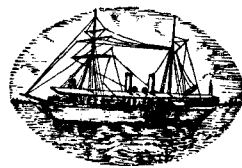
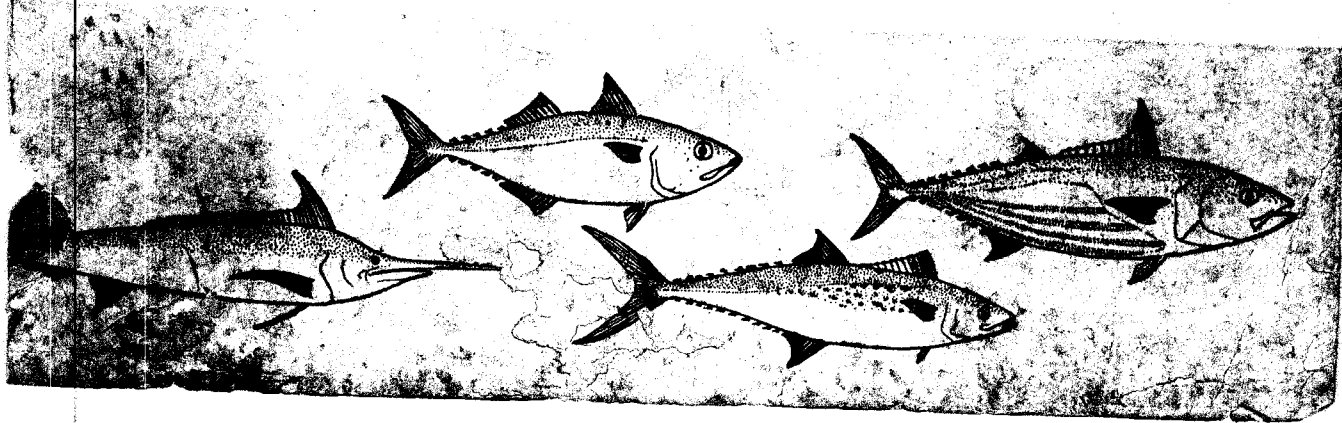


SYMPOSIUM ON
SCOMBROID FISHES

PART I



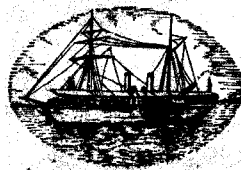
MARINE BIOLOGICAL ASSOCIATION OF INDIA
MANDAPAM CAMP
S. INDIA



PROCEEDINGS OF THE
SYMPOSIUM
ON
SCOMBROID FISHES

HELD AT MANDAPAM CAMP FROM JAN. 12—15, 1962

PART I



SYMPOSIUM SERIES I
MARINE BIOLOGICAL ASSOCIATION OF INDIA
MANDAPAM CAMP
S. INDIA

MACKEREL FROM THE ANDAMAN SEA

BY

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INTRODUCTION

The study of the mackerel (Genus *Rastrelliger* Jordan and Starks) of the Andaman Sea is of special interest in as much as it covers an area adjacent to the Indonesian waters from where as recently as 1951 de Beaufort recognised three species of mackerel, the validity of one of which is open to question. Fishery workers in India have hitherto recognized only a single species of mackerel, *Restrelliger kanagurta* (Cuvier) from Indian coastal waters and in this connection also the Andaman Sea presents an interesting area for study. In the course of a number of collections from there by members of this Institute including the authors in 1960-61, it has been possible to obtain material of two distinct species of mackerel, sufficient to enable drawing up a detailed comparison. It should be mentioned here that sporadic observations on the morphometric and meristic characters of *R. kanagurta* made by different authors from various parts of the Indo-Pacific do not indicate marked deviations of any specific nature in character from place to place. Unfortunately, upto now no attempt has been made to re-describe the typical *R. kanagurta*. *Scomber kanagurta* Cuvier is based on Russell's brief description and drawing of *kanagurta* (vernacular name) a fish from the Vizagapatnam coast north of Madras. However, Cuvier (1831) has also given a description of *R. kanagurta* based on material from Pondicherry about 100 miles south of Madras. As will be discussed later on, our examination of a small sample of *R. kanagurta* from Madras indicates differences between it and the Andaman material of the same species and it is felt that eventual analysis may show that they may belong to different populations. Thus it will be seen that the study of the Andaman mackerel is also closely linked with our having some idea of their congeners from different parts of their distributional ranges. Hence before comparing the two species from Andaman Sea, a resume of previous work on mackerel from this area is given below.

HISTORICAL RESUME

Day (1870) described *Scomber reani* as new from the Andamans and the species was characterised as:

“B.vi; D.6 I 1/12/V. P.19; V.1/5; A. 1/11; C.19; Vert. 9/22.

Length of head $\frac{1}{4}$, of caudal $\frac{1}{5}$, height of body $\frac{1}{4}$ of total length. Eyes with wide adipose margins. Diameter $\frac{2}{7}$ of length of head, 1 diameter from end of snout, $1\frac{1}{2}$ diameters apart. The maxilla extends to opposite the posterior margin of the orbit, snout pointed; opercles scaly. Fins: A groove along the base of the first dorsal fin, extending halfway to the base of the second dorsal. Caudal deeply forked, a keel along either side of its base. Airbladder present. Caeca pylori numerous. Colours: Back bluish green, becoming silvery white along the abdomen. A darkish longitudinal band along the lateral line, three above it and two yellow ones below it.” Habitat: “Andamans, where it is very common upto 12 inches in length. Said to refuse all bait.”

The depth of the body in relation to total length, the pointed nature of the snout, and the colouration suggest that the species is conspecific with *R. kanagurta*, a reasoning which Day himself had arrived at, at a later date (1878) when he synonymised *S. reani* with

S. microlepidotus (= *R. kanagurta*). The only other species of mackerel that Day (1870) reported from Andamans was *Scomber kanagurta* Cuvier and Valenciennes, but in the absence of a description it is hardly possible to refer this to anything other than *R. kanagurta* (Cuvier) itself. Day (1878, pl. liv, fig.5) has given the figure of a 12-inch specimen of *Scomber microlepidotus* which has the same body-form as *R. kanagurta*, the body being less deeper in both the forms.

Herre (1941) recorded three species of mackerel from the Andaman waters, namely, *Scomber microlepidotus* Rüppell; *Restrelliger brachysoma* (Bleeker) and *R. kanagurta* (Rüppell). Of these, as mentioned elsewhere (Jones, Silas and Dawson, 1960), *S. microlepidotus* and *R. kanagurta*, are conspecific, leaving two species of mackerel, *R. kanagurta* and *R. brachysoma* as being known from the Andaman Sea.

**SCOMBER NEGLECTUS VAN KAMPEN, A SYNONYM OF SCOMBER
BRACHYSOMA BLEEKER**

De Beaufort (1951) recognised *Rastrelliger neglectus* (van Kampen) along with *R. brachysoma* and *R. kanagurta*, distinguishing the three species as follows:

- (a) Height 2.79. Head as long as high.....*R. brachysoma*
- (b) Height 3.1—3.4. Head as long as high.....*R. neglectus*
- (c) Height 3.4—3.8. Head longer than high.....*R. kanagurta*

His description of *R. brachysoma* is made after the "type and single specimen known, long 120 mm without caudal", and he has corrected Bleeker's description by drawing attention to the fact that the type specimen has 6 dorsal and 6 anal finlets instead of 5 each as mentioned by Bleeker. However, we do not agree with de Beaufort in his action of relegating *R. brachysoma* Day (*nec* Bleeker as he calls it) to the synonymy of *R. neglectus*, for the following reasons:

(1) Day gives the depth of body of this species he described from Andamans as $3\frac{1}{2}$ in length. This falls within the expected range for *R. brachysoma* in our collection.

(2) Day's remark that the posterior margin of the spinous dorsal of this species is black is a very conspicuous feature which cannot be missed when specimens of *R. kanagurta* and *R. brachysoma* are compared. The outer margin of the first dorsal is only lightly dusky in the former.

(3) We feel that the action of van Kampen in naming a second species from the Java Sea as *S. neglectus* was unwarranted as the name *S. brachysoma* was already available for the deep bodied form occurring there. The argument put forward by de Beaufort is that "Van Kampen (l.c.) pointed out, that the two common species of *Restrelliger* in the Java Sea have been confused by Bleeker and others. The species which Bleeker called *loo* C.V., is the same as that of the French authors, but it is a synonym of *kanagurta* C.V. This species therefore has to be called *kanagurta*. The other species is mentioned by Bleeker and others as *kanagurta*, and had therefore to be renamed. Van Kampen called it *neglectus*".

(4) *R. neglectus* was also recognised by Delsman and Hardenberg (1934) and as de Beaufort remarks, the basis for this was that "Generally the species called *neglectus* by Van Kampen is mentioned as *brachysoma* Blkr., but last named species is probably different (see above), being still deeper". It should be remembered that *Scomber brachysoma* was described from a single specimen by Bleeker and this and the inadequate description may be responsible for some of the subsequent workers failing to recognise this species from Indonesian waters, although definitely a deep bodied form occurs there.

(5) Another point mentioned by de Beaufort needing comment is that "Many authors record 44-45 gill rakers on the lower branch of the first arch, which fact suggest that there are still other species, or perhaps races of one and the same species, not yet described. The two species differ in that *kanagurta* is more slender than *neglectus*. Delsman and Hardenberg also mention a difference in the gill rakers. They find only 20 rakers on the lower branch of the first arch in *kanagurta*, and about 30 in *neglectus*, which difference they attribute to the different mode of life of the two species; *kanagurta* being a open sea form, feeding on the coarse pelagic plankton, the other a coastal form, feeding on the finer neretic plankton." With the earlier part of the statement regarding the number of gill rakers of the two species, we are not in agreement with Delsman and Hardenberg for the simple reason that we feel that the full complement of gill rakers on the lower limb of the outer arch for both the species has not been counted. The figure given by Delsman and Hardenberg clearly shows that the last raker on the lower limb of both the species is more than half the length of the longest raker. In reality this may not be the case, for the examination of our material shows that the last raker is hardly 1/4 the length of the longest gill raker and certain amount of care has to be used for removing the branchial arch intact or else one is liable to miss the first few rakers of the upper limb (which likewise are also minute) and the last few rakers on the lower limb. This we feel is the main reason for the very low counts of 'about 20' and 'about 30' counts for *kanagurta* and the so-called *neglectus* respectively given by Delsman and Hardenberg.

However, we agree with these authors that the structure of the gill rakers is different in the deep bodied and the narrow bodied species, but in the absence of comparative data on the mode of feeding and the food of the deep bodied species it is not possible to adduce reasons here. To say that *kanagurta* is an open sea form feeding on 'coarse pelagic plankton' and so has lesser number of rakers when compared to the second species will need substantiation with more data on the habits of these species. Although *kanagurta* occurs regularly in the inshore waters along our coast, it could perhaps be considered a more open sea form as it has a wider spatial distribution as compared with the deep bodied form which we consider as *brachysoma*.

It is our contention that only two species of mackerel occur in Indonesian waters as well, one the narrow bodied form, *R. kanagurta* and the second, the deep bodied form, *R. brachysoma*, which name has priority over *S. neglectus* Van Kampen. Manacop (1958) has described *R. brachysoma*, from Philippine waters, and has also given details of morphometric and meristic data for *R. chrysozonus* (= *R. kanagurta*). It is likely that in both these species infra-specific variations depending on the geographical locations of the occurrence of the species may occur. However, work is yet to be carried out in this direction.

MACKEREL-LIKE FISHES OCCURRING IN THE ANDAMAN SEA

Fraser-Brunner (1950) recognises two species of chub mackerels, *Scomber scombrus* Linnaeus and *S. japonicus* Houttuyn relegating *S. australisicus* Cuvier, and *S. janeseba* Bleeker to the synonymy of the latter. We are in full agreement with de Beaufort when he says that "We are greatly in need of a revision of the Indo-Pacific species of *Scomber* and for that of the whole genus too, but this can only be done at the hand of a very large material, and on a statistical basis". Until such time we shall recognise *S. japonicus* as the species occurring in the Indian Ocean. Fraser-Brunner (1950) mentions Seychelles, Gulf of Aden, Red Sea, Muscat and Madras, as localities from the Indian Ocean from where material of this species was available to him for examination. The range of the species clearly indicates the likelihood of its occurrence in the Andaman Sea.

A second mackerel-like fish needing mention is the double-lined mackerel *Grammat-
orcynus bicarinatus* (Quoy and Gaimard). We have obtained several specimens of this species
from Andamans. The genus as pointed out by Kishinouye (1923) is more akin to the true
Scombrinae than, to the Thunninae, Gasterochismatinae, and Scomberomorinae, all sub-
families of the family Scombridae (Jones and Silas 1960).

