ON THE UTILITY OF THE DORSAL AND ANAL FINS OF THE INDIAN MACKEREL, *RASTRELLIGER KANAGURTA* IN DETERMINING RACES

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Introduction

The median fin ray counts of *Rastrelliger kanagurta* (Cuvier), as reported by various workers, differ from one another. Perhaps the first to describe this fish was Russell (1803, p. 28). Though there is no ambiguity about his description and drawing, his work has not been recognised on account of the nonusage of binomial nomenclature. Russell's description of the dorsal and anal fins of *Kanagurta* is as follows: "the first dorsal with 9 spinous rays; the second with 12 rays; 5 pinnulae above and below". Subsequently many workers have described the species under different names, some of which are listed below.

Cuvier and Valenciennes (1831, p. 49)

Scomber kanagurta

D. 9-$\frac{1}{11}$ & 5

A. $\frac{2}{11}$ & 5

Gunther (1860, p. 361)

Scomber microlepidotus

D. 10. 12. 5

A. $\frac{1}{11}$ .5

Kner (1869, pp. 142-143)

Scomber loo

D_1 10, D_2 12-13+5

A. $\frac{1}{11}$ +5

Scomber microlepidotus

D_1 10, D_2 12+5

A. $\frac{1}{11}$ +5

Day (1878, p. 251)

Scomber microlepidotus

D. 8-10/ $\frac{1}{11}$ + v-vi

A. $\frac{1}{11}$ + v-vi

Kishinouye (1923, p. 406)

Rastrelliger chrysozonus

D. 10, 12, 5

A. 12, 5

de Beaufort (1951; p.213) and Munro (1955, p.218) agree with Kishinouye.

Manacop (1956)

Rastrelliger chrysozonus

D_1, VIII-IX (mostly IX)

D_2, 11-12 (mostly 12) + 5-6 (mostly 5)

A, 11-12 (mostly 12) + 5-6 (mostly 5)

Smith (1964, p.180)

Rastrelliger kanagurta

D, IX-X + 11-12 + 5

A, I-II + 11-12 +5

Jones and Silas (1964b, pp.279-280)

Rastrelliger kanagurta (East African waters)

D_1, VIII-IX, D_2 + finlets, 11—12+5

A + finlets, 10-12+5

Rastrelliger kanagurta (from South African waters)

D_1, IX, D_2 + finlets, 12+5

A + finlets 11+5

Jordan and Starks (1908, p. 607) created the genus *Rastrelliger*. de Beaufort (1951, pp. 212-213) considered all the above species as synonyms of *Rastrelliger kanagurta* (Cuvier).

The present paper forms part of the racial studies on the Indian mackerel, *Rastrelliger kanagurta*. Considerable work has been conducted to study races in fishes using the variability in the number of median fin rays. Hubbs (1955, p. 4) established two different varieties of *Gambusia affinis* based on "taxonomic character" in the number of dorsal and anal rays. Holt (1959, p. 109) believes that "features which are individually constant and yet have a sufficient range of variability in *Rastrelliger* populations might exist in the number of rays of the anterior dorsal". Lindsey (1961, p. 54) considers "counting of meristic series is a convenient technique in looking for evidence of population segregation". The present study on the Indian mackerel was started in early 1959. Though certain preliminary observations were included in the Annual Report of the Central Marine Fisheries Research Institute (1960, pp. 514-515) the details could not be published so far.

Material and Methods

Samples of fish were obtained from Mandapam (Lat. 9° 15′ N.), Madras (Lat. 13° 5′N.) and Waltair (Lat. 17° 43′N.) on the east coast of India and Kanyakumari (Lat. 8° 5′ N.), Vizhingam (Lat. 8° 22′ N.), Cochin (Lat. 10° N.), Kozhikode (Lat. 11° 15′ N.), Mangalore (Lat. 12° 50′ N.), Bhatkal (Lat. 14° N.) and Karwar (Lat. 14° 50′ N.) on the west coast. The fish were in different length groups ranging from 15 mm to 280 mm. All measurements in the text are in total length. Samples were drawn from different gears like shore seine, boat seine, gill net and drift net. The clearing and staining technique adopted by Clothier (1950, p. 81) for bone study with minor modifications was employed to count the number of rays and their supports. In referring to the fin-ray counts no distinction was made between spines and rays. The term 'fin-ray' has been used invariably. The numbering of finlets as recommended by Marr and Schaefer (1948, p. 242) has been avoided in view of Hardenberg's (1956) and Matsui's (u.d., p. 60) method of counting quoted in this paper. While describing the fin formula of the first dorsal and anal fins, one ray is shown separately in brackets from the hyphenated number (range) as $D_1, \frac{(I).\ VIII\text{-}XI}{xi}$ to denote that this single ray has no corresponding fin-support. The number of fin-supports is shown below the rays in small Roman numerals as 'xi'. The first fin-support of D_2 which resembles that of D_1 is also shown in brackets.

