

breaking yield plateau in rice. Marker-aided selection will greatly facilitate genetic metamorphosis toward ameliorating fundamental processes of yield formation. The reliability and stability of QTL in different environments should be tested before using them in breeding programme. The information needs to be generated to correlate extended grain filling interval with grain yield under stressed environments in *indica-japonica* crosses of rice.

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## New record of the sympatric distribution of two Asian species of the horseshoe crab

The geographical distribution of four extant species of the horseshoe crab all over the world has been discussed in detail by many workers<sup>1-3</sup>. Co-existence of two or more species of the horseshoe crab at one place has not been reported, so far. In India, 2 species of the horseshoe crab are commonly found along the north-east coast (West Bengal and Orissa) where mature pairs of the horseshoe crab, in amplexus, migrate towards the shore throughout the year for breeding<sup>4</sup>. The co-existence of two species of the horseshoe crab along Orissa coast is reported here.

The surveys for the present study were conducted in the coastal areas of West Bengal and Orissa (lat. 19°16'N, long. 84°53'E and lat. 22°19'N, long. 88°39'E, Figure 1). A shore seine having an area of 200 m<sup>2</sup> was operated with the help of fishermen to collect live specimens from the natural environment during the high tide. The survey was conducted from March 1996 to February

1997 coincident with full/new moon phases. The average number of crabs collected in each lunar phase was recorded and identified.

The percentage of crabs collected during each lunar cycle during the present study is given in Table 1. The population of horseshoe crab along the

West Bengal coast (Canning and Digha) comprised only *Carcinoscorpius rotundicauda* (Latreille) in the mangrove swampy areas. In Orissa (Kirtania, Balramgari, Paradeep, Khairnasi and Gopalpur), the population of the horseshoe crab showed only the presence of *Tachypleus gigas* (Müller).

Table 1. Average percentage of the horseshoe crab collected during March 1996 to February 1997

Area surveyed	Species	New moon phase (%)	Full moon phase (%)
West Bengal			
Canning	<i>C. rotundicauda</i>	15.0	9.0
Digha	<i>C. rotundicauda</i>	–	4.5
Orissa			
Kirtania	<i>T. gigas</i>	–	4.5
Balramgari	<i>T. gigas</i>	34.0	38.6
Paradeep	<i>T. gigas</i>	11.3	9.0
Khairnasi	<i>T. gigas</i>	–	4.5
Gopalpur	<i>T. gigas</i>	–	4.5
Hukitola	<i>T. gigas</i>	2.2	27.2
	<i>C. rotundicauda</i>	4.5	38.6

