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SOME REMARKS ON THE HYDROGRAPHY AND BIOLOGY OF THE BAY OF BENGAL*

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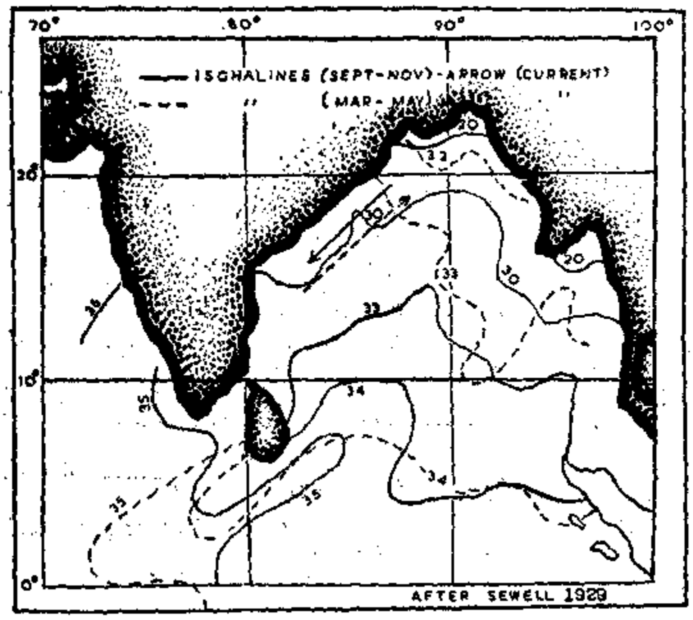
INTRODUCTION

The Indian ocean still remains practically unexplored compared with the Atlantic and Pacific oceans. Since 1952 the Andhra University has conducted 52 Oceanographic cruises in the shelf area off the east coast of India, and data have been collected and partly analysed from more than 700 stations.



Based on the data already collected and analysed, the following remarks are made on the drainage and its influence on the hydrographical conditions, distribution of salinity and nutrient salts, surface water formation in the north Indian Ocean and on the plankton and fisheries in the Bay of Bengal.

OBSERVATIONS

The drainage will be at its maximum during the post-monsoon months, namely September and October. It is estimated (Khosla, 1949 ; Lotka, 1956) that on an

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average, per annum, nearly 1,300 million acre feet of freshwater are drained into the Bay (Table below) and if this water were to be evenly spread over the Bay, its water level would increase by approximately 5 feet.

Name of the River.	*Annual run-off in millions of acre-feet.*
Irrawadi.	300.00
Ganga.	397.09
Brahmaputra.	308.95
Meghna.	50.00
Karanjuli.	16.00
Mahanadi.	75.25
Godavari.	101.76
Kistna.	36.42
Cauvery.	8.10

Such enormous inundation would naturally convert the whole Bay into an 'Estuary' where the surface waters are always less saline than the bottom waters. Further, the large amounts of silt contributed by the river drainage would reduce the transparency of the waters over a large area, thus reducing the rate and quantum of photosynthesis per unit area.

The pattern of isohalines in the Bay follows the water movements and the salinity is at its lowest (17-24°/$_{oo}$) all along the east coast of India, when the northern dilute waters are flowing south from September to November. With the onset of the northerly current in December the salinity makes a rapid recovery in the surface waters, but still the isohaline of 34 is more or less outside the Bay limits (Chart from Sewell, 1929). In the Bay of Bengal, therefore, there are always, warm, low saline waters in the surface region, and cold saline waters at subsurface levels. Such a situation is not favourable for the occurrence of large scale mixing processes.

The mean annual variation of surface temperature ranges from about 25° to 30°C. The higher temperatures coincide with the period of maximum drainage into the Bay during July to October period, while the temperatures are lower from December to February in the north east monsoon months.

Of all the nutrient salts (Table below) silicates show a high value, again as a result of the heavy drainage into the Bay. The waters, however, are not rich in inorganic phosphates.

TABLE SHOWING HYDROGRAPHICAL FEATURES OF THE SURFACE WATERS (FROM MONTHLY AVERAGES) OFF WALTAIR
(Ganapati and Sarma, 1958 and Ganapati and Subba Rao, 1958)

Maximum		*Months*	*Minimum*	*Months*
Temperature °C.	29.50	June-September.	24.92	January-February
Salinity ‰	34.70	March-May	24.40	October-November
Inorganic PO (μg.at./L.)	1.66	December-January.	0.27	March-April
Silicates (μg.at./L.)	29.91	September-October.	7.0	January-March
O_2 (cc./L.)	4.95	March-June	2.37	September-October
Chlorophyll. (μg./L.)	0.216	March-April	0.02	December.

There are two surface currents in the Bay one in a clockwise direction from January to June and the other in the opposite direction from July to December. The effect of these two currents are very pronounced in the shelf zone up to a distance of about 15 miles (Ganapati and Murthy, 1954). The anti-clockwise current or the southerly current which may also be called the turbid current, is characterised by low salinity, high turbidity and high temperature while the northerly current of the clockwise circulation (otherwise known as the transparent current) which brings in the oceanic waters into the bay, is characterised by high salinity, high transparency and rich nutrients (Rao, 1957). These two currents do not seem to bring about any large scale mixing except in the surface layers.

Sewell (1932) has given a chart showing the bottom drift of the Antarctic water which upwells near the Carlsberg ridge and bifurcates into two branches one of which enters the Bay. La Fond (1954) has reported local upwelling off the east coast of India, near Visakhapatnam. While local upwelling may to some extent replenish the nutrients in the surface waters resulting in increased phytoplankton production in limited areas, the observations so far made do not indicate any large scale mixing processes in the Bay. Nielsen (1957) has estimated organic production of 0.12 to 0.24 $gr/c/m^2$/per day in the Bay of Bengal which is only a little more than that of the tropical ocean water.

Analysis of the plankton collected from a fixed station in the 10 fathom line off this coast for the past 10 years has shown, that there is a major peak of production from February to April corresponding to the northerly current period and a minor peak in the October-November months when the current is southerly in direction. We have also found that the composition of the organisms in the two peaks vary to a great extent presumably owing to the entirely different hydrographical conditions of the two water masses.

Conclusion

The studies so far have revealed that the hydrobiological conditions of the shelf waters on the east coast of India, up to a distance of approximately 15 miles, are highly variable under the influence of the changing monsoons, drainage, surface currents and vertical water movements.

One of the special features of the Indian fisheries is that 80% of the total landings come from the West coast. The absence of rich fisheries on the east coast of India is an important marine biological problem. At present fishing is limited to a coastal strip of 3-4 miles on the east coast. It is possible that rich demersal fisheries exist further offshore, beyond the fluctuating influences of drainage and monsoon winds.

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