Results

First dorsal fin

There are 12 rays in the first dorsal fin, situated in a groove. The first ray is shorter than second. But this complement of 12 rays is generally met with only in the postlarvae and early juveniles, below 20 mm in length. In fish above this size, but below 50 mm, there are invariably 11 rays only. As the fish grows further, the last 1 or 2 or even 3 lepidotrichia disappear (Fig. 1 & plate I). The groove which originally extends upto the commencement of the second dorsal gradually tends to close. This closing up starts when the fish is about 80 mm in length. But when the specimen is cleared for dyeing the entire groove becomes clear once again exhibiting the vestiges of the disappeared ray(s). Thus the number of rays of the first dorsal is not an individually constant character, but is dependent on the size and age of fish. (Table 1). Though typically there are 12 lepidotrichia the endoskeletal structures are only 11. The fin-support of the first ray is not traceable. The first interspinous bone is, however, conspicuous by its comparatively longer and stouter size (Fig. 2, A). Except in the case of the first fin-support the endoskeletal structure of D_1 is essentially a two-part system, a flattened bone embedded in the side muscles (axonost or "interspinal" of Cuvier) and a serrated wing-like baseost ("bony buckler" of Starks 1910) under the skin in the groove of D_1 (Fig. 2, B, C).

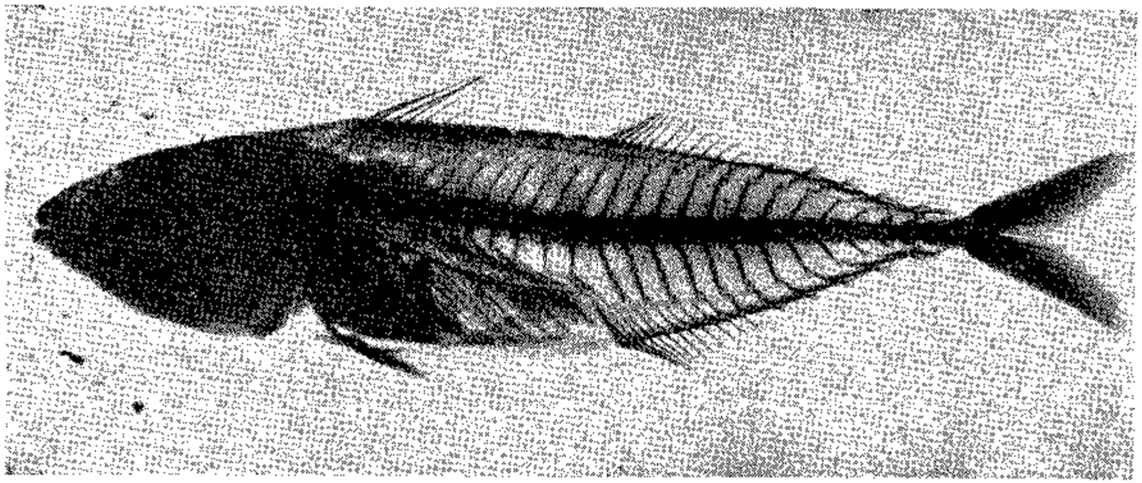

Plate I—Photograph of the cleared and alizarine-stained specimen of *Rastrelliger kanagurta* measuring 160mm.

