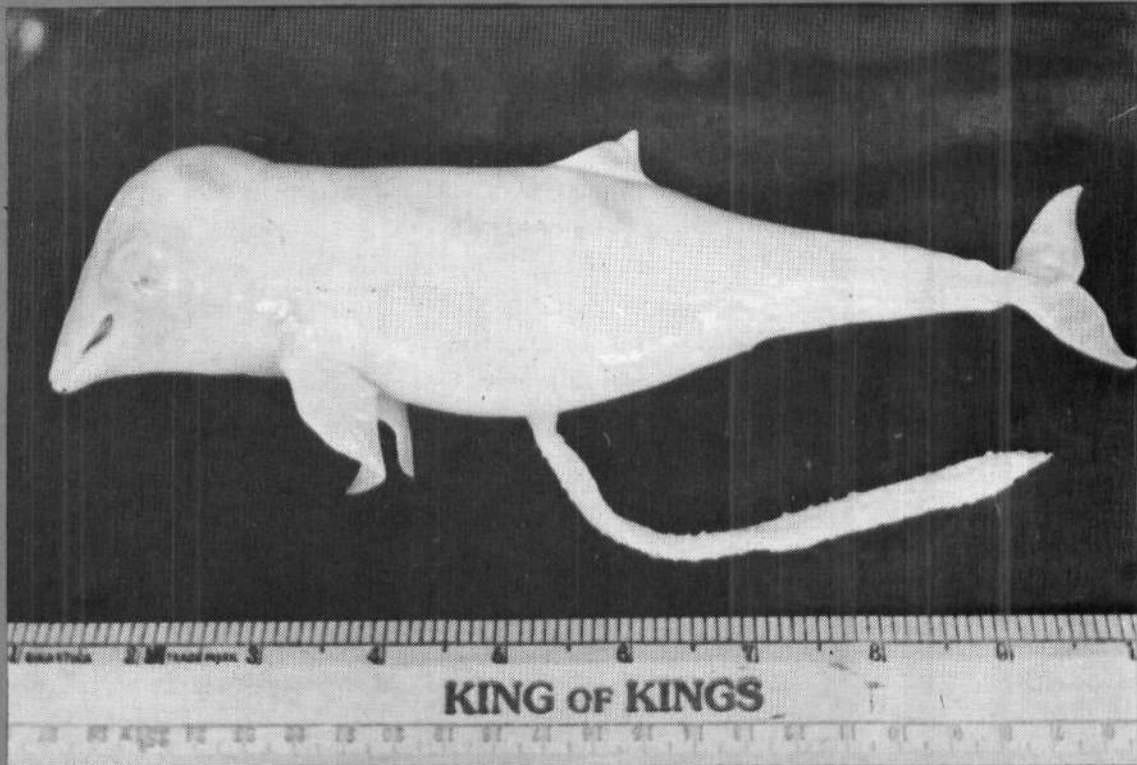




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भारतीय कृषि अनुसंधान परिषद  
INDIAN COUNCIL OF AGRICULTURAL RESEARCH

# FISHERY AND RESOURCE CHARACTERISTICS OF MACKEREL OF VISAKHAPATNAM COAST

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## Introduction

Mackerel in recent years accounted for 1-3% of the total marine fish landings in Andhra Pradesh. It occurred in two broad regions: one along the coastal stretch of Visakhapatnam and East & West Godavari districts, and another along the districts of Guntur, Prakasam and Nellore. Mackerel landings of the East Godavari alone formed about 45% of the state's mackerel catch, and that of the Guntur-Prakasam districts accounted for another 45%. Visakhapatnam area contributed to about 3% of the state's mackerel landings. This account deals with some aspects of the fishery and resource characteristics of the Indian mackerel, *Rastrelliger kanagurta*, based on observations made at Visakhapatnam from 1989-90 to 1993-94\*.

## Mackerel landings

The annual mackerel landings ranged between 71 and 153 t with the average at 107 t. The bulk of this catch came from the drift gillnet (56%) followed by shrimp trawl (38%), sardine gillnet (4%) and boat seine (2%). Their respective catch per net (cpue) with their ranges and averages were : 1.3-9.3 (3.7) kg; 0.6-4.5 (1.9) kg; 0.6-3.1 (1.1) kg; and 0.5-2.1 (0.9) kg. The percentage composition of mackerel (range and average) in the total fish landings for the above four gears were respectively 24-66% (48%); 0.03-1.6% (0.7%); 2.4-15.0% (4.3%) and 0.5-5.3% (2.7%). The lowest composition of mackerel in shrimp trawl was due to the high catch per net of a variety of demersal and a few groups of pelagic fishes caught in this gear compared with any single fishing unit in the artisanal fishing sector. Mackerel formed about 13% of the total fish catch landed by the artisanal sector. Thus, drift gillnet and shrimp trawl are the two principal gears landing mackerel in this area, and the former could be regarded as the standard (effective) gear for catching mackerel, as at many localities along the Indian coast.

