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SPAWNING PERIODICITY ; LARVAL ABUNDANCE, GROWTH RATE AND SURVIVAL OF *MUGIL CEPHALUS L* (*MUGILIFORMES; MUGILIDAE*) IN THE BOLGODA LAGOON

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Abstract

Mugil cephalus spawns twice a year in the Southwestern Coastal waters of Sri Lanka. Its fingerlings are available in the Bolgoda Lagoon from *ca* December to *ca* January and from *ca* May to June. The survival rate of *M. cephalus* in this lagoon is about 82%. The growth rate is about 2 cm per month. The length of the commercially exploited fish range from *ca* 12 to 24 cm with mean age of about 8 months.

Introduction

A well established prawn and finfish fishery exists in the Panadura-Bologoda Lagoon system (Fig. 1). *Penaeus monodon, P. indicus, Metapenaeus ensis* and *M. dobsoni* are the most commonly occuring species of penaeid prawns, while *Tilapia mossambica, Etroplus suratensis. Caran melampygus* and *Mugil cephalus* are the most commonly occurring finfishes.

M. cephalus is one of the most popular species of brackish water food fish in Sri Lanka. Its annual production is about 3 metric tons or *ca* 20% of the total shellfish and finfish production in this lagoon system. It is caught primarily using encircling nets, with a mesh size of 2 cm. Frequently, fingerlings and juveniles of *M. cephalus* enter fish ponds, ditches, creeks, channels and abandonee paddy fields which are abutting the lagoon system.

The food and feeding habits, chemical composition and growth rate of *M. cephalus* under different salinity conditions have been studied (De Silva and Perera, 1976 ; Perera, 1978). *M. cephalus* is cultivated in most parts of the world. However, no attempts have been made to cultivate this fish in Sri Lanka as yet due to the paucity of biological information on it.

Hence, the objective of the present study was to determine the spawning periodicity of *M. cephalus* in the Coastal waters; its larval abundance, juvenile growth rate and mortality in the Panadura-Bolgoda lagoon system.