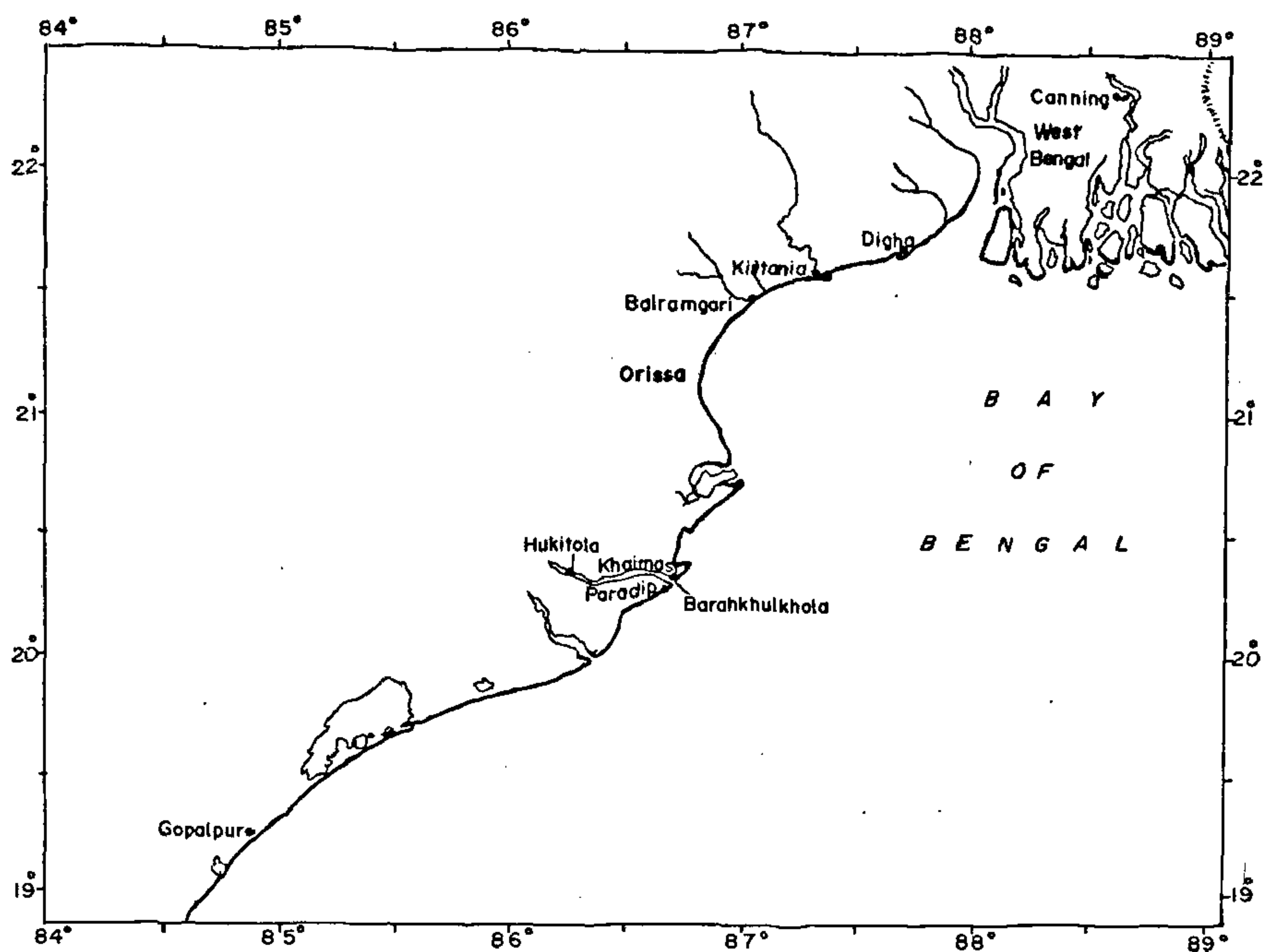


Figure 1. Map showing areas where surveys were conducted.