KEY TO THE IDENTIFICATION OF MACKEREL AND MACKEREL-LIKE FISHES
FROM THE ANDAMAN SEA

- 1a. Side of body with a second decurved lateral line commencing from a point above
mid-length of pectoral and travelling along the lower half of the abdomen to the
caudal keel where it becomes confluent with the main lateral line ; gill rakers
on lower limb of outer gill arch generally not exceeding 16
 ...*Grammatorcynus bicarinatus* (Quoy and Gaimard)
- 1b. Side of body with a single lateral line ; gill rakers on lower limb of outer gill
arch exceeding 20.....2
- 2a. Vomer and palatine toothed ; an osseous and moderately stiff anal spine present
 ...*Scomber japonicus* Houttuyn
- 2b. Vomer and palatine edentulous ; osseous stiff anal spine absent.....3
- 3a. Greatest height of body 23% to 27% of fork length ; length of head distinctly
more than greatest depth of body, being 26.1% to 29.1% in fork length ;
snout pointed, anterior margin of first dorsal dusky ; scales behind pectoral
deciduous, getting easily detached when handled ; dark stripes or rows of dusky
spots along upper half of body more distinctly seen in areas where scales have
fallen off
 ...*R. kanagurta* (Cuvier)
- 3b. Greatest height of body 28.6% to 34% of fork length ; length of head distinctly
shorter than greatest depth of body, being 25.6% to 28.7% in fork length ;
snout short and bluntly rounded ; outer margin of first dorsal conspicuously
black, scales on body non-deciduous and not easily detachable when handled,
no dark stripes or regular rows of dusky spots along upper half of body.
 ...*R. brachysoma* (Bleeker).

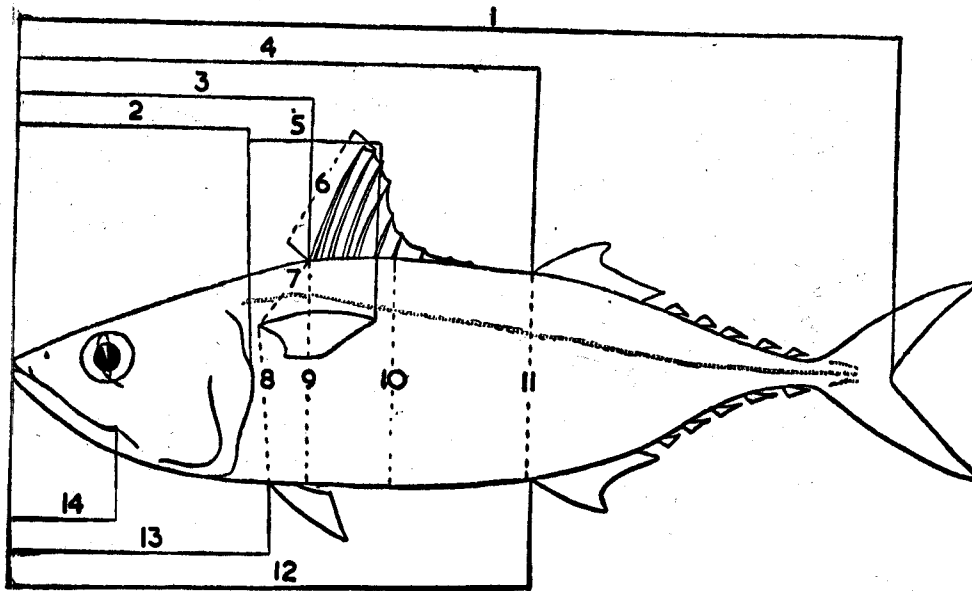
COMPARISON BETWEEN *R. KANAGURTA* AND *R. BRACHYSOMA* FROM THE
ANDAMAN SEA

MATERIAL AND METHODS

This preliminary study is based on 31 specimens of *R. kanagurta*, 126 mm. to 278
mm. in fork length, and 36 specimens of *R. brachysoma*, 137 mm. to 221 mm. in fork length,
all collected at Port Blair, Andamans.

In text fig. 1, the methods used for taking morphometric measurements are indi-
cated. For additional details for taking morphometric measurements and meristic counts
in mackerel and other scombroid fishes, reference is invited to Jones and Silas, (1960).

We have been able to examine one specimen of *R. kanagurta* from South African
waters and seven specimens of the same species from East African waters, and relevant
observations on these specimens are also included. In general body form, some of the
abnormal specimens of *R. kanagurta* collected by us along the Indian Coast show some
similarity to *R. brachysoma* from Andaman waters, which could lead to confusion in
identity. A few typical conditions observed by us are dealt with here.



Text Fig. 1.—Schematic drawing of mackerel showing methodology used in taking body measurements. (No. 5 should be measured from the upper point of origin of the pectoral as given for Nos. 7 and 8).

BODY SHAPE

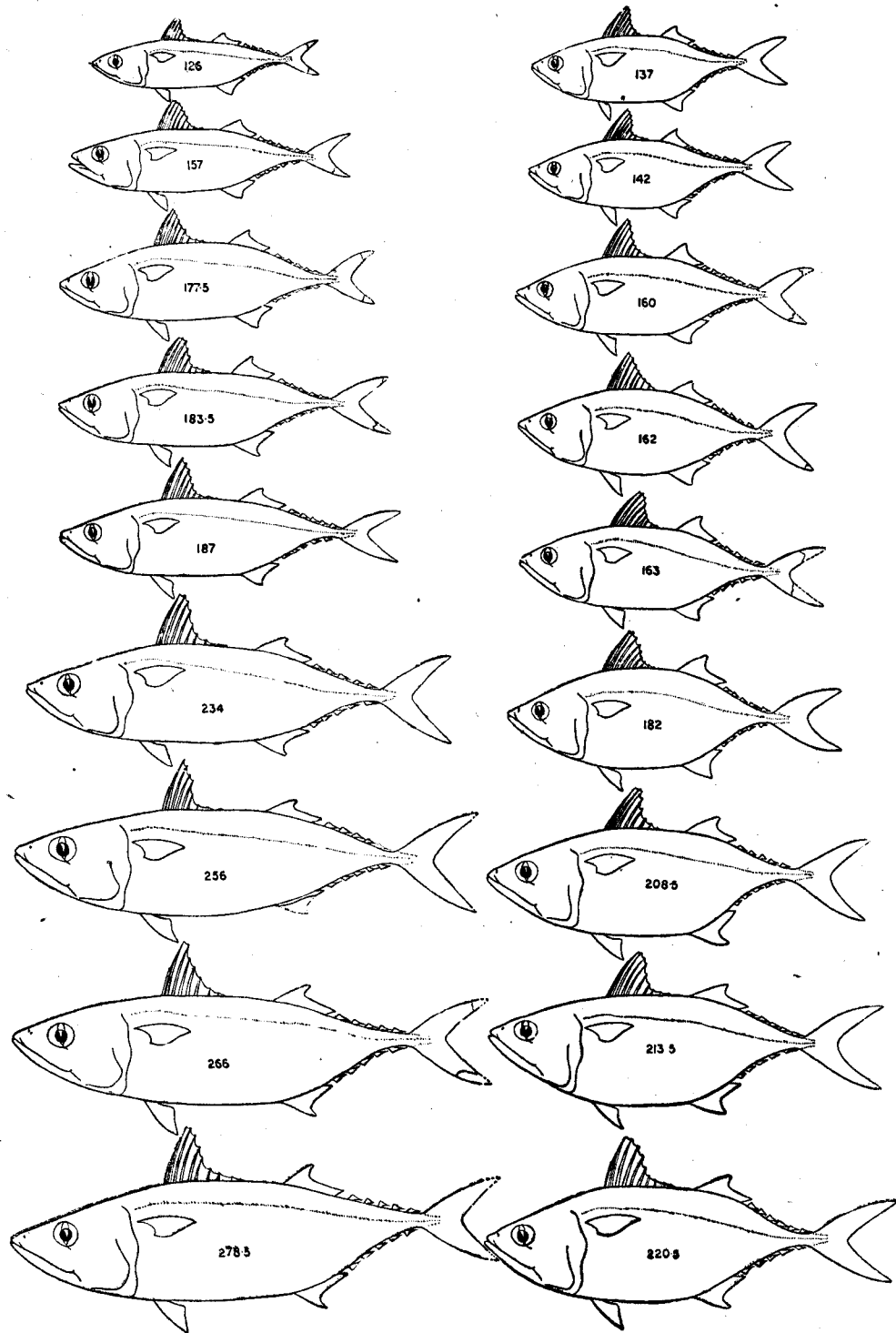
In text fig. 2 outline drawings of graded series of specimens of *R. kanagurta*, 126 mm. to 278.5 mm., and *R. brachysoma* 137 mm. to 220.5 mm. from Andaman waters are given side by side to show the difference in body profile. The deeper body of *R. brachysoma* as a consistent character is seen in all sizes, and is markedly pronounced in the larger specimens. In *R. kanagurta* the depth of the body is shorter, giving the body a spindle-shaped appearance. These may be compared with the outline drawings of some of the abnormal specimens of *R. kanagurta* (text figs. 8 and 9) given later on, as well as with text fig. 10 showing outline drawings of specimens of *R. kanagurta* from East and South African waters.

Manacop's (1958) figures of juvenile *R. brachysoma* and *R. chrysozonus* (= *R. kanagurta*) indicate that some of the adult differences are well established even in early juveniles. Thus his drawings of a 54 mm. and a 48 mm. (fork length) specimen each of *R. brachysoma* and *R. chrysozonus* respectively show that in the former, the greatest depth of the body, the anterior height of the dorsal, and the length of the pectoral are relatively greater than in the latter. The body is more or less cylindrical in the early juveniles of *R. chrysozonus*, while the curved ventral profile is clear in *R. brachysoma*.

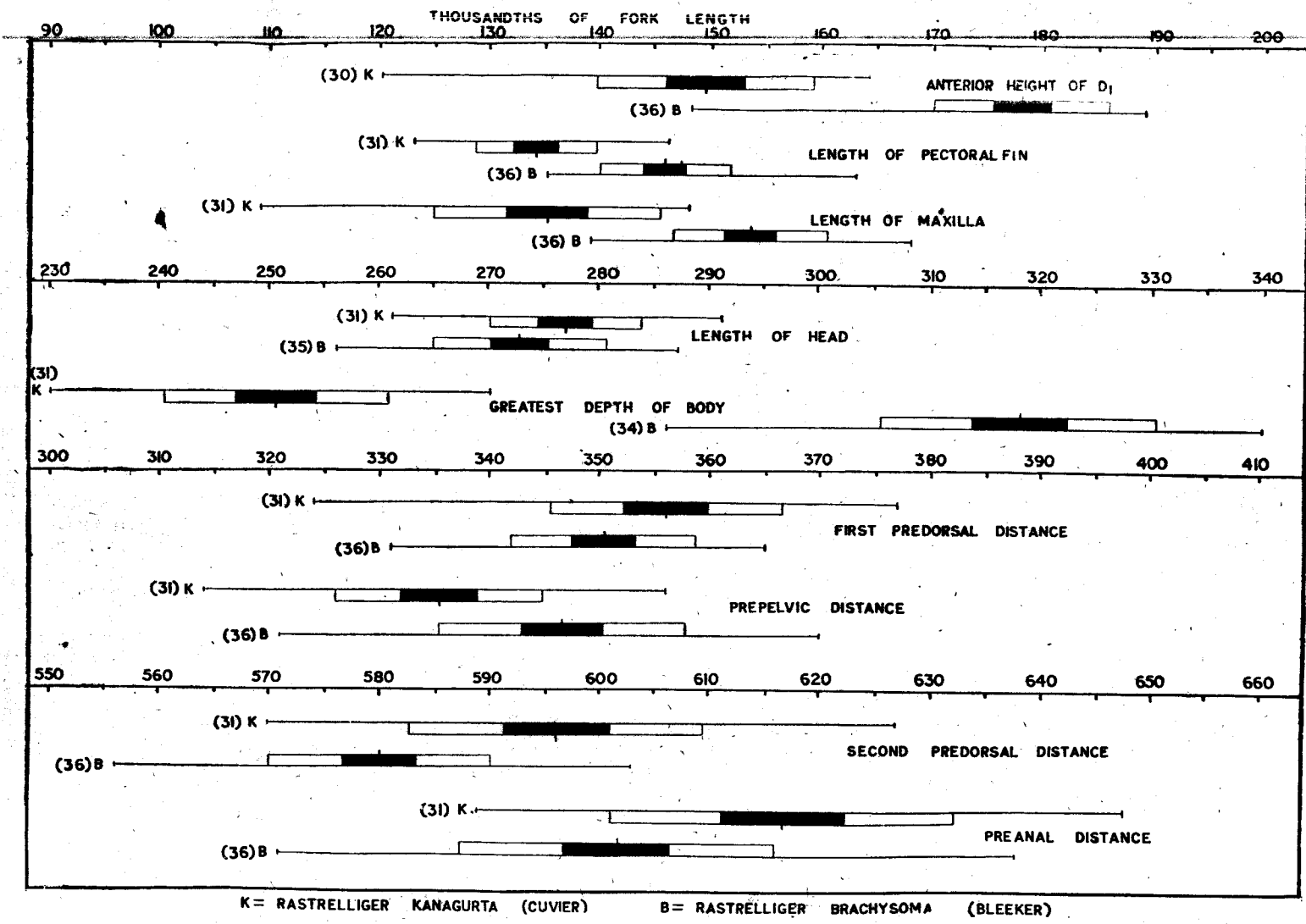
BODY PROPORTIONS

In specimens of both the species, the percentages of intergradation and divergence have been calculated for nine characters (Table I: A, B and C). It will be seen that in the following characters, namely, second predorsal distance; length of the pectoral fin; anterior height of first dorsal fin; and the length of the maxilla, divergence to the magnitude of 75% or more is seen. In the greatest depth of the body there is no overlap, giving 100% divergence. The data for the nine characters are graphically represented in text figure 4.