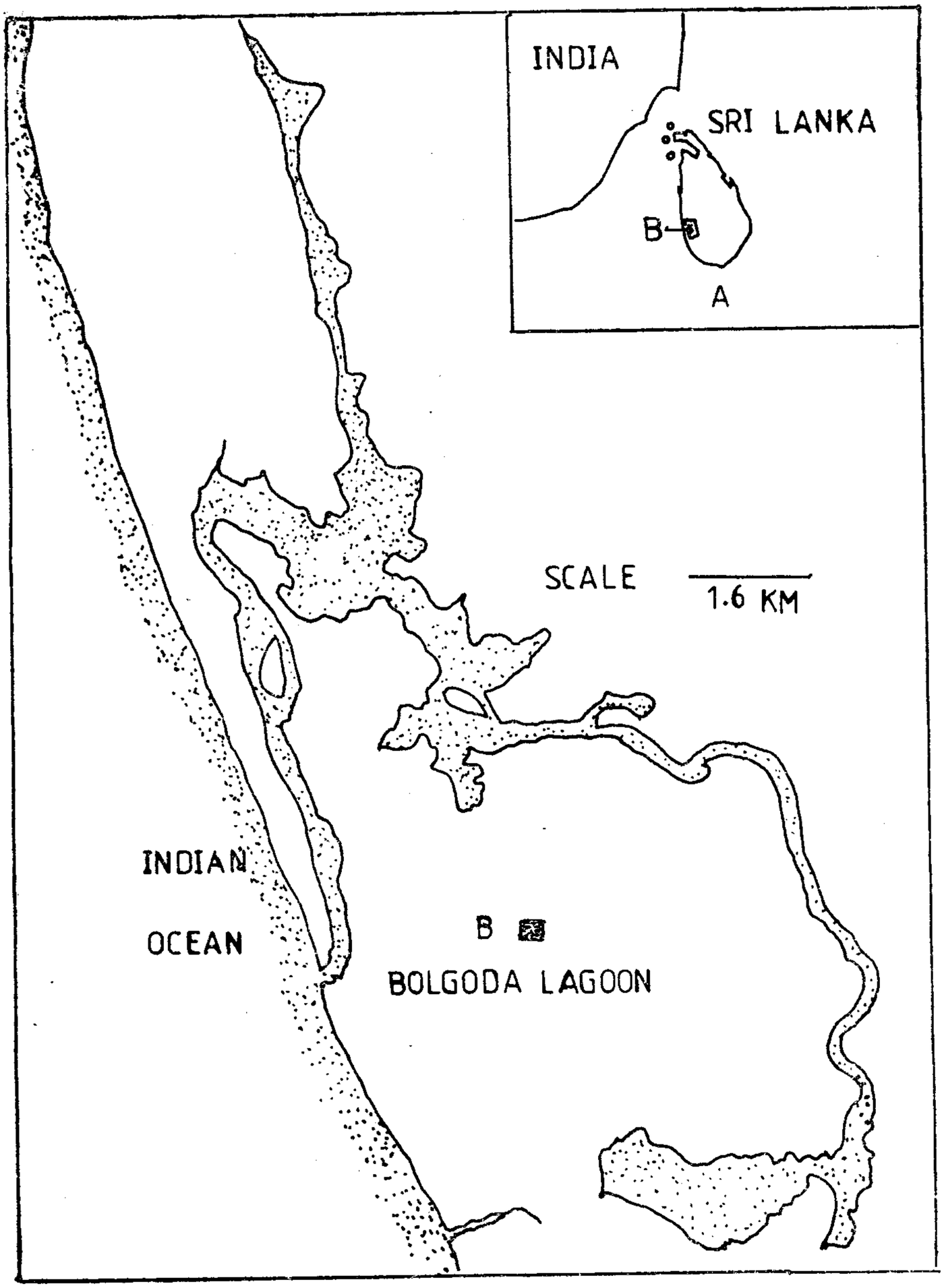

Figure 1. Bolgoda-Panadura Logoon System, A. pstition of the lagoon system in Sri Lanka, B. Lagoon system with its branches. (1) Panadura Ganga, (2) Weras Ganga, (3) Northern Bolgoda Lake, (4) Bolgoda Ganga, (5 Southern Bolgoda Ganga, (6) Daltara, the main fish landing center.