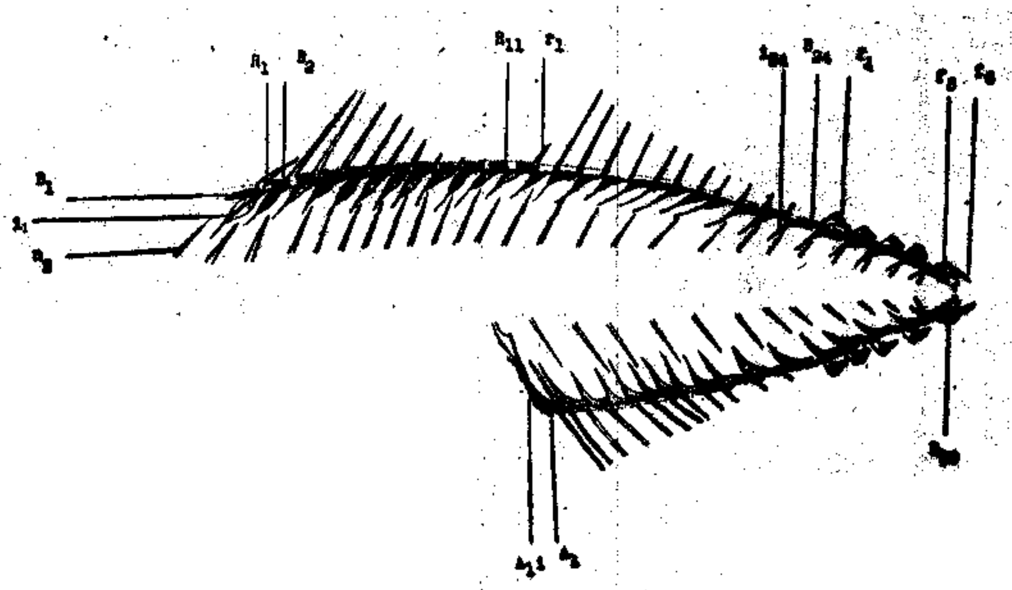

FIG. 1 *Pattern of arrangement of fin-rays and their endo-skeletal supports.*

n_2, Second neural spine; i_1, Interspinous bone (axonost) of R_1; R_1, First ray of D_1; B_1, Basost of R_1; B_2, The "bony buckler" of the second ray of D_1; R_{11}, Rudiments of the eleventh ray of D_1; r_1, First ray of D_2; I_{24}, Interspinous bone of the anteriormost finlet (f_1). B_{24}, Basost of f_1; f_5, f_6, Posteriormost finlets; A_1I, First interspinous bone of anal fin; A_1, First ray of anal fin; B_{26}, The skeletal structure between the spines of the 26th and 27th vertebrae.

TABLE 1—*Number of finrays in D_1 in different length groups*

Locality	Number of lepido-trichia	Size groups in mm													
		20-39	40-59	60-79	80-99	100-119	120-139	140-159	160-179	180-199	200-219	220-239	240-259	260-279	280-300
Waltair 35 nos.	8	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	9	..	..	..	..	..	..	..	..	..	2	3	..	..	..
	10	..	7	13	1	..	1	..	..	..	..	..	..	..	..
	11	..	6	2	..	..	..	..	..	..	..	..	..	..	..
	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	Mean	..	10·4	10·1	10·0	..	10·0	..	..	..	9·0	9·0	..	..	..
Madras 45 nos.	8	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	9	..	..	1	..	..	..	..	..	..	3	..	..	..	..
	10	..	2	14	7	8	..	..	..	..	2	..	..	..	..
	11	..	7	1	..	..	..	..	..	..	..	..	..	..	..
	Mean	..	10·7	10·0	10·0	10·0	..	..	..	..	9·4	..	..	..	..
Mandapam 28 nos.	8	..	..	..	..	..	..	..	..	..	2	3	..	..	..
	9	..	..	..	..	..	..	..	..	9	7	1	..	..	..
	10	..	..	..	..	..	..	..	..	4	2	..	..	..	..
	11	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..

	Mean	..	..	..	—	..	—	..	..	9·3	9·0	8·2	..	..	..
Kanya kumari 160 nos.	8	—	—	...	...	..	..	—	—	...	1	2	8	7	3
	9	—	—	—	..	2	4	11	10	8	10	7	3	2	..
	10	—	12	13	15	14	6	6	3	1	..	..	..	..	..
	11	—	10	3	—	—	—	—	—	—	..	..	..	..	..
	12	..	—	—	—	—	—	—	—	—	..	..	..	..	..
	Mean	...	10·4	10·2	10·0	9·8	9·6	9·3	9·3	9·1	8·9	8·7	8·2	8·2	8·0
Vizhingam 218 nos.	8	..	..	..	..	—	—	—	—	—	1	1	3	7	4
	9	..	..	..	—	6	8	8	6	10	9	14	6	5	1
	10	..	15	19	21	18	10	8	5	4	1	..	..	..	..
	11	11	4	..	..	..	—	—	—	..	..	..	..	..	..
	12	12	1	..	..	..	...	—	...	..	..	..	..	..	..
	Mean	11·5	10·3	10·0	10·0	9·7	9·5	9·5	9·4	9·2	9·0	8·6	8·6	8·4	8·2