As will be seen from Table II, in the nine characters chosen, the difference between *R. brachysoma* and *R. kanagurta* from Andaman waters is statistically significant at the 5% level.



Text Fig. 2.—Outline drawings of graded series of specimens of *Rastrelliger kاناşurta* (Cuvier) and *R. brachysoma* (Bleeker) from Andaman Sea showing the characteristic profile and body shape of the two species at different sizes. The numbers given on the body represent fork length of the respective specimens in mm.



Text Fig. 4.—Graph showing variations in 9 characters in two samples of *R. kanagurta* and *R. brachysoma* from Andaman Sea. (The horizontal line represents the total range; the short vertical line the mean; the solid rectangle two standard errors on each side of the mean and the hollow rectangle one standard deviation on each side of the mean). The number of specimens in each sample is given in parenthesis.

TABLE I

Divergence and intergradation levels in species of *Rastrelliger* from Andaman Sea

A

Character	Head length/Fork length						1st predorsal distance/F.L.						Prepelvic distance/F.L.											
	250	260	270	280	290	Number of specimens	220	230	240	250	260	270	Number of specimens	310	320	330	340	350	360	370	Number of specimens			
Class intervals (in thousandths of F.L.)	259	269	279	289	299		229	239	249	259	269	279		319	329	339	349	359	369	379				
Frequency :																								
<i>R. kanagurta</i>	...	...	4	16	9	2	31	1	1	4	14	8	3	31	2	6	11	9	3	...	...	31
<i>R. brachysoma</i>	...	2	9	17	2	...	35	...	3	16	9	8	...	36	...	1	12	6	14	2	1	36		
Divergence-Intergradation levels	Intergradation Divergence						Intergradation Divergence						Intergradation Divergence											
	...						41% 59%						32% 68%						31% 69%					

B

Character	2nd predorsal distance/F.L.						Preanal distance/F.L.						Length of P ₁ /F.L.												
	550	560	570	580	590	600	610	620	Number of specimens	570	580	590	600	610	620	630	640	Number of specimens	120	130	140	150	160	Number of specimens	
Class intervals (in thousandths of F.L.)	559	569	579	589	599	609	619	629		579	589	599	609	619	629	639	649		129	139	149	159	169		
Frequency :																									
<i>R. kanagurta</i>	3	8	5	10	4	1	31	...	1	3	6	8	6	5	2	31	8	17	6	31
<i>R. brachysoma</i>	...	1	5	11	14	3	2	36	1	8	5	9	10	2	1	...	36	...	7	21	7	...	36
Divergence-Intergradation levels	Intergradation Divergence						Intergradation Divergence						Intergradation Divergence												
	...						25% 75%						33% 57%						19% 81%						

TABLE I—(contd.)

C

Character	Greatest depth of body/F.L.														Anterior height of first dorsal/F.L.						Length of maxilla/F.L.								
Class intervals (in thousandths of F.L.)	230	240	250	260	270	280	290	300	310	320	330	340	No. of speci- mens	120	130	140	150	160	170	180	No. of speci- mens	100	110	120	130	140	150	160	No. of speci- mens
	239	249	259	269	279	289	299	309	319	329	339	349		129	139	149	159	169	179-189		109	119	129	139	149	159	169		
Frequency :																													
<i>R. kanagurta</i> ..	3	14	8	5	1	...	...	..	..	..	..	..	31	2	2	8	15	3	...	...	30	1	1	6	11	12	...	...	31
<i>R. brachysoma</i> ...	...	...	...	...	...	2	1	5	11	8	6	1	34	...	...	1	...	4	13	18	36	...	...	...	1	10	19	6	36
Divergence—Inter- gradation levels	Intergradation Divergence												0% 100%	Intergradation Divergence						6% 94%	Intergradation Divergence						15% 85%		

TABLE II

Biometric data based on thousandths of fork length of selected morphological characters in species of *Rastrelliger* from Andaman Sea

Characters (proportions expressed in thousandths of fork length for selected characters)	<i>Rastrelliger kanagurta</i> Range 126-278 mm. in fork length					<i>Rastrelliger brachysoma</i> Range 137-221 mm. in fork length					Differences between Means	t	P	
	No.	Range	Mean	σ	σM_1	No.	Range	Mean	σ	σM_2				
	1 Head length/F.L.	...	31	261-291	276.81	6.8506	1.2304	35	256-287	272.60				7.9076	1.3366	4.21	2.3171	P at 5% level is 1.960
2 First predorsal distance/F.L.	...	31	324-377	356.06	10.5920	1.9024	36	331-3653	350.42	94.800	1.4133	5.64	2.379	
3 Prepelvic distance/F.L.	...	31	314-354	335.45	9.4393	1.6953	36	321-390	346.78	11.225	1.8708	11.33	4.4880	
4 Second predorsal distance/F.L.	...	31	570-627	596.225	13.274	2.3841	36	556-603	580.36	10.010	1.6683	15.86	5.4516	
5 Preanal distance/F.L.	...	31	589-648	616.90	15.107	2.7133	36	571-638	601.92	14.367	2.3944	14.98	4.1388	
6 Greatest depth of body/F.L.	...	31	230-270	250.45	10.198	1.8316	34	286-340	318.00	12.498	2.1434	67.55	23.9726	
7 Anterior height of first dorsal/F.L.	...	30	120-164	149.20	9.8285	1.7944	36	148-189	177.694	7.8236	1.3039	28.49	12.8463	
8 Length of maxilla/F.L.	...	31	109-148	135.064	10.344	1.8578	36	139-168	153.42	7.0143	1.1691	18.36	8.3685	
9 Length of pectoral fin/F.L.	...	31	123-146	134.00	5.4535	0.9735	36	135-163	145.67	5.9161	0.9860	11.67	8.3963	

The greatest depth of body measured for both species is generally almost midway between the origins of first and second dorsal fins. Measurements of the body at the origins of the first and second dorsals respectively, did not show any overlap in the samples of the two species examined (text-figure 5). Further, an interesting feature that may be noticed from the above figure (text-fig. 5) is that in *R. brachysoma* a distinct increase in depth of body is seen with growth, while in *R. kanagurta* the increase in the depth of the body in relation to the fork length in specimens over 150 mm. is not so apparent.

Body proportions for seven additional characters for the two species from Andaman waters are given below in Table III.

TABLE III

Character	<i>R. kanagurta</i>			<i>R. brachysoma</i>		
	No. of specimens	Range %	Mean %	No. of specimens	Range %	Mean %
Depth at D ₁ /F.L. ...	31	22.7—26.3	24.49	36	27.6—32.3	30.27
Depth at D ₂ /F.L. ...	30	22.2—26.1	23.92	35	28.0—31.7	30.36
Distance from P ₁ to D ₁ origin/F.L. ...	31	11.1—14.7	13.17	35	12.0—15.1	15.39
Distance from P ₁ to D ₂ origin/F.L. ...	31	15.1—17.8	16.94	36	18.2—21.9	20.56
Width of body at P ₁ /F.L. ...	31	10.3—15.7	14.29	36	13.0—15.9	14.06
Length of longest gill raker/F.L. ...	15	8.2—10.4	9.41	36	9.5—12.5	11.05
Length of longest gill filament/F.L. ...	15	6.2— 7.3	6.67	36	5.4— 7.5	6.31

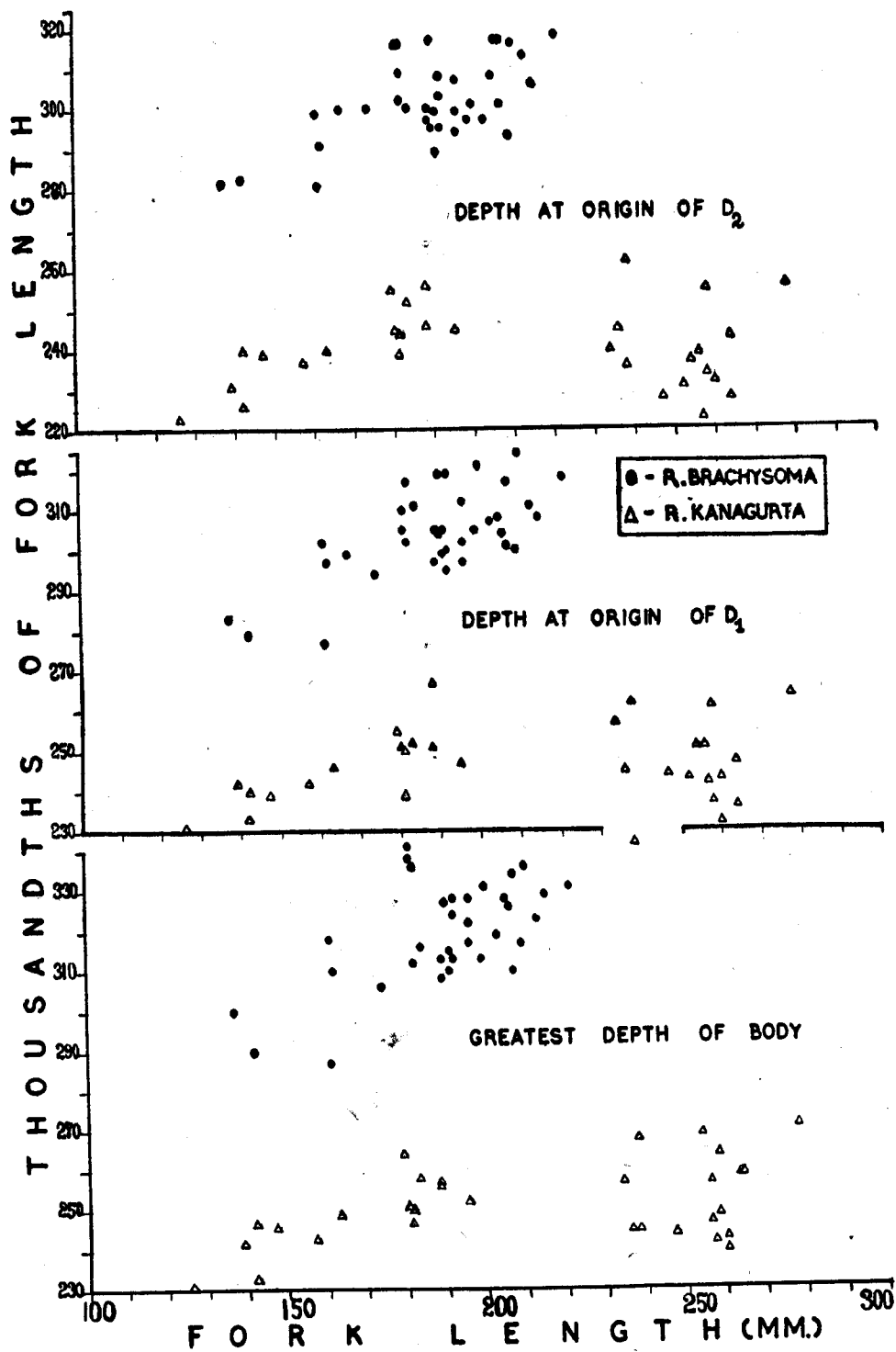
COLOURATION

The major differences in adult body colour between *R. kanagurta* and *R. brachysoma* are :

1. The upper half of the body has a series of linear blotches which are very clear in specimens of *R. kanagurta* in portions where the scales have been lost. In *R. brachysoma* such longitudinal bands are absent although stray spots may be present in the dorsal half of the body.
2. The tip and outer margin of the spinous dorsal fin are tinged light grey in *R. kanagurta*, but in *R. brachysoma* the tip and outer margin of the spinous dorsal fin are blackish.
3. The conspicuous dark spot seen below the pectoral in fresh specimens of *R. kanagurta* is very indistinct in *R. brachysoma*.
4. Sides of the body are more silvery in *R. brachysoma* than in *R. kanagurta*.

DORSAL AND ANAL FINLETS

The frequency of occurrence of the number of dorsal and anal finlets in *R. kanagurta* and *R. brachysoma* from Andaman Sea is given in Table IV. In both species, 5 dorsal and 5 anal finlets are more typical, the other combinations of 6/5 and 6/6 being exceptions.