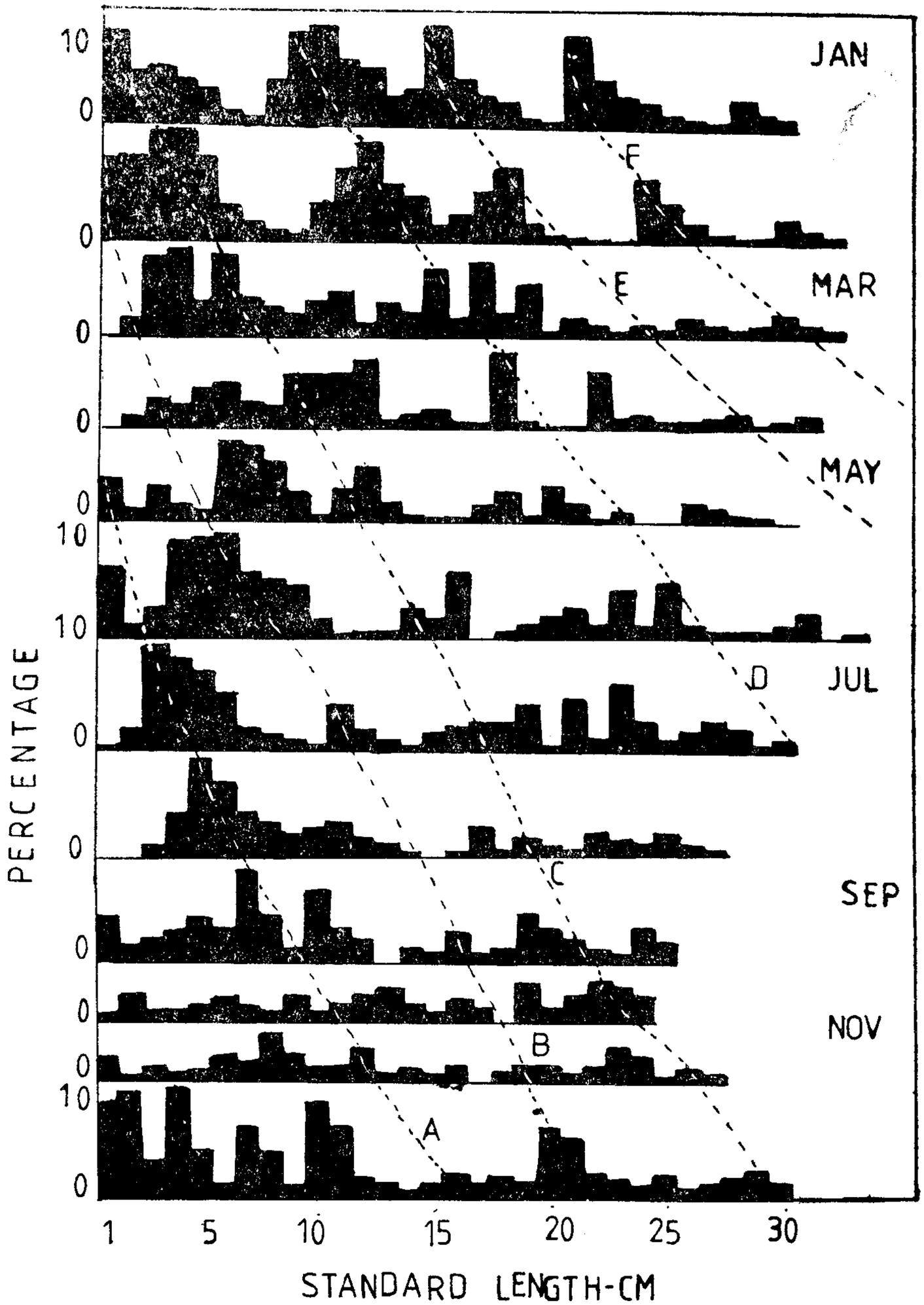

Figure 2. Percentage length frequency distribution of *M. cephalus*, stratified according to months.

Materials and Methods

Fish caught from the lagoon using encircling nets are auctioned at the fish landing center at Deltara, South western province. In 1981, fish caught in encircling nets were sampled fortnightly. On each sampling day, a random sample of about 75 fish from the total catch was taken, and their standard length were measured. The total number of fish measured each month was used to compute the percentage length frequency diagrams. The progress of the modes (Fig. 2, A, B, C, D and E) and their corresponding modal lengths and the number of fish in each of the modes were traced from the inception of a mode until its dissappearance. The modal length for each month was used to estimate the growth rate according to Nakamura (1969) and mortality according to Gulland (1975).

Results and Discussion

The percentage length frequency diagrams stratified according to months indicated that the fish caught ranged from *ca* 1 cm to *ca* 31 cm, with a clear polymodal distribution of five modes formed at 1 cm, 10 cm, 15 cm, 21 cm, and 28 cm respectively. A shift in the modes were also seen from the left to the right from any one given month to the succeeding month. For example, in January the mode at 1 cm had shifted over a period of 12 months to its right in December forming a mode at 28 cm. Similar shifts have been observed from mode one to mode five.

The progress of the first three modes in the above manner demonstrates the pattern of growth of *C. cephalus*. A growth rate of about 23 cm within one year (Fig. 3) (L—24 cm.) which is relatively very high when compared to a growth rate of 15—18 cm obtained for fish cultured in ponds. The high growth rate may be attributed to freely available food prevalent under natural envioronmental conditions in the lagoon.

The total mortality coefficient (Natural and Fishing) of *M. cephalus* could be calculated according to Gulland (1975) as follows :

$$\frac{N_2}{N_1} = S \; ; \quad S = e^{-z\,(t2-t1)},$$

Where, N_1 = the number of fish alive at year or month one (at the begining)

N_2 = the number alive after a year or a month later (from the same batch).

S = survival rate.

$t_2 - t_1$ = time interval.

Z = total mortality coefficient.