TABLE 1—(*Contd*) *Number of fin-rays in* D_1 *in different length groups*

Locality	Number of lepido-trichia	Size groups in mm													
		20-39	40-59	60-79	80-99	100-119	120-139	140-159	160-179	180-199	200-219	220-239	240-259	260-279	280-300
Cochin 58 nos.	8	..	..	..	..	..	..	..	..	..	..	3	..	..	..
	9	..	..	..	..	..	..	2	12	10	12	12	..	..	..
	10	..	..	..	..	..	..	4	2	1	..	..	..	..	..
	11	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	Mean	..	..	..	..	..	..	9·6	9·1	9·0	9·0	8·8	..	..	..
Kozhikode 53 nos.	8	..	..	..	..	..	..	..	..	..	1	..	..	..	..
	9	..	..	..	..	..	..	8	9	10	11	..	..	..	..
	10	..	..	4	4	3	..	2	1	..	..	..	..	..	..
	11	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	Mean	..	..	10·0	10·0	10·0	..	9·2	9·1	9·0	8·9	..	..	..	..
Mangalore 53 nos.	1	..	..	..	..	..	..	..	..	..	1	6	4	..	..
	9	..	..	..	..	..	..	..	..	9	16	9	3	..	..
	10	..	..	..	..	..	..	..	..	3	2	..	..	..	..
	11	..	..	..	..	..	..	..	..	..	..	..	..	..	..

	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	Mean	..	..	..	..	..	..	..	..	9·2	9·0	8·6	8·4	..	..
Bhatkal 25 nos.	8	..	..	..	..	..	..	..	..	..	..	9	3	..	..
	9	..	..	..	..	..	..	..	..	..	6	4	3	..	..
	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	11	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	Mean	..	..	..	..	..	..	..	..	..	9·0	8·3	8·5	..	..
Karwar 244 nos.	8	..	..	..	..	..	..	..	..	..	3	5	7	9	..
	9	..	..	..	2	8	14	21	25	26	27	26	14	10	..
	10	..	..	..	2	8	16	10	6	3	2	..	..	..	..
	11	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..
	Mean	..	..	..	9·5	9·5	9·5	9·3	9·1	9·1	8·9	8·8	8·6	8·5	..