Text Fig. 5.—Scatter diagram showing the depth of body at three points, plotted against the fork length of specimens of the species *R. kanagurta* and *R. brachysoma* from Andaman Sea.

TABLE IV
Frequency of number of dorsal and anal finlets in species of *Rastrelliger* from Andaman Sea

Number of dorsal/anal finlets	<i>Rastrelliger kanagurta</i>		<i>Rastrelliger brachysoma</i>	
	No. of specimens	Per cent	No. of specimens	Per cent
5/5	30	96.77	33	91.66
6/5	1	3.23	2	5.55
6/6	...	...	1	2.77

For Philippine waters, Manacop (1958) gives the following data (Table V).

TABLE V

No. of finlets	<i>R. brachysoma</i>		<i>R. chrysozonus</i> (<i>R. kanagurta</i>)	
	No. of specimens	Per cent	No. of specimens	Per cent
5/5	839	92.40	72	93.50
5/6	50	5.60	3	3.90
6/5	6	0.67	...	...
6/6	2	0.23	2	2.60
5/4	1	0.11	...	...
4/5	9	0.99	...	...

SEX AND MATURITY

R. kanagurta : Of 20 specimens sexed, 10 were immature, while 3 were mature males and 8 maturing females. A 23.8 cm. female was found to have small translucent ova 0.21 to 0.34 mm. in diameter, while the largest specimen in the sample, a female 27.8 cm. had opaque ripening ova 0.51 to 0.57 mm. in diameter. According to Holt (1959) these specimens fall under stage II "Mature virgins....." and stage III "Ripening" respectively.

R. brachysoma : Of 30 specimens sexed, 6 were immature, 12 were males and 12 females, the last said ranging in size from 18.4 to 22.1 cm. The 18.4 cm. specimen showed developing ova, the largest of which were 0.19 to 0.22 mm. in diameter, while the 22.1 cm. specimen had ova 0.4 to 0.51 mm. in diameter. The maturity of these two specimens corresponds to stages II and III as given by Holt (1959).

Although our observations are inadequate, a matter which needs further attention would be to check whether in Andaman waters *R. brachysoma* matures at a smaller size than *R. kanagurta*, for, from the above it would appear that the 18 to 22 cm. specimens of the former show corresponding stages of maturity as the 23 to 27.8 cm. specimens of the latter, all taken at Port Blair, Andamans, during the month of December 1961.

That *R. brachysoma* could be a distinctly smaller species is also evident from the observations of Manacop (1958). He remarks that in Philippine waters *R. brachysoma* "reaches a maximum length of 220 mm. and a weight of about 200 grams. The average size taken is about 180 mm. and the average weight 100 grams." As for *R. chrysozonus* (*R. kanagurta*),

the average size of the commercial catch is about 250 mm. (not cm.) (230 gm.) with a maximum of about 300 mm. (not cm.) (380 gm.).

GILL RAKERS

Contrary to the opinions expressed by Delsman and Hardenberg (1934), and de Beaufort (1951), we find that the gill raker counts in *R. kanagurta* and *R. brachysoma* from Andaman waters show considerable overlap. Hence, unless large series are examined, gill raker counts alone as a single character may not suffice to separate the two species. The gill raker counts on the upper and lower limbs of the outermost gill arch on the left and right sides of the specimens of each species show variations as will be seen in Tables VI A-F, VII and VIII. Maximum divergence of

Tables showing frequency distribution of the counts of gill rakers in the outer gill arch in species of *Rastrelliger* from Andaman Sea

TABLE VI-A

Species	No. of specimens	No. of gill rakers on upper limb of left side				
		17	18	19	20	21
<i>R. kanagurta</i>	31	2	9	14	4	2
<i>R. brachysoma</i>	36	1	14	16	4	1
Intergradation 45%			Divergence 55%			

TABLE VI-B

Species	No. of specimens	No. of gill rakers on upper limb of right side					
		17	18	19	20	21	22
<i>R. kanagurta</i>	31	3	11	9	6	2	...
<i>R. brachysoma</i>	35	1	7	16	6	4	1
Intergradation 38%			Divergence 62%				

TABLE VI-C

Species	No. of specimens	No. of gill rakers on lower limb of left side										
		33	34	35	36	37	38	39	40	41	42	
<i>R. kanagurta</i>	31	...	...	1	4	4	9	8	3	...	2
<i>R. brachysoma</i>	36	...	...	1	...	6	8	10	8	2	1
Intergradation 38%			Divergence 62%									

TABLE VI-D

Species	No. of specimens	No. of gill rakers on lower limb of right side									
		33	34	35	36	37	38	39	40	41	42
<i>R. kanagurta</i>	.. 30	1	...	...	6	5	8	7	2	1	..
<i>R. brachysoma</i>	.. 36	...	...	...	2	4	11	8	9	1	1

Intergradation 37% Divergence 63%

TABLE VI-E

Species	No. of specimens	Total number of gill rakers on the left arch (upper and lower combined)										
		51	52	53	54	55	56	57	58	59	60	61
<i>R. kanagurta</i>	... 31	...	...	...	4	4	6	4	6	3	1	3
<i>R. brachysoma</i>	... 35	...	...	1	...	5	5	6	9	6	2	1

Intergradation 38% Divergence 62%

TABLE VI-F

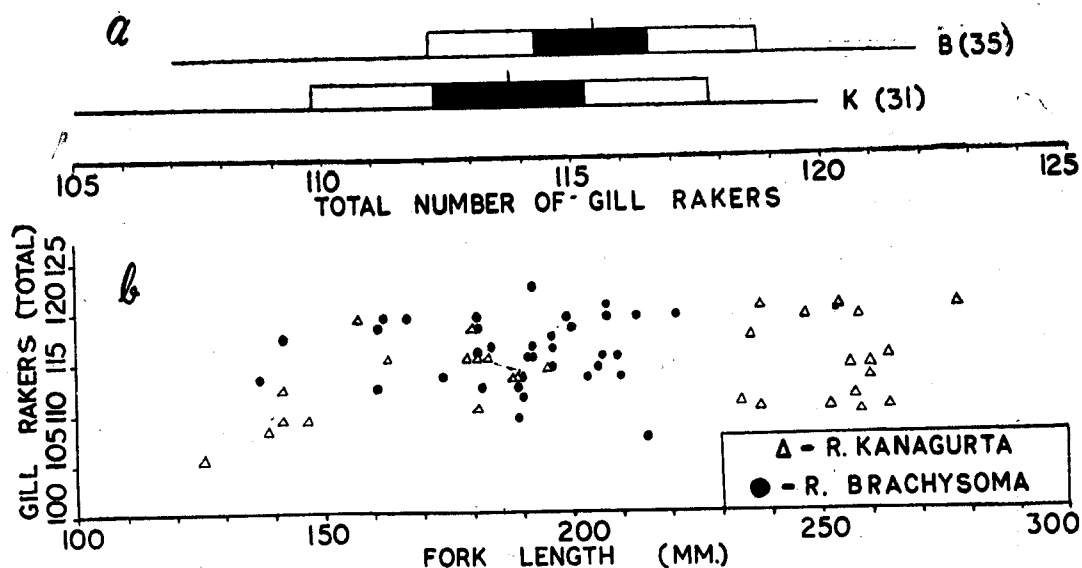
Species	No. of specimens	Total number of gill rakers on the right arch (upper and lower combined)										
		51	52	53	54	55	56	57	58	59	60	61
<i>R. kanagurta</i>	... 31	1	...	2	4	3	5	5	8	...	1	2
<i>R. brachysoma</i>	... 36	...	...	...	2	...	6	7	6	5	7	3

Intergradation 32% Divergence 68%

73% was seen when the grand total number of gill rakers (left and right combined) were counted for specimens of both the species falling within the size group 126 mm to 195 mm. (Table VIII). These data may be compared with the graphical representation of the grand total of gill rakers given in text-fig. 3a and also with the frequency distribution of the total counts in relation to fork length of the fish given in text-fig. 3b. No definiteness in the number of gill rakers is noticeable in the specimens over 140 mm. in fork length. The range of gill rakers for the two species from Andaman waters was found to be as follows:

R. kanagurta: 17-21 + 33-42.

R. brachysoma: 17-22 + 35-42.



Text Fig. 3-a.— Graph showing the variation in the total number (left and right combined) of gill rakers in *R. brachysoma* (B) and *R. kanagurta* (K) from Andaman Sea. (The horizontal line represents the total range; the short vertical line the mean; the solid rectangle two standard errors on each side of the mean and the hollow rectangle one standard deviation on either side of the mean).

3-b. Scatter diagram of the total number of gill rakers in the two species plotted against the fork length.

The shape and size of the gill raker differ in both the species. In *R. kanagurta* the raker is relatively shorter being 8.2 to 10.4% of the fork length, while in *R. brachysoma* it is longer, being 9.5 to 12.5%. This difference is best seen when the mouth of both the species is kept open. (Plate II, figs. A and B.) The gill rakers are seen feather-like projecting out to a greater extent in *R. brachysoma* than in *R. kanagurta*. Another difference is that the raker in the latter is more densely pigmented, and the number of simple branches on the raker is more and they are relatively shorter. (Plate II, figs. C and D). The length of the longest gill filament in *R. kanagurta* ranges from 6.3% to 7.5% of the fork length, while in *R. brachysoma* it is 5.3% to 7.5%, but mostly 5.3% to 6.6% in fork length, indicating that unlike the gill rakers, the gill filaments are relatively longer in *R. kanagurta* than in *R. brachysoma*. It is difficult at this stage to presume whether this is on account of the more oceanic habit of the former.

TABLE VII

Species	No. of specimens	Total number of gill rakers on both (right and left combined) outer branchial arches														Mean			
		105	106	107	108	109	110	111	112	113	114	115	116	117	118		119	120	121
<i>R. kanagurta</i> ...	31	1	...	...	2	3	3	1	2	3	3	5	...	1	1	3	3	...	113.58
<i>R. brachysoma</i>	35	...	...	1	...	1	...	1	3	5	2	5	3	2	3	7	...	1	115.4

Intergradation 29%

Divergence 71%

TABLE VIII
Frequency of occurrence of total number of gill rakers on both the right and left outer gill arches (combined) in *Rastrelliger kanagurta* and *R. brachysoma* for the size group between 126-195 mm.

Species	No. of specimens	Total gill rakers																	Mean	
		105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121		122
<i>R. kanagurta</i>	15	1	...	...	1	2	1	...	1	2	1	4	...	...	1	1	...	...	...	112.66
<i>R. brachysoma</i>	20	...	...	...	...	1	...	1	3	3	...	3	2	1	2	3	...	...	1	115.20

Intergradation 27%

Divergence 73%

Since we find considerable overlap in the number of gill rakers in both species, it is felt that variations on account of differences in the feeding habits of these two species may be more easily seen from the structure and relative length of the rakers than from their numbers. A study of the food of both the species from Andaman waters will certainly throw light on the real significance of these differences.

In Philippine waters also the same trend of differences in the gill rakers between *R. brachysoma* and *R. kanagurta* is seen. Manacop (1958) gives the following data (Table IX) for adult and juvenile specimens from Philippines.