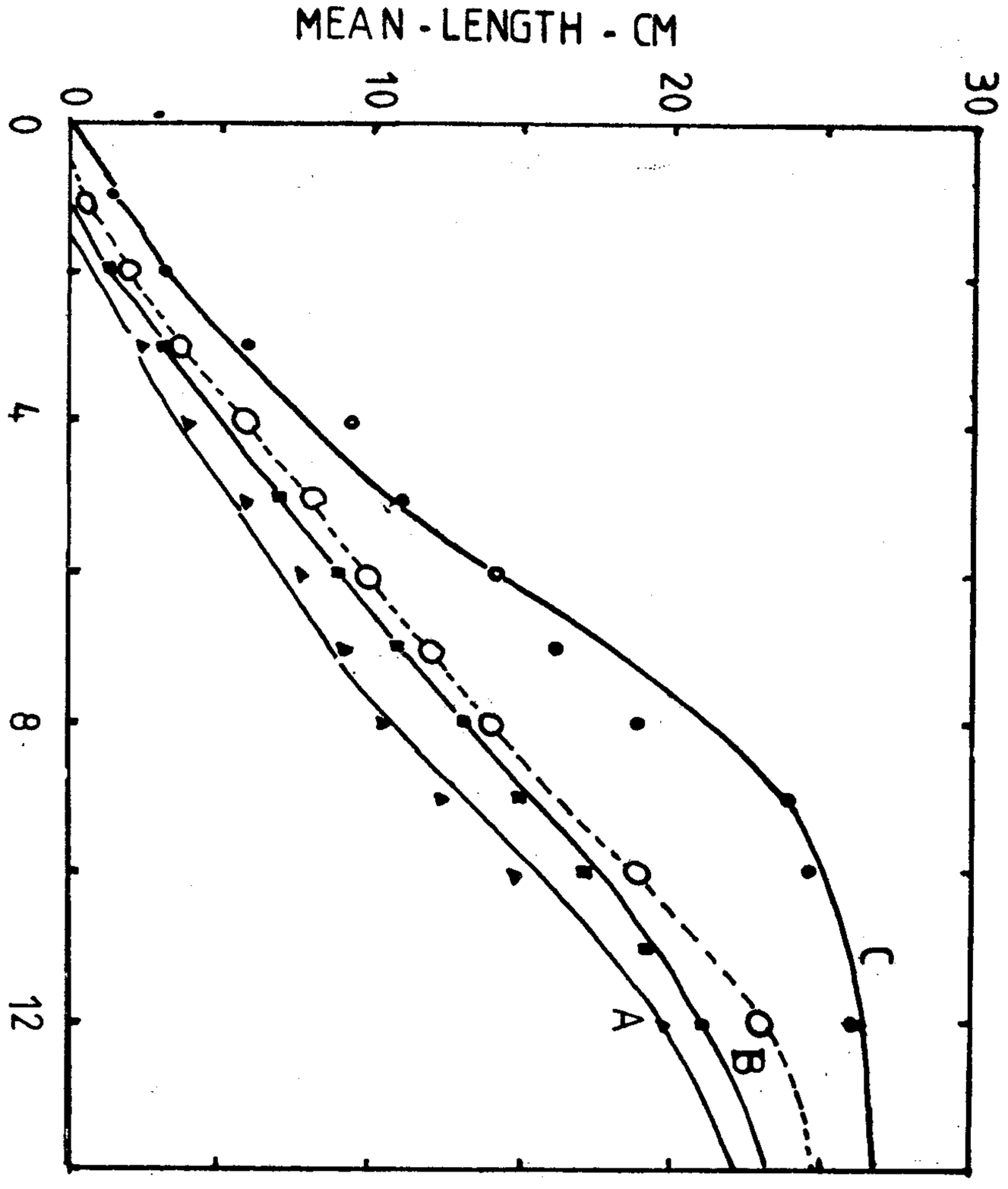

Figure 3. The distribution of mean length of *M. cephalus* according to months (mean lenghts were obtained from A, B, C etc of Fig. 2).

