

# NOTES

## STUDIES ON THE MONSOONAL FLOW OF THE MANDOVI ESTUARY

### ABSTRACT

Flow characteristics were studied in the Mandovi estuary during the monsoon season. High ebb current velocities at the surface (110-212 cm/sec) were observed during this period. The large amount of suspended material brought by the river is getting deposited at the river mouth due to the slowing down of the current and this contributes to the formation of a sand bar.

Flow characteristics have been studied in the Mandovi estuary during the months July and August, when the monsoon is active. The river Mandovi is opening into the Arabian Sea by a permanent connection. A bar is formed at the river mouth during the monsoon period (June-September) and then the river is not used for navigational purposes. Due to the presence of a large number of tributaries, the freshwater flow through this river is more than in other rivers of this region. The freshwater discharge is maximum during the monsoon months. The tide in this region is of mixed semidiurnal type with a maximum range of about 2.3 m.

Murty and Das (1972) have studied the tidal flow characteristics of this estuary during the pre-monsoon period. But no information is available on the flow characteristics during the monsoon season when the fresh water discharge is maximum. Some observations on the

salinity changes in the area during the months February and August have been reported earlier by Dehadrai (1970). The study of the monsoonal flow characteristics of this region is important due to sedimentation and the subsequent formation of a sand bar, Reis Magos / Aguada, occurring during this season at the river mouth.

The tidal current measurements were carried out during July and August, from a single station located about 5 km upstream from the river mouth. The station position is shown in Fig. 1. Hourly observations on currents were taken at the surface and at the bottom using an Ekman type current-meter, during a 12-hour tidal cycle. Simultaneously, water samples were also collected using the Nansen Reversing water bottles for salinity measurements.

Fig. 2 represents the current velocities and the salinity variations at the surface and bottom measured during the month of July. The maximum flood

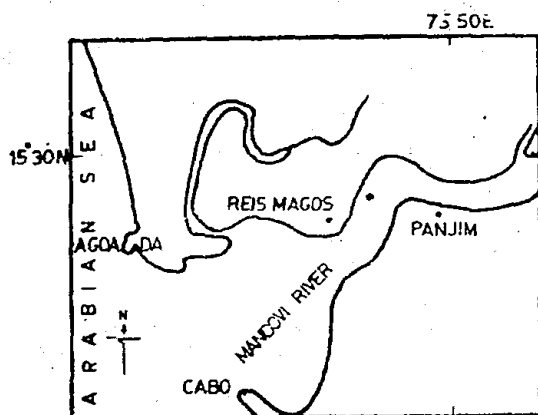


Fig. 1 Location of station.

velocities recorded at the surface and bottom were 48 cm/sec and 75 cm/sec respectively.

During the ebb, there was very little difference in the maximum values of velocity at the surface and bottom. The maximum values were 110 cm/sec at the surface and 106 cm/sec at the bottom. The zero velocity at the bottom lagged behind the predicted high tide at Mormugao by half an hour. But this lag was not observed at the surface which may probably be masked by the river runoff during this period.

The salinity variations followed the tide. The estuary was stratified during the period of observation and the vertical salinity gradient was strong (15‰). The maximum salinity values observed at the surface and bottom were 21.6‰ and 33‰ respectively. Very low salinity values were recorded at the surface and bottom during the beginning of the flood (2.2‰) and at the end of the ebb (6.9‰) respectively, indicating the greater discharge of fresh water. The

occurrence of maximum and minimum salinity lagged behind the predicted high and low waters by about half an hour to one hour.

Observations on currents made in the month of August, showed very high velocities especially during the ebb (Fig. 2). During the flood, the maximum velocity observed was 84 cm/sec at the surface and 153 cm/sec at the bottom. Although the zero velocity at the surface coincided with the predicted high water, at the bottom it lagged by half an hour. The ebb velocity was as high as 212 cm/sec at the surface and 167 cm/sec at the bottom. Towards the end of the ebb, the reversal from the ebb to the flood was noticed at the bottom first. Subsequent observations showed that the surface flow was still towards the sea with a speed of 13 cm/sec when the bottom flood flow had a speed of 93 cm/sec showing a high influx of fresh water.

In August also, the estuary was highly stratified except during the period when the ebb velocity was at its maximum. The maximum salinity values observed at the surface and bottom were 32‰ and 34‰ respectively. The minimum salinity values observed were 6.4‰ during flood at the surface and 15.8‰ at the bottom during ebb.