TABLE IX

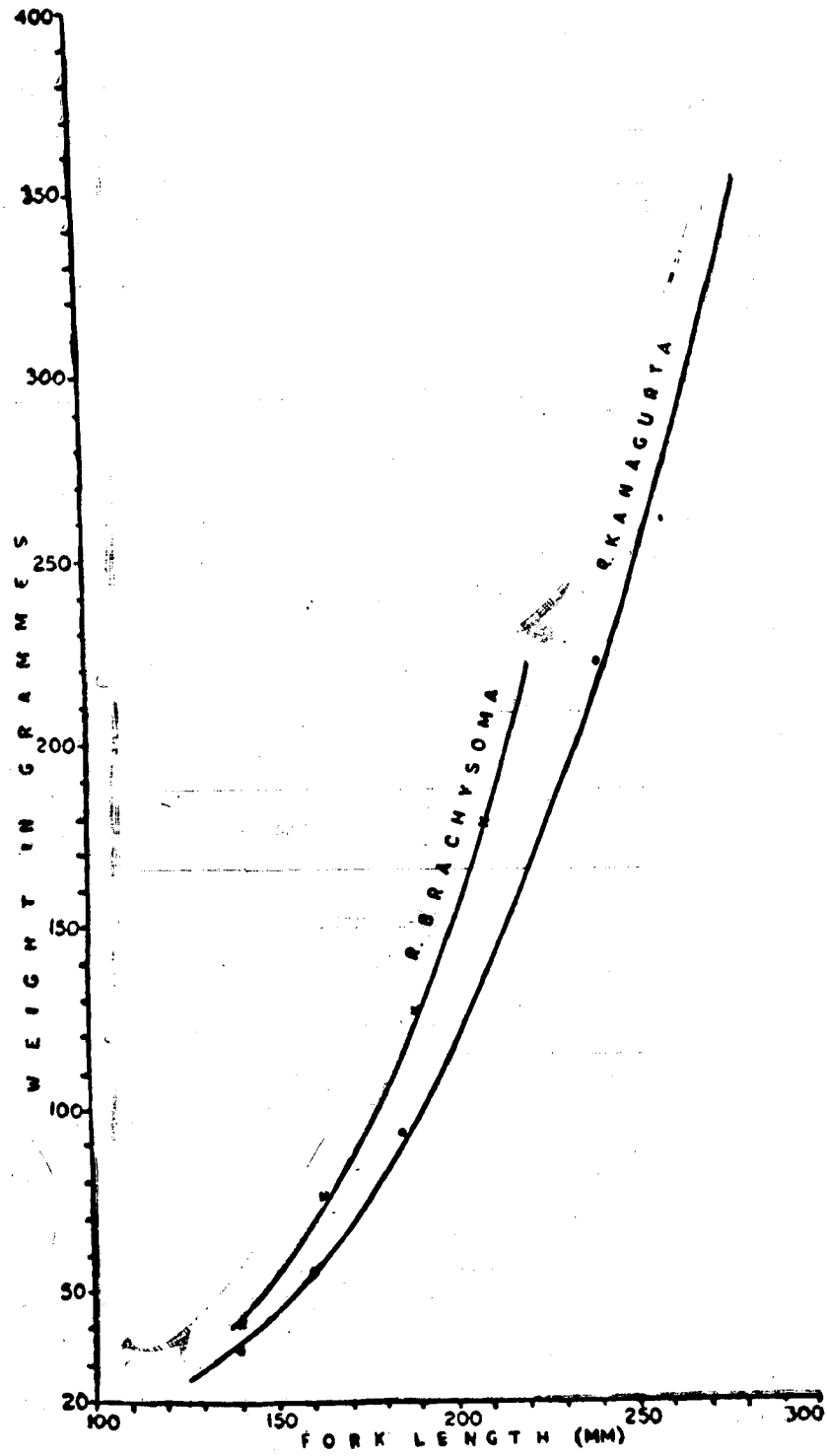
Character	<i>R. brachysoma</i>	<i>R. chrysozonus</i> (<i>R. kanagurta</i>)
Upper gill rakers	...	16-24 (mostly 20)
Lower gill rakers	...	19-23 (mostly 23)
		34-45 (mostly 39)
No. of gill raker pores (simple branches)	180-200	34-39 (mostly 37)
		130-152

The ranges and modes indicated for upper and lower gill raker counts in the above table differ slightly from that we have observed for specimens from Andaman waters. The significance of these differences will be more clear when data on good series of specimens from the Indonesian waters are examined.

LENGTH-WEIGHT RELATIONSHIP

The specimens could not be measured and weighed in the fresh state. On collection they were preserved in 10% formalin. The fork length of the fish to the nearest millimeter and the weight to the nearest milligram were taken, the latter after removing surface moisture. The material does not cover the various size groups, but consists of half grown and maturing adults. Since no visible external characteristics were noticeable to separate the sexes, data for both sexes have been combined in the present study.

The relationship of the average weight to the length in *R. kanagurta* and *R. brachysoma* is shown in text-figure 6, and the average observed and calculated weights for the samples



Text. Fig 6.—Length-weight parabola in *R. kanagurta* and *R. brachysoma* from Andaman Sea.

are given in Table X. These indicate that length for length *R. brachysoma* is heavier than *R. kanagurta*. The logarithmic relationship of the weight and length of the two species is shown in text-figure 7. The regression coefficient was tested and found to be linear. The regression equations obtained are given below :

$$R. kanagurta : \text{Log } W = 5.5390 + 3.3087 \text{ Log. } L.$$

$$R. brachysoma : \text{Log } W = - 6.0421 + 3.5779 \text{ Log. } L.$$

TABLE X

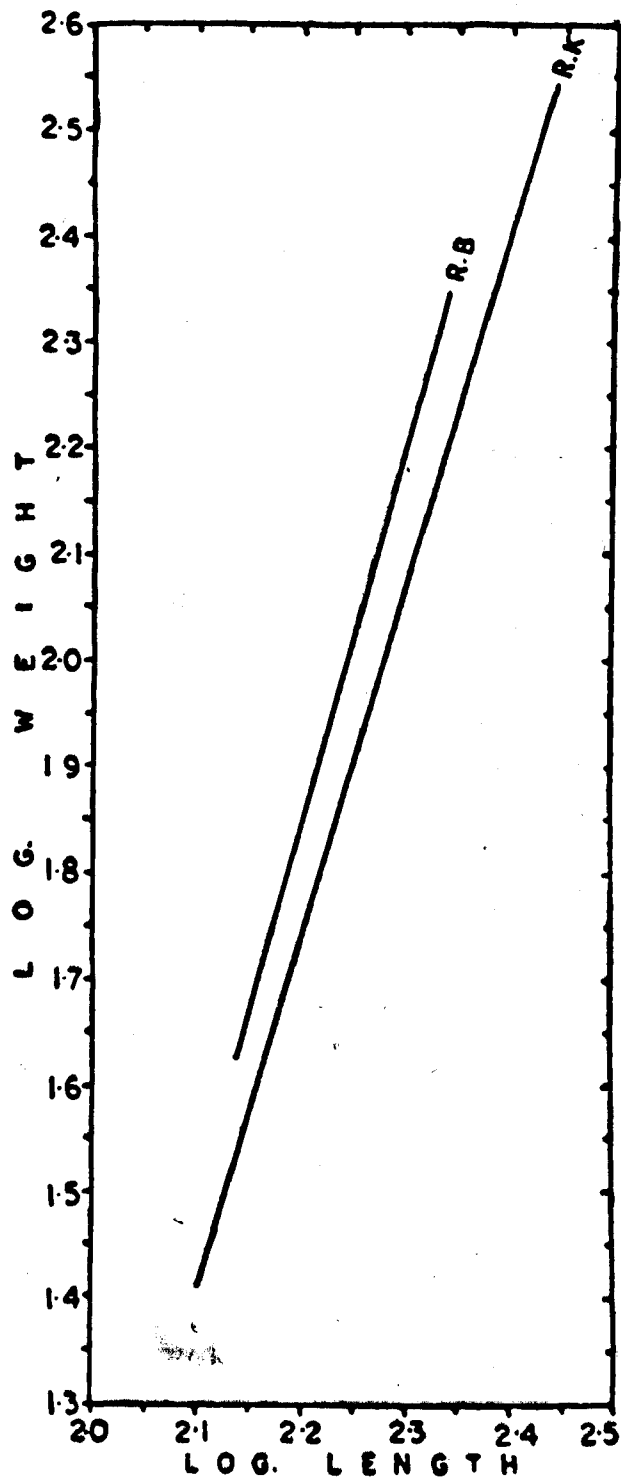
Average observed and calculated weights for samples of *R. kanagurta* and *R. brachysoma* from the Andaman Sea

Size groups (mm)	<i>R. kanagurta</i>				<i>R. brachysoma</i>			
	No. of obser- vations	Length (Average)	Weight in gm. (average)	Calculated weight in gms.	No. of obser- vations	Length (average)	Weight in gms. (average)	Calculated weight in gms.
125-149 ...	5	139.2	34.8	36.2	2	140.00	40.5	43.00
150-174 ...	2	160.00	55.5	56.5	4	162.5	76.00	73.25
175-199 ...	8	184.37	93.62	91.0	19	188.42	127.15	126.68
200-224 ...	...	...	...	...	11	208.45	178.48	180.63
225-249 ...	5	238.6	221.6	213.2	...	...	...	...
250-274 ...	10	258.3	260.0	276.9	...	...	...	...
275-300 ...	1	278.00	387.0	353.0	...	...	...	...

SCALES

Scales from the side of the body just below the tip of the pectoral fins in *R. kanagurta* (Pl. III, figures A, B and C) were examined in a number of specimens from the Andaman Sea. Data on scales of *R. kanagurta* both from East African and South African waters are included and they are figured on Pl. IV, figures A and B. Scales from identical positions from two of the abnormal specimens of *R. kanagurta* (specimens Nos. 1 and 6 in text-figure 8) are also shown in plate III, figures D and E, which indicate no deviation from the typical condition though the abnormal specimens are characterised by relatively deeper bodies as seen in *R. brachysoma*. The salient differences between *R. kanagurta* and *R. brachysoma* seen from the data given in Table XI and the figures on plates III and IV are :

(1) The scales are distinctly broader than long in *R. kanagurta* and in larger examples they are almost rectangular in shape. In *R. brachysoma* the scales are almost as broad as long or only slightly broader than long, appearing more or less squarish in shape.



Text Fig. 7.—Logarithmic relation of length and weight in *R. kanagurta* (R.K.) and *R. brachysoma* (R.B.) from Andaman Sea.

(2) An important difference is the size of the nucleus. In *R. kanagurta* from Andaman waters as well as elsewhere, and in the abnormal specimens of the same species examined the nucleus appears as a wide band along the middle of the scale, its width being contained 1.75 to 2.5 times in the greatest width of the scale. In *R. brachysoma* the nucleus is small, narrow and less wide, its width being contained 3.5 to 5.5 times in the greatest width of the scale.

(3) The number of ctenoid projections appears to be quite variable, but generally they are of slightly lesser number in *R. brachysoma*.

(4) The number of apical and basal circuli in the scales is seen to be more in *R. brachysoma* than in *R. kanagurta* when scales from similar sized specimens of both the species are examined.

(5) On account of the small and centrally placed nucleus, incomplete lateral circuli were not seen in the scales of *R. brachysoma* which were examined. Incomplete lateral circuli are present in almost all scales of *R. kanagurta* examined from identical position behind the pectorals.

TABLE XI
Particulars of scales of *R. kanagurta* and *R. brachysoma*

Species and locality	Length of specimens (mm)	L. of* scale	W. of* scale	No. of ctenoid projections	No. of apical circuli	No. of basal circuli	Incomplete lateral circuli	
							Left	Right
<i>R. kanagurta</i> (E. Africa)	198	47	66	22	46	33	1	4
<i>R. kanagurta</i> (S. Africa)	222	59	77	27	48	48	1	Nil
<i>R. kanagurta</i> (Andamans)	245	69	100	37	45	53	6	6
"	160	43	55	Damaged	38	18	6	8
"	"	38	49	"	34	18	6	9
"	"	38	52	"	32	19	9	7
"	255	60	96	37	40	46	7	4
"	"	60	97	34	37	53	5	2
"	"	58	95	31	37	48	1	7
"	"	60	97	33	40	50	3	7
"	"	59	95	35	41	53	3	7
"	"	60	92	33	45	47	6	5
"	"	58	90	32	47	42	7	8
<i>R. brachysoma</i> (Andamans)	162	51	58	17	55	40	Nil	Nil
"	195	57	72	22	47	48	Nil	Nil
"	221	68	82	31	47	62	Nil	Nil
"	"	66	78	Damaged	52	60	Nil	Nil

*Length and width of scales are given in microdivisions. 17.5 m.d. = 1 mm.

ABNORMAL SPECIMENS OF *R. kanagurta* FROM INDIAN COASTAL WATERS

We have found that along the Indian Coast, occasionally among catches of *R. kanagurta* a few abnormal specimens may be encountered, some of which may even be mistaken for

R. brachysoma by those not familiar with the latter species. The frequent abnormalities seen are listed below :

- (1) Short stumpy forms in which depth of the body is equal or greater than the length of the head.
- (2) The shortening of the portion of the body behind the second dorsal.
- (3) "Twisting" or curvature of the vertebral column in the caudal peduncular region.
- (4) Loss of one or more dorsal finlets due to injury.
- (5) Increase in the number of dorsal and anal finlets due to "twisting" of the caudal peduncular region.
- (6) Increase in number of first dorsal spines.
- (7) Short first dorsal fin.

The above are easily noticeable even in the field. We have not examined the osteological features of these specimens some of which are illustrated here in text-figs. 8 and 9. Morphometric and meristic data for these specimens are given in Table XII.