Although a variety of fishes were captured by the drift gillnet, mackerel (24-66%), carangids (19-27%) and seerfishes (8-18%) formed the bulk of its catch accounting for 65-80% of the total fish caught. The other groups met with in the landings of this gear were tuna, bullseye, croakers, wolf herrings, Indian drift fish, perches, catfishes, pomfrets and others. While the operational depth of this gear as well as that of the other artisanal gears extends upto 40 m depth, that of the shrimp trawl extends up to 60-80 m, and rarely upto 100m.

## Fishery season

Fishery season for mackerel started in December-January lasting till March-May. Very good catches were obtained during January, February and May during the present observations. However, mackerel occurred in spurts during the other months also, though not consistently every year, contributing to very good catches. In the present study 57% of the annual catch was obtained in a five month period from January to May; and another 14% during June-July (Fig. 1). Catch, effort and catch per net (cpue) for mackerel in the two major gears namely drift gillnet and shrimp trawl are depicted in Figs. 2 & 3 respectively. It was observed that whenever the monthly cpue was high in shrimp trawl, it was generally low in drift gillnet and vice-versa, indicating frequent movement of mackerel between nearshore and further deeper waters.

## Sex ratio and size at first maturity

In the drift gillnet and shrimp trawl where the occurrence of adult mackerel was high, the sex ratio of adult fish varied in certain months. But the annual sex ratios showed no significant difference statistically. The size at first maturity of *R. kanagurta* has been estimated as 195-199 mm size group since 50% of fish examined in this size were mature, having gonads in maturity stages III and above including those

\* A second species of mackerel, *R. faughni*, was observed occasionally in the artisanal fish landings. It occurred during March-June and September-November over the period of this study and accounted for 0.02-3.0% of the annual mackerel landings. Both older juveniles and adults in advanced stages of maturity were encountered.

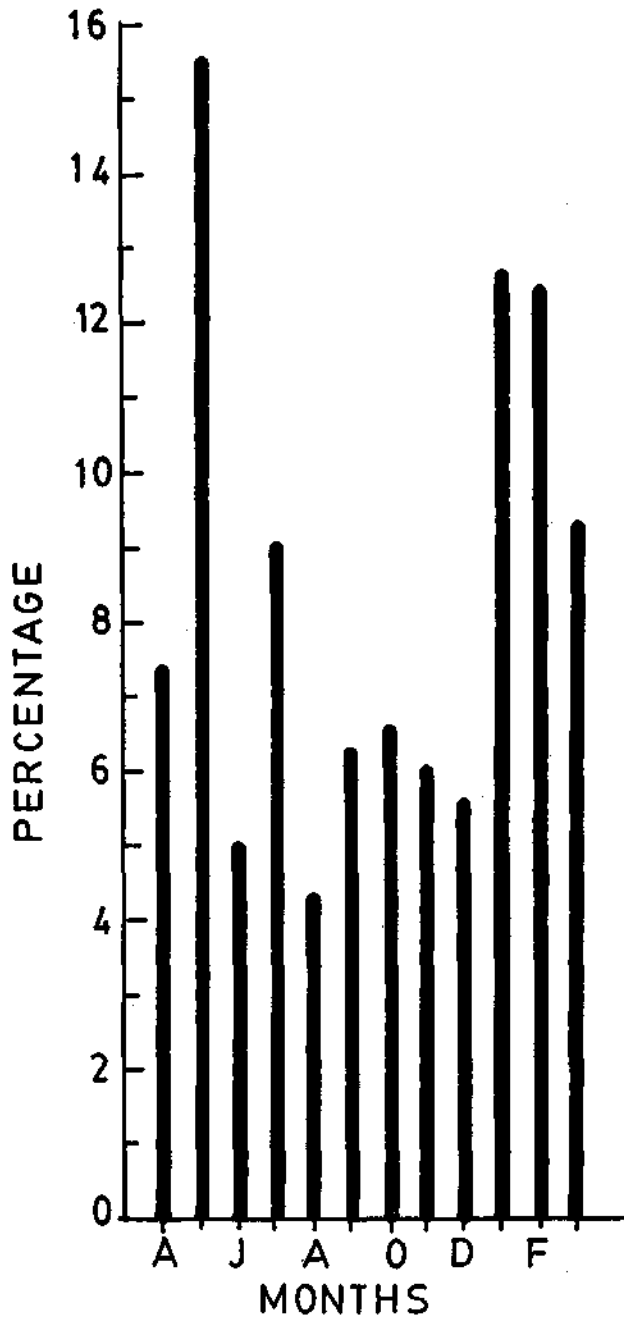


Fig. 1. Trends in the total monthly mackerel (*R. kanagurta*) landings by all gears over the period of study at Visakhapatnam.

in spent-resting stage. The percentage of such fish steeply increased from this size group onwards.