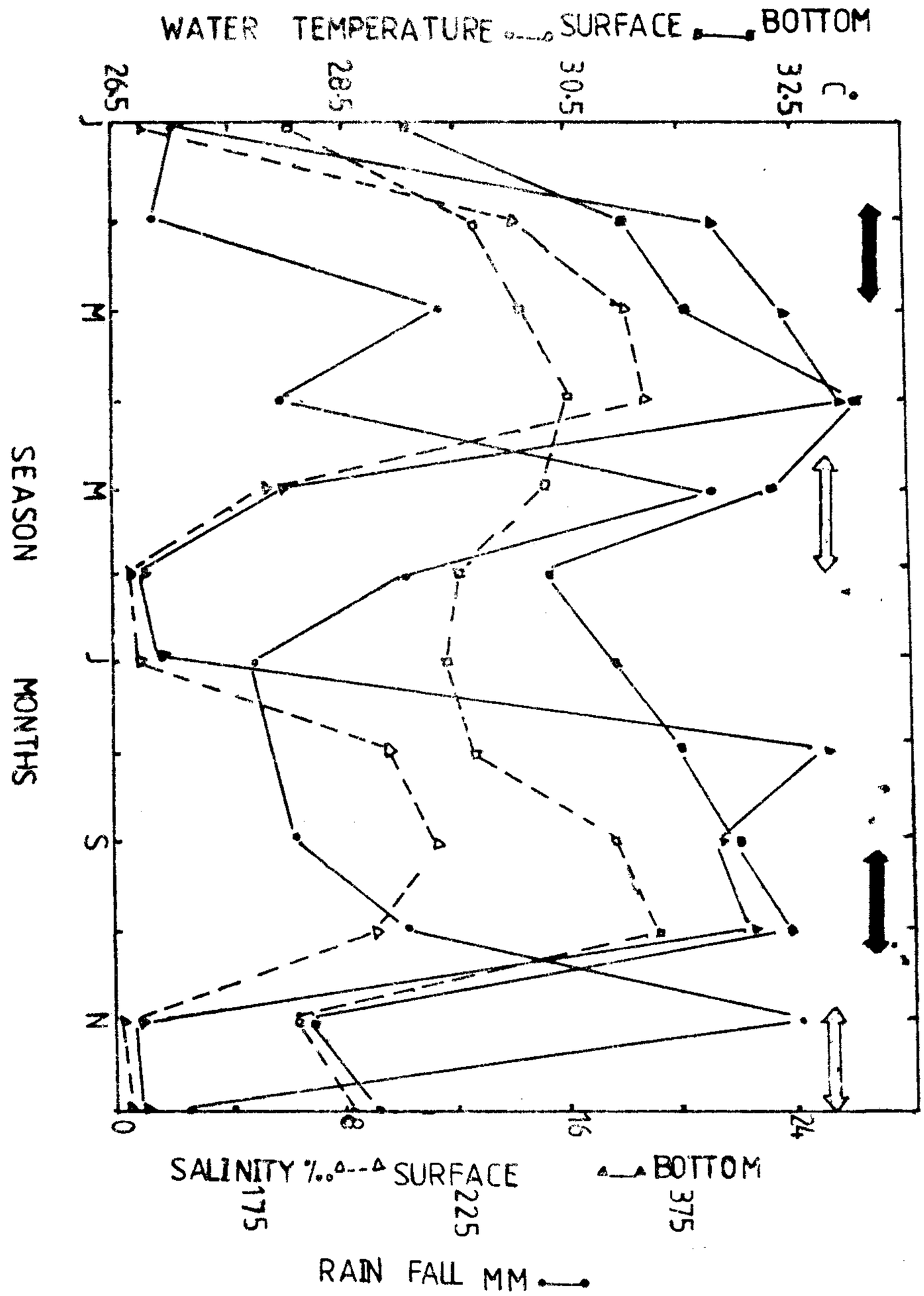

Figure 4. The distribution of salinity, temperature of the fishing area and the rainfall of the region (solid double arrow indicates the spawning season and the black double arrow indicates the period of larval abundance).

Using the above formular, monthly survival rates were calculated for the five modes (Fig. 3). The results indicated an average survival rate of 0.82 (82%), which is very high when compared to that of most other marine species of fish. A survival rate > 1 in come months may be attributed to: (i) sampling error and (ii) immigration from elsewhere. In the lagoon, which is a nursery ground for most species of brackish water fish (Gross, 1975) *M. cephalus* could have such a high survival rate as the fish are generally protected from predators that are relatively fewer in numbers than in the sea. Furthermore, hydro-biological conditions in the lagoon are more favourable for the survival of larvae and post-larvae.

The total mortality coefficient calculated is 0.18. The fingerlings are mostly abundant in the lagoon from December to January and May to which coincides with the period with low salinity associated with heavy rainfall (Fig. 4). Therefore, the spawning periods of *M. cephalus* could be just before the rainy season that range from about September to October and from February to March. During these periods. the salinity of the lagoon is high compared to the rest of the year. Therefore, *M. cephalus* could easily adapt themselves to proceed to the sea for spawning.

Conclusions

The percentage length frequency distributions could be used to estimate the average age and growth rate of *M. cephalus*. The results show that the age of the commercially exploited *M. cephalus* from the lagoon range from *ca* one month to *ca* 14 months. Their growth rate in the lagoon is about 2 cm per month, with a mean of *ca* 23 cm for year and with a very high survival rate of about 0.82 (Table 1) (82%). The fingerlings are available in the lagoon twice a year, which indicates that *M. cephalus* spawns twice a year.

TABLE 1

Calculated survival rate of *M. cephalus* in the Bolgoda logoon system

Month	*Mode according to Figure 2*				
	1	2	3	4	5
Jan./Feb.	—	—	0.72	0.87	0.764
Feb./Mar.	—	0.27	0.50	0.85	0.153
Mar./Apr.	—	1.00	0.75	1.00	0.990
Apr./May.	2.00	1.66	0.66	4.00	—
May./June.	2.50	0.80	0.25	—	—
Jun./July.	3.26	0.25	2.00	—	—
Jul./Aug.	0.812	0.33	0.50	—	—
Aug./Sep.	0.615	0.33	2.00	—	—
Sep./Oct.	0.25	0.50	1.50	—	—
Oct./Nov.	1.75	0.10	0.33	—	—
Nov./Dec.	0.57	2.50	2.00	—	—
Mean	1.47	0.64	0.95	0.84	0.63
Grand Mean		0.82			

modes either not formed or disappeared.

Acknowledgments

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