TABLE XII

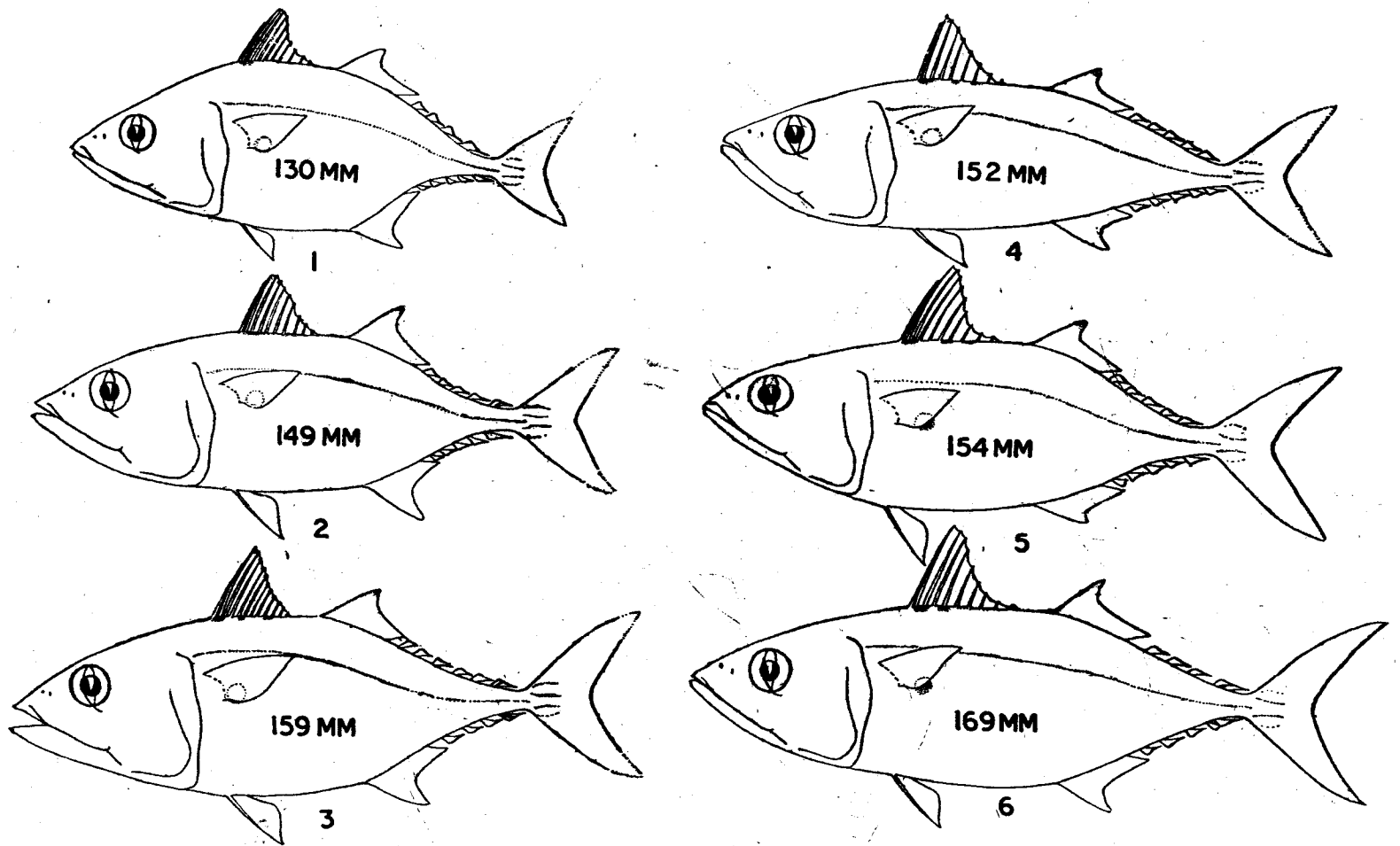
Morphometric and meristic data on abnormal specimens of *R. kanagurta* from Indian waters*

Characters	Localities								
	No. 1 Calicut ?	No. 2 Narakal 20-1-58	No. 3 Narakal Jan. 58	No. 4 Narakal 20-1-58	No. 5 Calicut 30-11-55	No. 6 Calicut 30-11-55	No. 7 Calicut 4-11-56	No. 8 Calicut 30-11-55	No. 9 Calicut 19-12-55
Fork length	130	149	159	152	154	169	150	175	193
Head length	43	50	52	47	47	50	45	53	57
Greatest depth of body	47	44	49	41	47	49.5	42	48	48
Length of pectoral	21	24	26	22	24	26	22.5	25	27
Length of maxilla	324	26.5	29	25	26	29	25	28	31
First predorsal distance	51.5	59	60	55	57	61	55	65	69
Second predorsal distance...	76	88	88	90	92	100	95	101	112
Prepelvic distance	52	59	64	56	56	61	56	63	70
Preanal distance	82	91	101	92	94	104	97	106	120
D ₁	XI	XI	XII	IX	X	X	IX	VIII	IX
D ₂ ÷ finlets	11 ÷ 4	11 ÷ 5	12 ÷ 6†	12 ÷ 5	12 ÷ 5‡	12 ÷ 4†	11 ÷ 6	12 ÷ 5†	12 ÷ 5
P ₁	19	19	20	20	19	20	19	19	20
A ÷ finlets	12 ÷ 5	11 ÷ 5	12 ÷ 4†	12 ÷ 5	12 ÷ 5	12 ÷ 4†	1 ÷ 6	13 ÷ 5†	12 ÷ 2
Gill rakers	Right	18 ÷ 35	19 ÷ 37	194 ÷ 0‡	20 ÷ 39	19 ÷ 37	19 ÷ 35	18 ÷ 41	20 ÷ 40
	Left	19+36	Removed‡	Removed	19+39	18+36	19+35	19+41	19+40

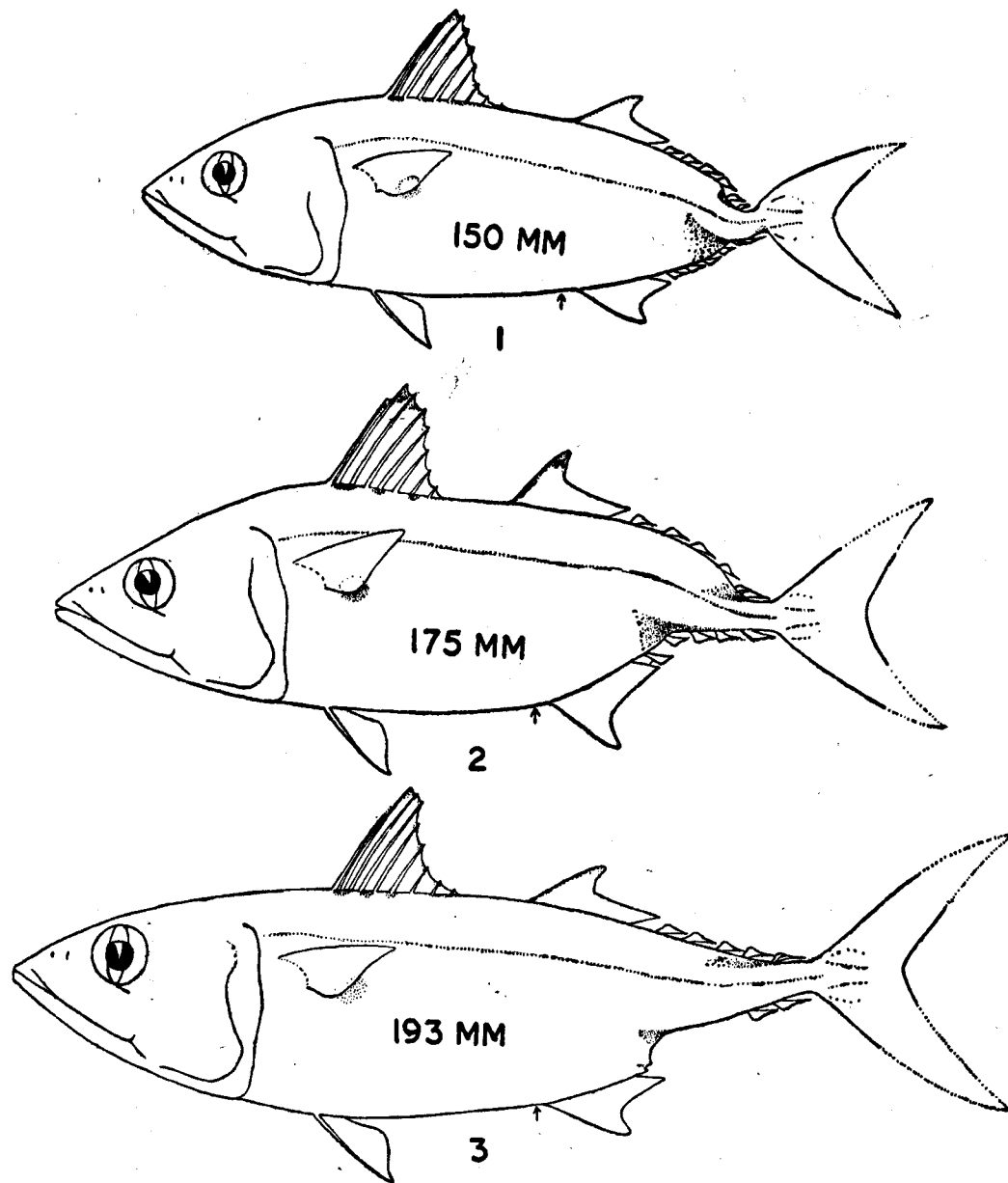
*All measurements are in millimetres. Specimen numbers 1-6 are figured in text fig. 8 and 7-9 in text. fig. 9

†Finlet nearest caudal base divided to base and appearing as two is counted as 1.

‡Outer left gill arch appears to have been completely removed.



Text Fig. 8.—Outline drawings of abnormal specimens of *R. kanagurta* collected from the south-west coast of India. The number given on the body of each specimen represents fork length in mm. See also Table XII.



Text Fig. 9.—Outline drawings of abnormal specimens of *R. kanagurta* collected from the south-west coast of India. The number given on the body of each specimen represents fork length in mm. See also Table XII.

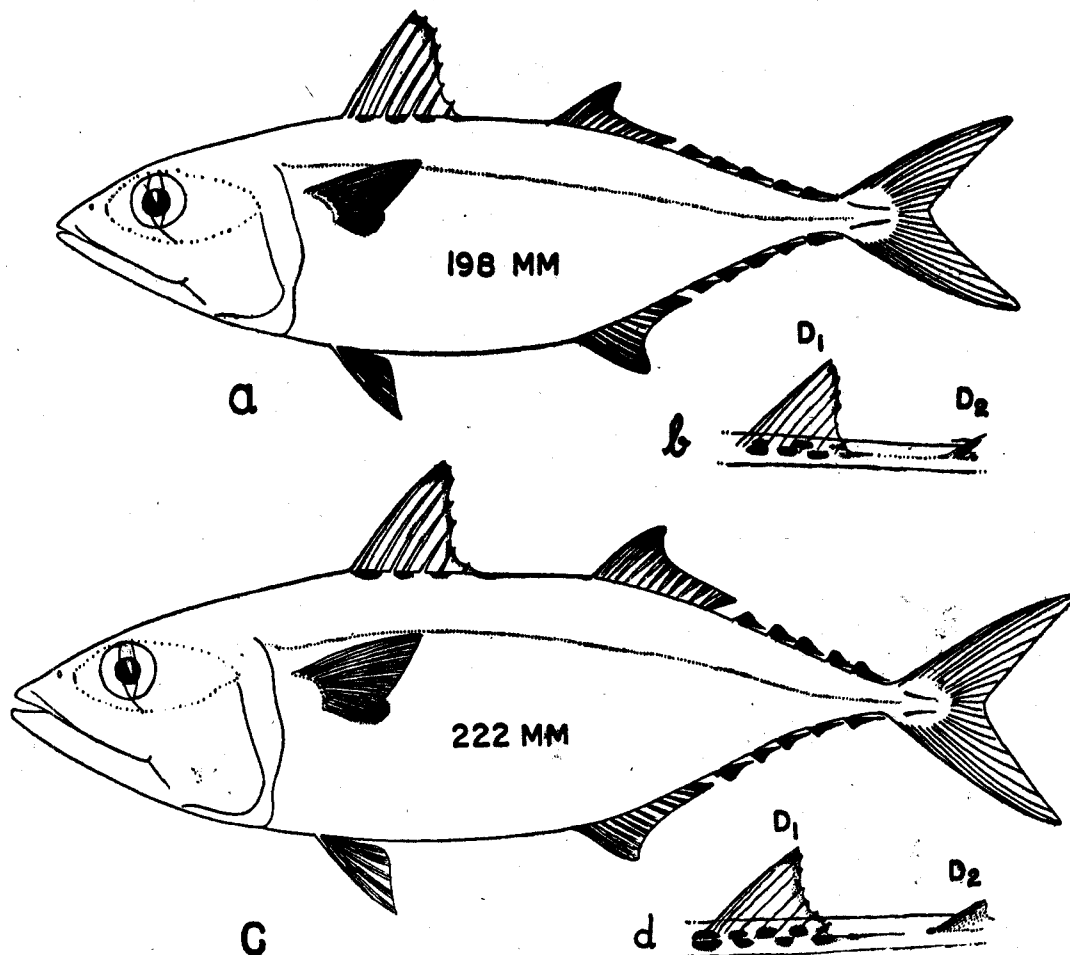
R. KANAGURTA FROM EAST AFRICAN WATERS

We have been able to examine seven specimens of *R. kanagurta* 145 mm. to 198 mm. in fork length (Text-figure 10a, b) from the British East African Waters kindly sent to us by Mr. F. Williams who had collected them off S. W. Zanzibar. The specimens do not show any marked difference from *R. kanagurta* occurring along Indian coastal waters and have the following meristic characters :

D_1 VIII—IX ; D_2 + finlets 11—12 + 5 ;

P_1 19—20 ; A + finlets 10—12 + 5 ;

scales along lateral line about 118—122.