**Seasonal distribution of fish in different maturity stages, and spawning season**

Over the period of study, fish with gonads in resting state (maturity stage II b) and in partially

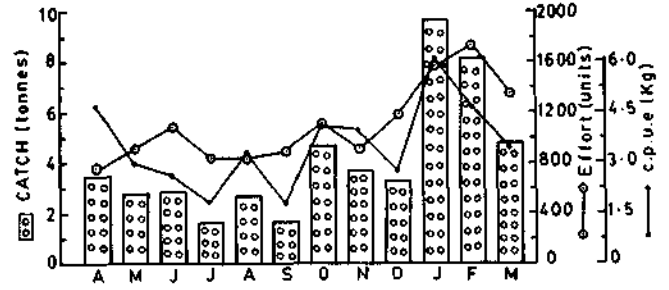


Fig. 2. Monthly variations in the catch, effort and catch per net (cpue) for mackerel, *R. kanagurta* landed by drift gillnet over the period of study at Lawsons Bay, Visakhapatnam.

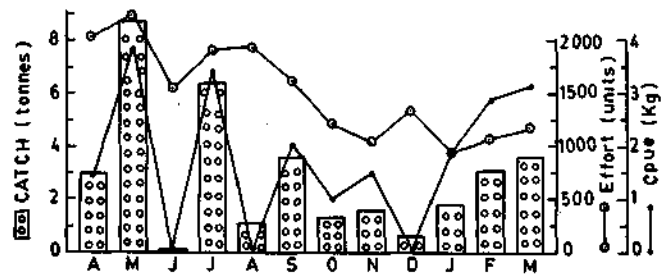


Fig. 3. Monthly variations in the catch, effort and catch per net (cpue) for mackerel, *R. kanagurta* landed by shrimp trawl over the period of study at fishing harbour, Visakhapatnam.

spent state (stage VII a) were common, each accounting for about 33% followed by fish in fully spent state (VII b) forming about 25% of the adult fish examined. Although fish in these three stages of maturity occurred almost throughout the year (Fig. 4), their periods of relative abundance were different. Fish with resting gonads were common

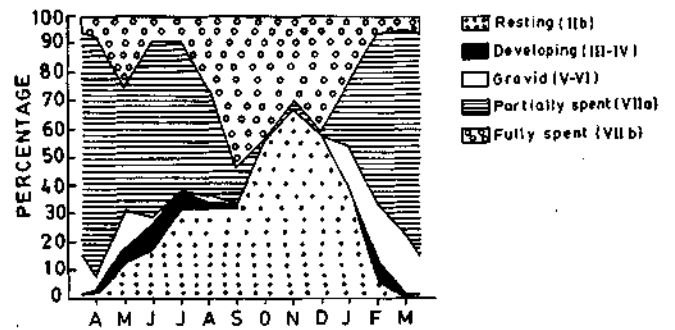


Fig. 4. Seasonal trend in the relative percentage distribution of mackerel, *R. kanagurta* in different maturity stages landed by drift gillnet over the period of study at Lawsons Bay, Visakhapatnam.

during July-January with higher abundance during October - December. They were rather rare during February-April. Fish with developing gonads (stages III-IV) accounted for only 2% of the adult fish component. Though they occurred over a long period, from February to September, their occurrence was relatively high only in February and May-July. This could indicate two periods of gonadal activity. Gravid fish (stages V-VI) also were rare in the catches with its composition as 8% of the adult fish caught over the period. Though gravid fish also occurred over a long period, from January to August, they were relatively more abundant during January-March and May. The partially spent fish (stage VII a), on the other hand, occurred almost throughout the year, with greater abundance during February-April and June-July. They were rather rare during October-December. Fish with fully spent gonads also occurred almost throughout the year, but their period of abundance was different, being May and August - January, with a peak in September. From these details it may be noted that in the inshore fishing grounds, the period October-December represents a period when (1) fish with gonads in developing, gravid and partially spent states were either scarce or absent, and (2) fish with resting gonads were quite high. These two situations when viewed together would suggest October-December as a period of low spawning and also as a period which affords favourable conditions for spent fish to recover quickly to reach the resting state. Therefore, the continued occurrence of fully spent fish during October - December may indicate that fish that have spent prior to this period may await the favourable period of October-December to recover and to reach the resting state (IIb).

