Satellite remote sensing and direct observational data of Pulicat Lake sea-mouth width on the northern side near Tupilipalem for the period 2000–2008

Year	Remote sensing or direct observation	Sea-mouth width (m)
2000 (November)	Remote sensing	26.98
2005 (January)*	Remote sensing	59.60
2006 (January)	Remote sensing	168.08
2006 (April)	Remote sensing	100.00
2007 (January)	Direct observation	71.00
2008 (January)	Direct observation	37.00

*Satellite imagery not provided.



Figure 2. Formation of sand bar near sea mouth of Pulicat Lake in January 2008.

The sea-mouth width according to remote sensing data for November 2000 was 26.98 m, for January 2005, 59.60 m; for January 2006, 168.08 m, and for April 2006, 100 m (Table 1). Thus the sea-mouth width gradually widened from 26.98 to 59.60 m during 2000–2005 after the tsunami on 26 December 2004 (Table 1 and Figure 1). From January 2005 to January 2006 sea-mouth width widened from 59.60 to 168.08 m. From January to April 2006, the sea-mouth width began to shrink and decreased from 168.08 to 100 m (Table 1 and Figure 1). Direct observation and measurement in the field on visiting the sea mouth showed 71 m in January 2007 and 37 m in January 2008. The decrease in the sea-mouth width has been attributed to sandbar formation due to wind direction towards the north, depositing sand (Figure 2). An interesting phenomenon observed during the field work was the sea mouth shifting gradually towards north. The minimum and maximum water depth at the sea mouth was 0.5 and 1.2 m respectively, in January 2007. In January 2008, the

minimum and maximum sea mouth water depth was 0.3–0.5 m due to silt formation.

The above observations reveal that the sea mouth is gradually closing down with sandbar formation (Figure 2) and the width of sea mouth is gradually shrinking. The tsunami-triggered sea wave may have had greater impact on widening the sea mouth. However, within two years, i.e. from January 2006 to January 2008, the sand dune and sandbar formation has taken place with a decrease in sea-mouth width. If this situation continues, the sea-mouth may further close down decreasing the flow of sea water into the lake and vice versa. This may pose a threat to the lake biodiversity, particularly rare migrant bird species and aquatic biodiversity, particularly fishes and shrimps on which the birds and about 30,000 fishermen are dependent. We recommend the declaration of the Pulicat lagoon as a Ramsar site to protect the lake and its biodiversity. An action plan has to be initiated to widen the sea mouth, and dredging and construction of groyne to prevent

the progression of the sandbar, as was done in the case of the Chilka Lake after its declaration as a Ramsar site^{7,8}.

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