Text Fig. 10.—Outline drawing of *R. kanagurta* (Cuvier) (A) specimen 198 mm. in fork length from southwest Zanzibar, British East Africa; (B) part of mid-dorsal profile at base of spinous dorsal showing faint black blotches; (C) specimen 222 mm. in fork length from the Natal coast, South Africa and (D) part of mid-dorsal profile at base of spinous dorsal of same showing distinct and conspicuous black blotches.

The gill raker counts for the seven specimens are as follows :

Outer gill arch on	Upper limb					Lower limb				
	15	16	17	18	19	34	35	36	37	
Right side	1	4	...	2	3	1	...	3
Left side	...	1	...	3	2	1	2	2	1	2

The various body proportions expressed in thousandths of fork length are as follows : Head 265 to 289 ; first predorsal distance 333 to 366 ; second predorsal distance 544 to 609 ; prepelvic distance 320 to 363 ; preanal distance 592 to 621 ; distance from origin of P to D₁ origin 112 to 131 ; distance from P₁ to P₂ origin 160 to 188 ; depth of body at origin of D₁ 224 to 260 ; greatest depth of body 224 to 278 ; depth of body at origin of D₂ 214 to 258 ; anterior height of D₁ 157 to 167 ; length of P₁ 126 to 143 ; length of maxilla 136 to 166 ; width of body at P₁ 98 to 136 ; length of longest gill raker 75 to 114 ; and length of longest gill filament 51 to 64.

The occurrence of *R. brachysoma* or a similar deep bodied form has never been reported from these waters, although it is listed in the ichthyofauna of South African waters.

R. KANAGURTA FROM SOUTH AFRICAN WATERS, S. W. INDIAN OCEAN

We have been able to examine a single specimen of *R. kanagurta* kindly loaned to us by Prof. J. L. B. Smith, (text-figure 10 c and d). The specimen shows the following characteristics :

D₁ IX ; D₂ + finlets 12 + 5 ; P₁ 19 ; A + finlets 11 + 5 ; scales along lateral line about 128. Gill rakers $\begin{matrix} R & 18 + 37 \\ L & 20 + 35 \end{matrix}$ (total—110)

The various body proportions expressed in thousandths of fork length are as follows : Head 293 ; first predorsal distance 360 ; second predorsal distance 599 ; prepelvic distance 347 ; preanal distance 617 ; distance from origin of P₁ to D₁ origin 191 ; depth at D₁ 275 ; depth at D₂ 261 ; greatest depth 286 ; anterior height of D₁ 150 ; length of P₁ 137 ; length of maxilla 158 ; width of body at P₁ 140 ; length of longest gill raker 115, and length of longest gill filament 68.

Gilchrist and Thompson (1907) ; Barnard (1927) ; Fowler (1935) and Smith (1949 ; 1961) record *Rastrelliger microlepidotus* (*R. kanagurta*) from South African waters.

Gilchrist and Thompson (1917) referred to *R. brachysoma* from South African waters and Barnard (1927) though he did not examine any specimens, gave the following brief description of this species : "Depth $3 \frac{1}{7}$ — $3 \frac{2}{3}$, length of head $3 \frac{3}{4}$ in length of body. Eye $3 \frac{4}{5}$ — $4 \frac{1}{3}$ in length of head, $1 \frac{1}{3}$ in snout, $1 \frac{1}{4}$ in inter-orbital width. DX + 12+5. A I, 11+5. Maxilla reaching to level of posterior third of eye. Gill rakers 44 on lower part of anterior arch." The description fits in well with the known characteristics for *R. kanagurta*. Smith (1949, 1961) also records *R. brachysoma* from South African waters,

However, he gives the depth of body of this species to be about $3 \frac{3}{4}$ in the length while for *R. kanagurta* the depth of body is mentioned to be about $3 \frac{1}{2}$, which means his *R. brachysoma* has a less deeper body than that of *R. kanagurta*. Other distinguishing characteristics mentioned for these two species from South African waters are :

Characters	<i>R. kanagurta</i>	<i>R. brachysoma</i>
D ₁	IX—X + 11—12 + 5	IX—X + 12—13 + 5
A	I—II, 11—12 + 5	I, 11 + 5
Gill rakers (on lower limb of outer gill arch)	25-35	I, 11 + 5 about 45

It may be mentioned here that the possibility of the occurrence in South African waters of *R. brachysoma* or a form closely allied to it cannot be ruled out. However, confirmation of its occurrence should await examination of good series of specimens.

The specimen of *R. kanagurta* we have examined from South Africa is characterised by more distinct black blotches middorsally on either side of the spinous dorsal, though in East African, Indian and Andaman specimens they are not so conspicuous. Smith (1961) has shown the upper third of the spinous dorsal fin as being coloured black in *R. kanagurta* (Pl. 68, figure 837), but in the specimen we have examined (Text-figure 10c and d) this is not the case. Proper gill raker counts and morphometric data are wanting for South African specimens of *R. kanagurta*.

ACKNOWLEDGEMENT

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THE PAPER WAS READ BY DR. E. G. SILAS

DISCUSSION

MR. S. K. BANERJI : You say that you have studied over 15 characters. Out of these how many show overlap and to what degree ?

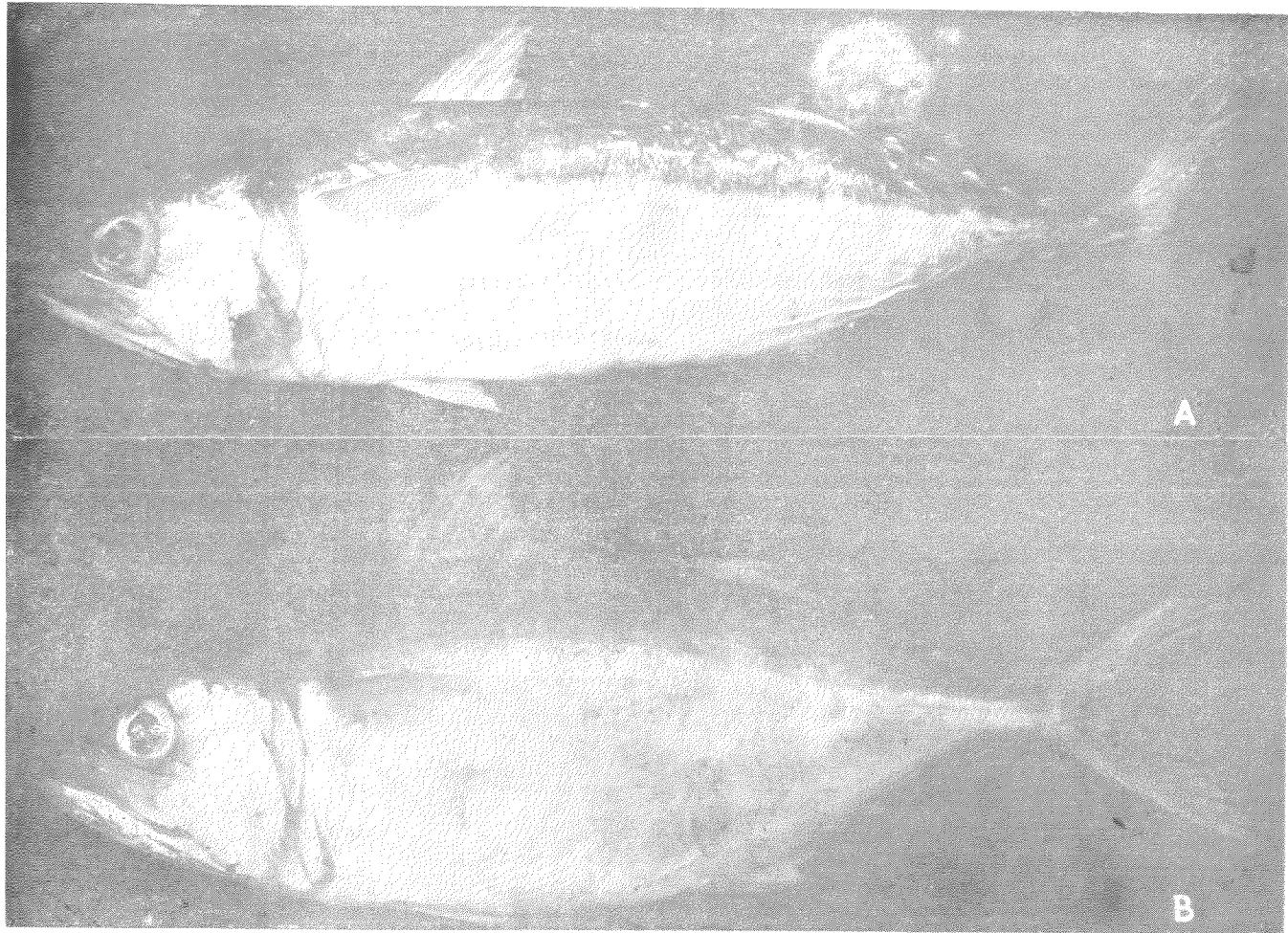
DR. E. G. SILAS : Initially over 35 characters, both morphometric and meristic, were analysed to select some dependable characters which would help in studying variations of interspecific nature. In about fifteen such characters partial overlap is seen to varying degrees. In characters such as depth of body at different points along the length of the body there appears to be no overlap, the degree of divergence in the samples of the two species examined being 100 per cent. Contrary to earlier belief we find that gill raker counts in both species show considerable overlap and may not prove to be of primary importance in species differentiation in this genus.

MR. RODNEY JONKLAAS : What was the method of collection employed there ?

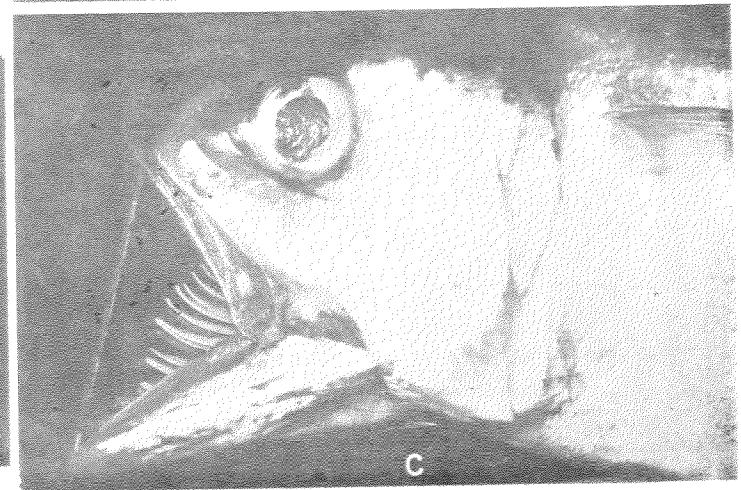
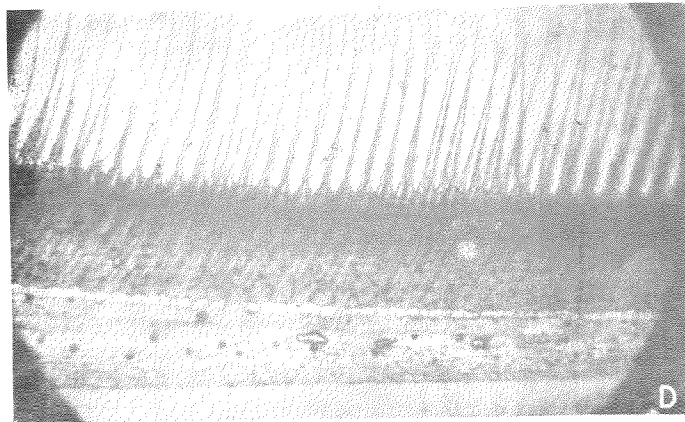
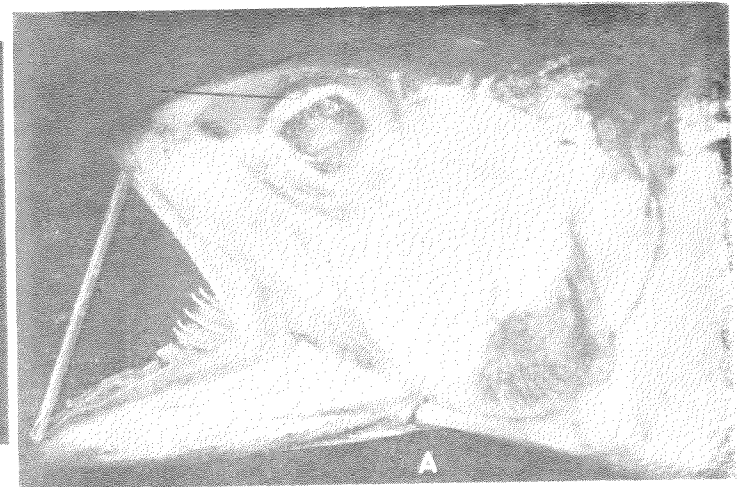
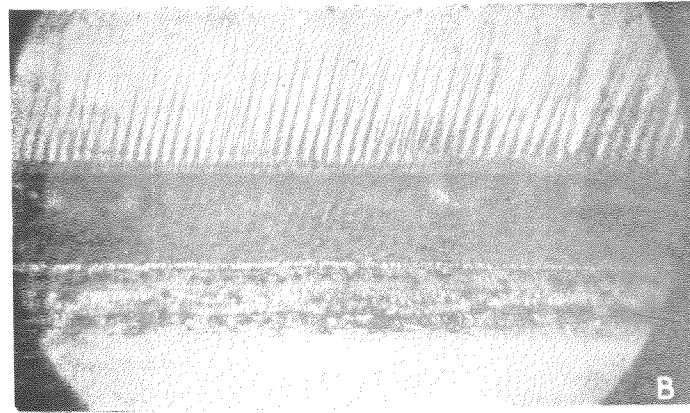
DR. E. G. SILAS : The specimens we examined were obtained in shore seines operated in bays close to Port Blair, Andamans.