The flow characteristics of the estuary during this period (south-west monsoon season) and the pre-monsoon season, as observed by Murthy and Das (1972) reveal the following features: During the pre-monsoon period, the

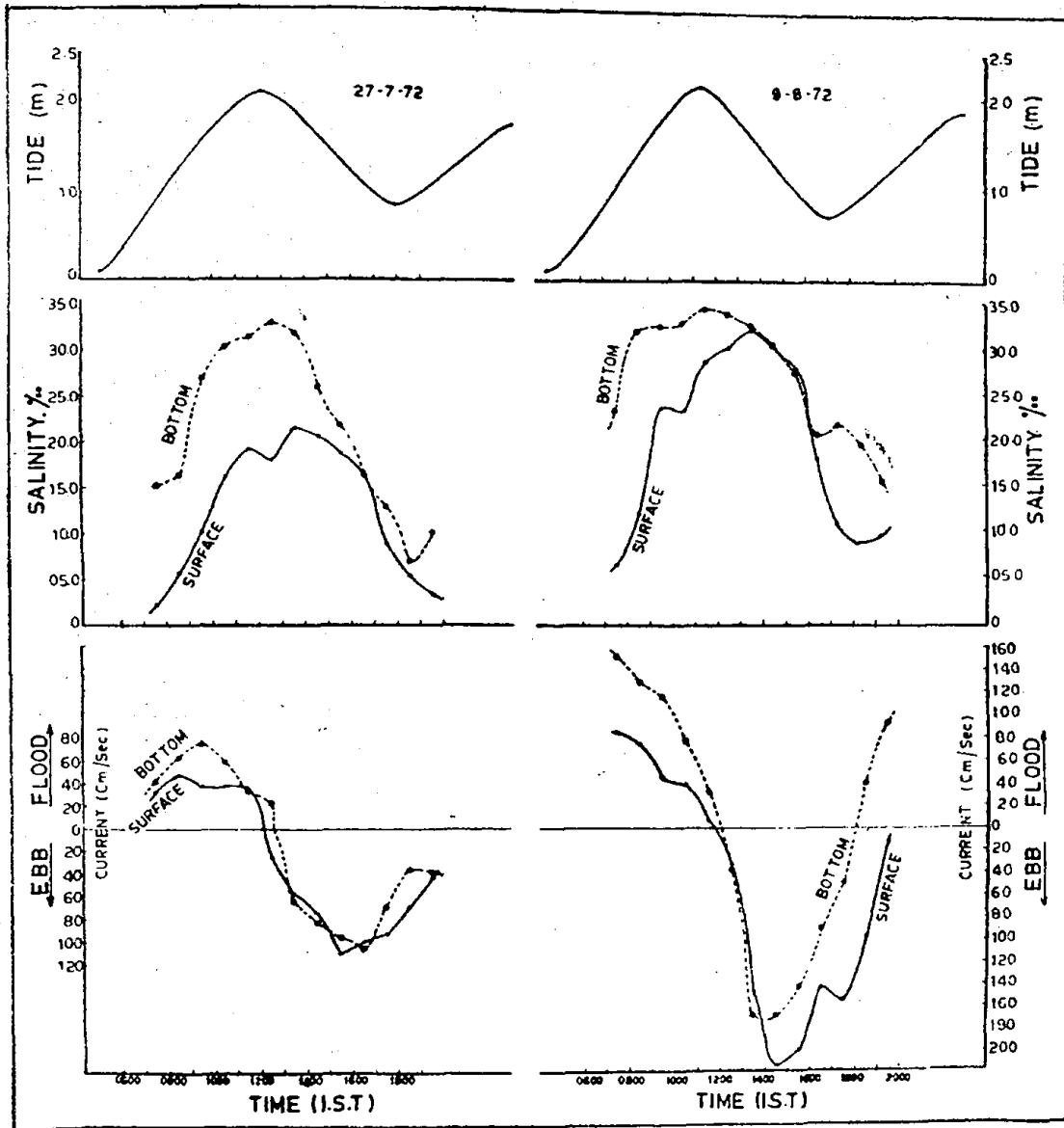


Fig. 2 Current velocities and salinity variations in July.

flood current was found to be dominating the ebb current. However, during the present observations the ebb flow was found to dominate the flood velocity. This is probably because of the considerable quantity of fresh water

discharge through the river into the estuary. The high flood velocity observed at the bottom is also an indication of large freshwater influx at the surface. The salinity variations during the tidal period were found to be quite

significant (2.2-21.6‰ at the surface and 6.9-33.0‰ at the bottom). But during the pre-monsoon period, the variations in the salinity values were 33.35-36.5‰ near the surface and 33.5 to 36.7‰ at the bottom.

Dehadrai (1970) reported a high percentage of suspended load in this estuary during the south-west monsoon. As the river flow tends to slow down

at the river mouth, partly due to the widening of the river mouth and partly due to the wave action, the flow velocity for the different sizes of particles may go below their critical velocity and may result in the deposition of the suspended particles. This may probably lead to the formation of sand bar at the river mouth.

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