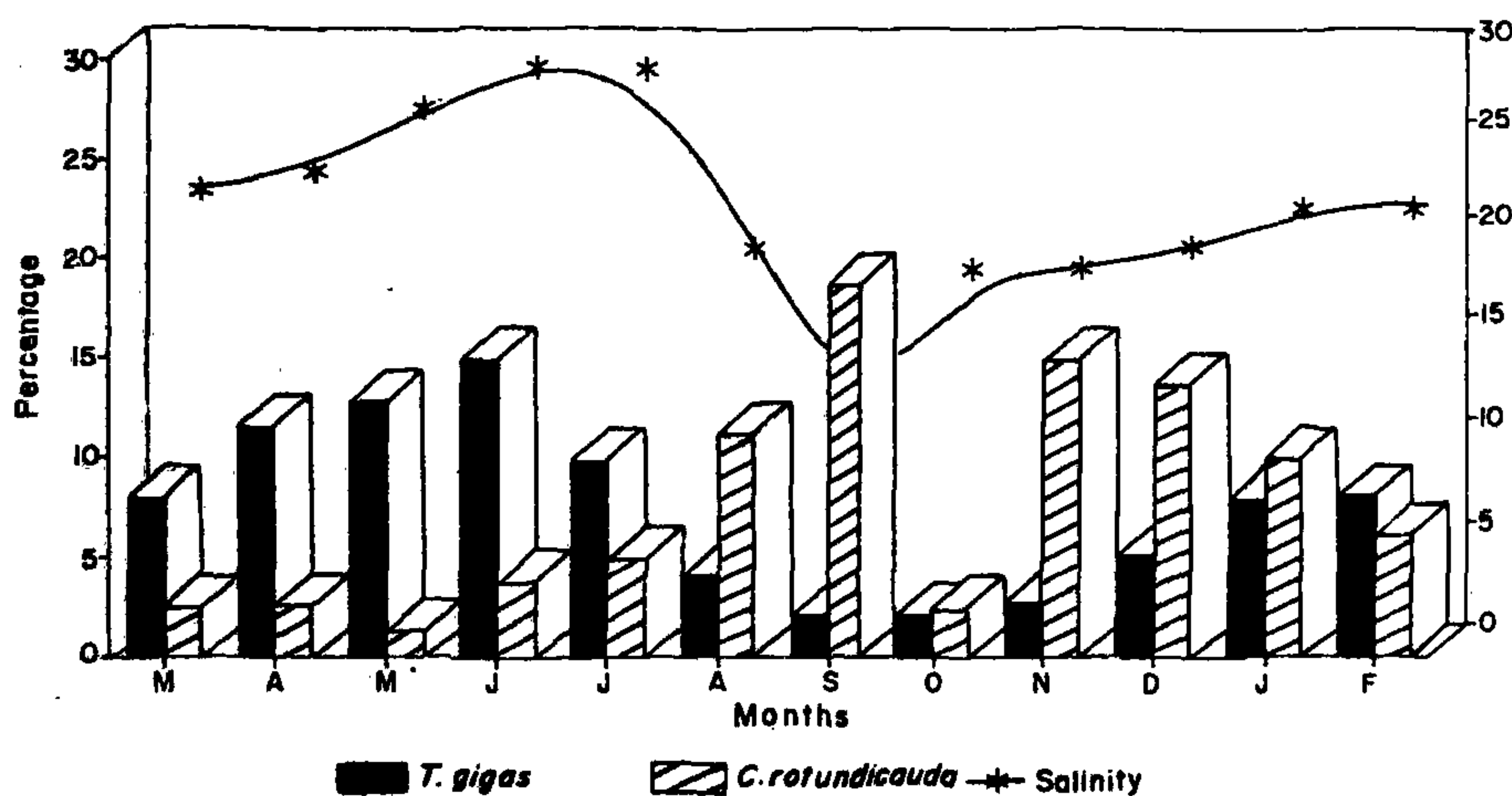


Figure 2. Seasonal abundance of two species of the horseshoe crab along the coast of Orissa.

This species was found breeding actively on relatively clean and sandy beaches. The other species (*C. rotundicauda*) was not reported in these areas.

However, during the survey in the Barahkhulkhola estuary at Hukitola, specimens of *T. gigas* were collected from the sandy beach at the mouth of the estuary whereas in the mangrove

areas of the same estuary, the specimens of *C. rotundicauda* were found. During March 1996 to early July 1996, a maximum population of *T. gigas* was found in coincidence with high saline condition ( $P < 0.001$ ). The population of *C. rotundicauda* was very low during the corresponding period in Barahkhulkhola estuary. Similarly, dur-

ing the monsoon season (June–September), when the salinity decreased considerably, the population of *C. rotundicauda* was high ( $P < 0.001$ ). Whereas the population density of *T. gigas* was very low (Figure 2). Maximum percentage of *T. gigas* (15.1) was recorded in June 1996 when the salinity of the area was 28 psu. Similarly, maximum percentage of *C. rotundicauda* (18.7) was recorded in September 1996 when the salinity was 10 psu (Figure 2).

Previous records on the distribution of horseshoe crab showed that the occurrence of their population strictly followed the unispecies pattern and coexistence was not reported<sup>6</sup>. The occurrence of different species at different places could be due to habitat preference as displayed by *T. gigas* and *C. rotundicauda*. The present result shows that in Barahkhulkhola estuary both the species are found sympatrically. The sympatric distribution of both the species is not only the first record but also gives an important clue to evolution of these two species of horseshoe crab from the same evolutionary tree.

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