Considering the combined seasonal abundance of fish in advanced stages of gonadal maturity (stages V-VII b), February - June emerges as the major spawning period, followed by a shorter minor peak period during August-September for the mackerel, *R. kanagurta* of Visakhapatnam area, and October-December comes out as the period of low spawning activity (Fig.5).

It is of interest to note that the period of high spawning activity (February-June) on the one hand, and the period of high spent recovering activity as well as the low spawning activity (October - December) on the other for mackerel (*R. kanagurta*) of Visakhapatnam area coincide re-



Fig. 5. Variations in the monthly relative percentage distribution of gonads in advanced stages of maturity (stages V-VII b combined) over the period of study to show the seasonal trend in the spawning activity of mackerel, *R. kanagurta* off Visakhapatnam.

spectively with the periods of upwelling and sinking phenomena that are known to take place along this part of the east coast (Bhavanarayana, P.V. 1970: *Prof. P.N. Ganapatt Shas. Comm. Vol. p.30*).

#### Length distribution

The size of *R. kanagurta* observed in the regular commercial fish landings ranged between 50-54 mm and 265-269 mm size groups. The total length range and the dominant size, as well as the proportion of adult fish in the catches of the four gears mentioned previously are given below.

Gear	Length range (mm)	Dominant size (mm)	% of fish in dominant size range	% of adult fish
Drift gillnet	120-265	200-245	94.4	97.5
Shrimp trawl	65-250	170-225	82.8	67.2
Sardine gillnet	90-215	130-195	92.6	7.4
Boat seine	50-220	110-165	63.6	2.9

From the foregoing table it may be seen that while adult fish formed bulk of the mackerel catches in drift gillnet and shrimp trawl, only juvenile fish accounted for the bulk of the mackerel catches in sardine gillnet and boat seine. The length distribution of the mackerel in the above four gears over the period of study are given in Fig. 6. Stray samples of mackerel collected from shore seine landings were in the size range of 35-135 mm with dominant modal sizes at 55 mm and 105 mm in March '92, at 90

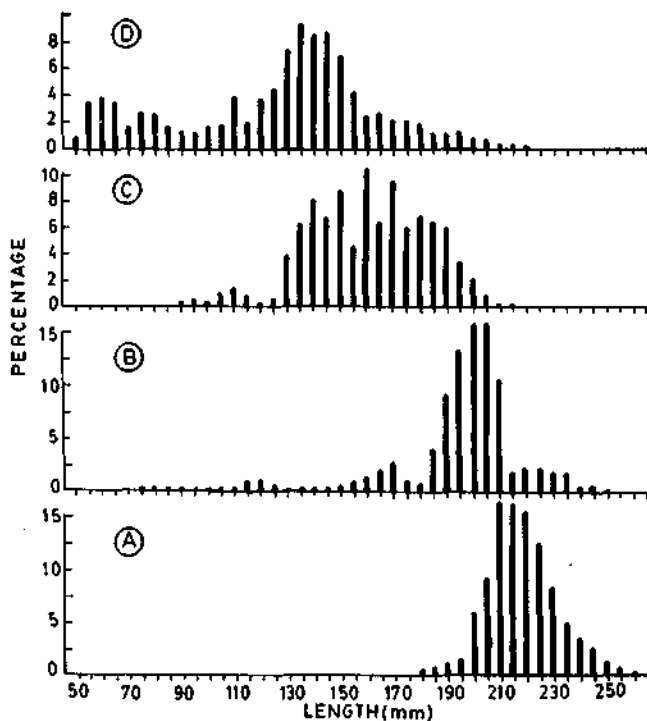


Fig. 6. Distribution of various size groups of mackerel, *R. kanagurta* (total length, mm) landed by different gears at Visakhapatnam over the period of study: (a) drift gillnet, (b) shrimp trawl, (c) sardine gillnet and (d) boat seine.

mm and 110 mm in May '93, and at 50 mm and 65 mm in March '94.

From the length distribution of fish caught in boat seine (a non-selective gear), it may be seen that fish of 50-90 mm size form the dominant group of youngest fish in the landings indicating that *R. kanagurta* is recruited to the fishery at this size. Fish with modal length within this size range was observed during March-May and October - December. (This confirms that mackerel has two spawning periods in a year). Medium sized fish of 100-190 mm was common in the catches of boat seine and sardine gillnet mainly during April-August and October-December. Though adult fish (from 195-199 mm size group onwards) was available throughout the year they formed dominant component of the catches during October-May.