MR. K. V. SHEKARAN : The specific name of the Indian mackerel has been spelt with 'c' as *R. canagurta* by workers from the Central Marine Fisheries Research Institute. You have used 'k' as *R. kanagurta* and I would like to know what spelling should be followed for this species.

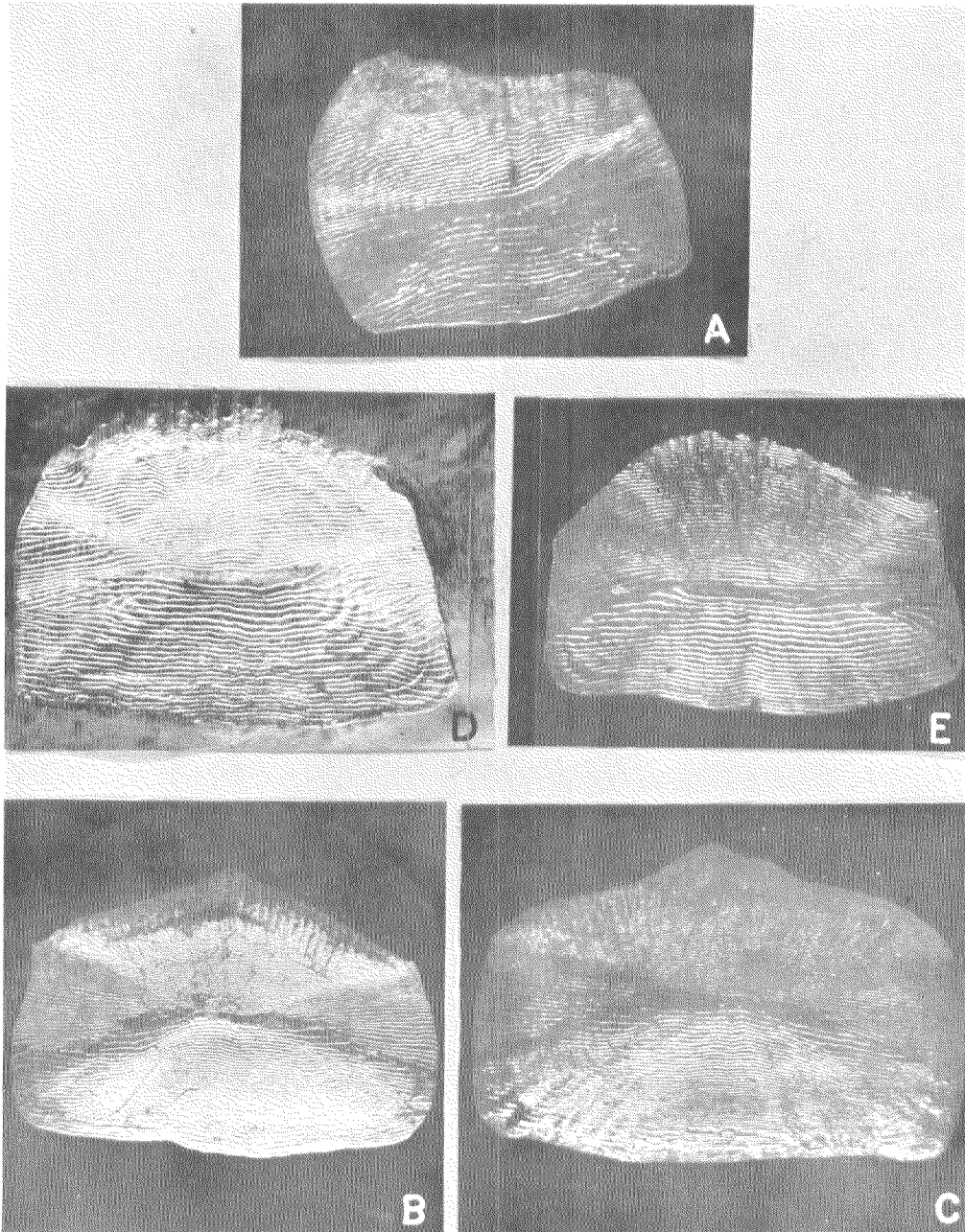
DR. E. G. SILAS : The specific name *R. kanagurta* is based on Russell's (1803) designation of the Indian mackerel by one of the local vernacular name used to denote it along the Coromandel Coast (Vizagapatam), namely *Kanagurta* (Telugu dialect: Also *Kanagadathalu* is used for the same species in the same dialect). Unfortunately the species described by Russell are not recognised on account of the non-usage of binomial nomenclature. However, it has been the custom to attribute the authorship of these species to the first subsequent worker dealing with the species and in this case Cuvier appears to be the first to mention Russell's species *Scomber kanagurta* in a footnote in 1817 (*Regne Animal*, 2 : 313). In the second edition of the same work appearing in 1829 (*Regne Animal*, 2 : 197) he uses the spelling *S. canagurta* for the species, although two years later in the 8th volume of *Histoire Naturelle de Poissons* (p. 49, 1831) again the species name is given as *Scomber kanagurta*. Another point to be mentioned is that according to the law of priority it is not proper to attribute the authorship of *Scomber kanagurta* to Rüppell (1828 : *Atlas Reise Nordl Afrika, Fische Rothen Meeres*, p. 93 : from Gomfuda, Red Sea) as some workers have done, especially as there is no ambiguity about Russell's *Kanagurta* both as evident from the description as well as his drawing of the species. In fact, unlike many earlier post-Linnean works, there is no ambiguity about most of the 200 species described by Russell, and if his work is recognised, the authorship of the Indian mackerel *Scomber kanagurta* (= *Rastrelliger kanagurta*) would rightly go to him. In addition, the spelling of the species as *R. kanagurta* is so widely current in literature that it will be most undesirable and unnecessary to change it at this stage.



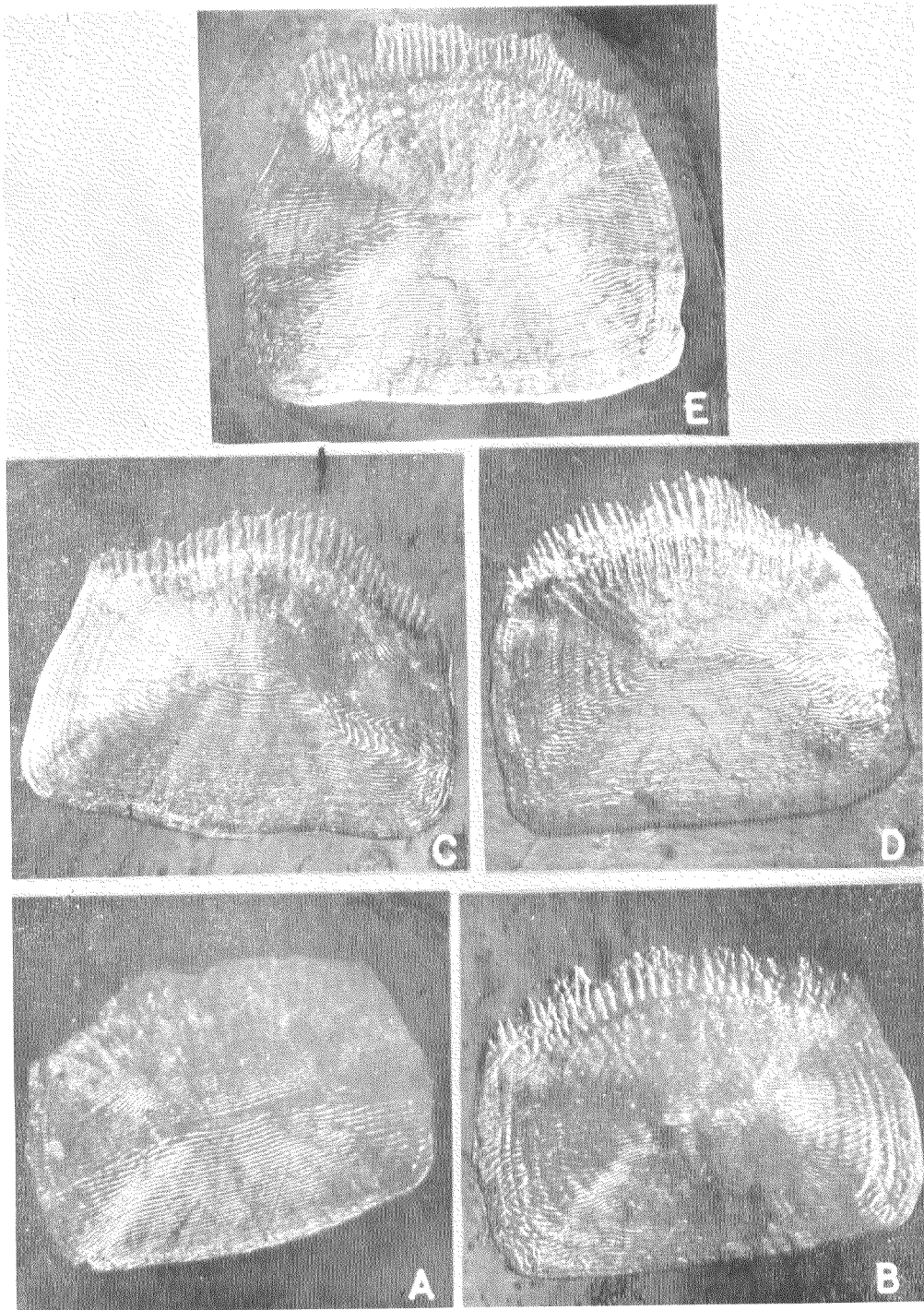
A. Rastrelliger kanagurta (Cuvier), 268 mm. in fork length. *B. Rastrelliger brachysoma* (Bleeker), 213 mm. in fork length.
Both the specimens are from Port Blair, Andamans.



Rastrelliger kanagurta (Cuvier) : (A) Mouth of 268 mm. specimen kept open to show the relatively less exposed gill rakers. (B) Part of longest gill raker on the lower limb of the outer gill arch of the same showing the dense pigmentation and the relatively shorter simple branches. *Rastrelliger brachysoma* (Bleeker) : (C) Mouth of 213 mm. specimen kept open to show the long feather-like exposed gill rakers. (D) Part of the longest gill raker of the same species showing the sparse pigmentation and the relatively longer simple branches.



Rastrelliger kanagurta (Cuvier) : Scales from behind tip of pectoral fin of (A) specimen 160 mm. (2.45×3.1 mm.) ; (B) Specimen 245 mm. (3.9×5.7 mm.) and (C) specimen 255 mm. (3.4×5.5 mm.) all from Andamans. Scales from identical position of (D) abnormal specimen 169 mm. (2.45×3.5 mm.) and (E) abnormal specimen 130 mm. (2.1×3.0 mm.) both from Calicut, West Coast of India (Measurements of scales are given in parenthesis after the length of the specimen).



Rastrelliger kanagurta (Cuvier) : Scales from behind tip of pectoral in (A) 198 mm. (2.7×3.7 mm.), specimen from Zanzibar, E. Africa ; and (B) 222 mm. (3.3×4.4 mm.) specimen from South African waters. *Rastrelliger brachysoma* (Bleeker) : Scales from identical position in (C) specimen 195 mm. (3.2×4.1 mm.); (D) and (E) specimen 221 mm. (3.7×4.4 and 3.9×4.7 mm.) from Port Blair, Andamans. (Measurements of scales are given in parenthesis after the length of the specimen).