### Growth

As the bulk of the regular fortnightly fish samples for biological studies came mainly from

drift gillnet landings comprising large sized fish, the length data as and when available from other gears namely, shrimp trawl, sardine gillnet, boat seine and shore seine were supplemented to the regular length data to understand the growth in length of mackerel, *R. kanagurta* from the shifting of their modal lengths. Average lengths of fish for different ages (in months) estimated from the modal progression analysis, as well as the calculated lengths obtained employing the Von Bertalanffy Growth Function (VBGF) are given below. The curve for growth in length based on the VBGF is given in Fig. 7.

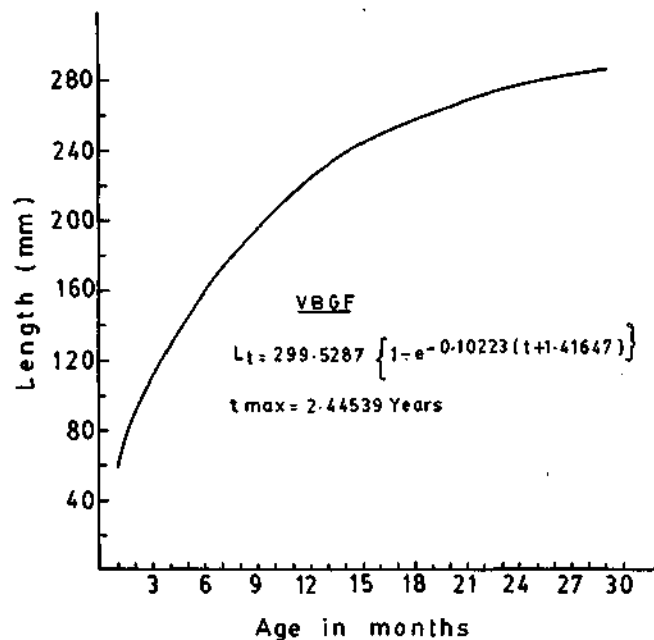


Fig. 7. Von Bertalanffy Growth Curve (growth in length) for mackerel, *R. Kanagurta*, of Visakhapatnam area.

Month	Average empirical total length (mm)	Calculated total length (mm) using VBGF
3	108	108.8
6	159	159.2
9	197	196.3
12	225	223.5
15	243	243.6

From the present study the effective life-span of the mackerel, *R. kanagurta* of this area has been estimated as 2.45 years.

For selected lengths (mm) of *R. kanagurta* in

\*  $\log W = -5.6817 + 3.3066 \log L$  ( $r = 0.99$ ), where  $W$  = total weight of fish and  $L$  = total length of fish.

fresh condition the respective estimated weights in g (given in brackets) based on the length - weight relation obtained\* are as follows: 9(6.0), 10(8.5), 11 (11.7), 12(15.6), 13(20.3) 14(26.0), 15(32.6), 16(40.4), 17 (49.4), 18(59.6), 19(71.3), 20 (84.5), 21(99.3), 22(115.8), 23(134.1), 24(154.4), 25(176.7), and 26 (201.2).

#### **General remarks**

The salient fishery and biological features of the mackerel, *R. kanagurta* of the Visakhapatnam area may be stated as follows.

Mackerel is recruited to the fishery at the age of 1-2 months twice in a year during March-May and October - December. But adult fish of 9-15 months of age form the bulk of its landings, being contributed mainly by drift gillnet and shrimp trawl. These catches are supplemented by relatively smaller quantities of juvenile fish of 3-9 months of age captured by boat seine and sardine gillnet. January-May generally represents the season when bulk of mackerel landings take place. In the beginning of this period fish in spent-

resting state followed by fish with partially spent, fully spent and gravid gonads in that order occur in the catches. But during February - April period mackerel with partially spent gonads dominate in the landings. Gravid fish also makes significant appearance during this period, though with low relative abundance. The partially spent fish however, continue to be well represented in the catches till July. Thus, the partially spent fish mainly supports the mackerel fishery of Visakhapatnam area. During the off season of the fishery (August-December) adult fish with fully spent and spent-resting gonads, as well as young and medium sized fish occur in the catches. The spent resting fish, however, are dominant during October-December, which also forms the period of low spawning activity. Coincidence of the last mentioned period, October-December, with the sinking phenomenon and that of the main fishery season as well as the main spawning season (February-June) with the period of upwelling that are known to take place off Visakhapatnam is quite interesting, and requires further intensive studies.