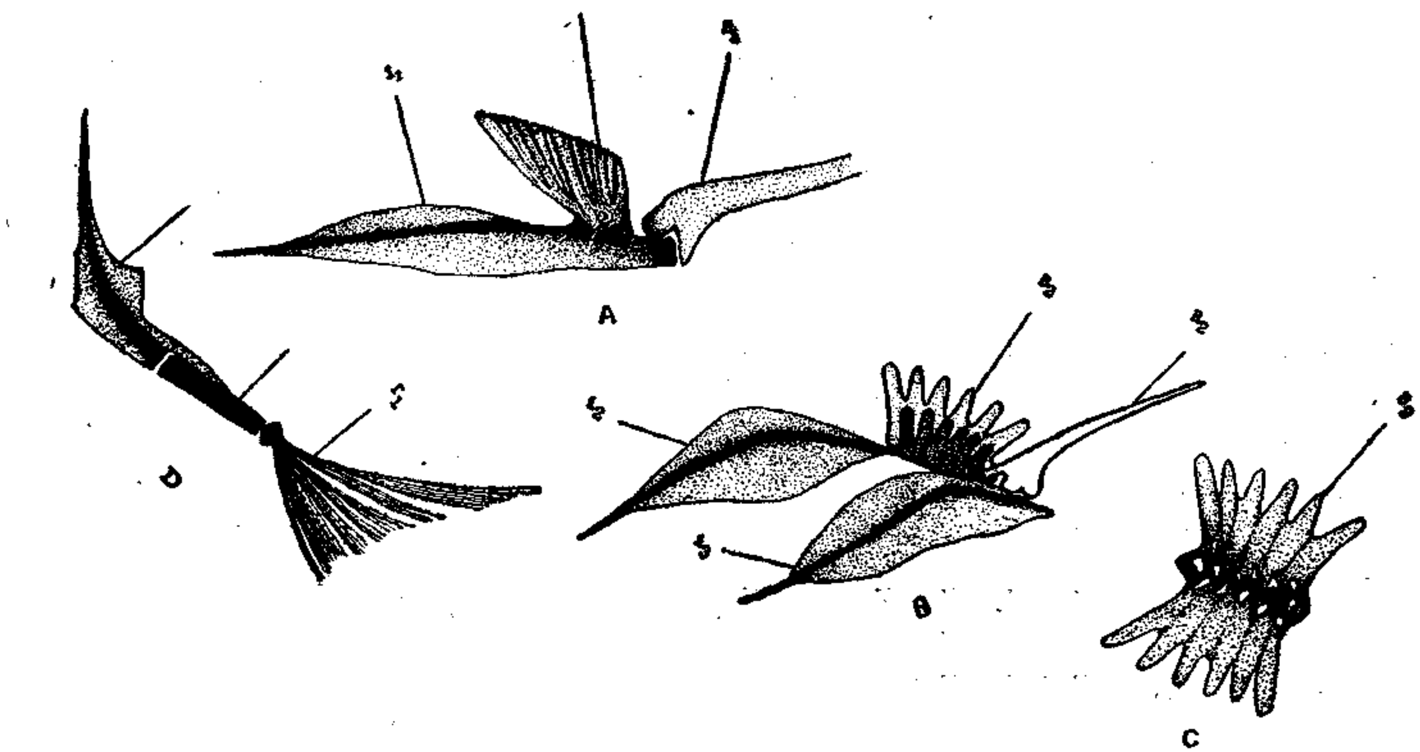

FIG.—2 Details of the structure and arrangements of the ray, the baseost and axonost (lettering as in Fig.1). A, First ray of D_1 with its endoskeletal supports B, Second ray of D_1 with its baseost and interspinous bone; C, Dorsal view of the baseost; D, The anteriormo anal finlet.

The lepidotrich is inserted on the posterior end of this bony buckler which acts as a sort of fulcrum for its swift motion. Collectively these baseosts (10 in number) form the groove of D_1 into which the rays are retracted. The wing-like baseost of the first fin-support is not recognisable. However, there is a long and flat bone placed perpendicularly which is fused with the interspinous bone. (Fig. 2 A, B_1). The first interspinous bone is inserted between the 2nd and 3rd neural spines. Generally the arrangement of interspinous bones is, 1 between 2nd and 3rd neural spines, 1 between 3rd and 4th, 2 between 4th and 5th and one each between the successive spines, the 11th or last one coming between 11th and 12th (Table II). Thus the fin-ray formula is, $D_1, \frac{\text{(I)}.\overline{\text{VIII-XI}}.}{\text{xi}}$

Second dorsal fin and finlets

There are 12 rays in the second dorsal fin. The first ray (Fig. 1, r_1) is considerably shorter than the second which is the longest. The corresponding 12 fin-supports are clearly recognisable in the dyed fish. The two-part endoskeletal structure is recognisable only in the case of the first ray. The axonost and baseost in this case resemble those of D_1. The baseost is, in fact, situated in the interspace between D_1 and D_2. The interspinous bone is immediately behind the last one of D_1, namely, between 12th and 13th neural spines. In the subsequent fin-rays of D_2 the baseost can be recognised as a miniature bony buckler in early juveniles only. In older specimens its identity is lost possibly because of its fusion with the base of the lepidotrich.

The most common pattern of interspinous bones is, one each between 12th and 13th, 13th and 14th, two each between the next four successive pairs of spines, and one each between the next two pairs, the last one being between 19th and 20th neural spines. The 12-rayed D_2 is followed by six finlets (Fig. 1, f_1—f_6 & Plate I). Each of the finlets is made up of a single much-branched (usually 7—8) ray (Fig. 2, D). The two posteriormost ones are situated so close as to give a deceptive appearance of a single finlet in the uncleared state (Fig. 1, f_5 & f_6). Besides, in these two the number of branches of the ray are comparatively less, usually 4—5. Hence they look slightly smaller than the preceding four. In the early juvenile specimens where they are not so close and consequently more easily distinguished as two, they are seen to be connected by a fin-fold just as the other finlets in postlarval state. The two-part system of the fin-support is clearer here, but quite unlike that of D_1. The interspinal (Fig. 2 D) is a strong stout bone, bent at right angles. The baseost (B_{14}) which is a slender straight bone is attached to the upper horizonal half of the interspinal and itself occupies a horizontal position to which is attached the finlet. The interspinous bone of the anteriormost finlet is immediately behind that of D_2, between the 20th and 21st neural spines. The other five follow between pairs of successive vertebral spines, the last one being between 25th and 26th (Table II).

TABLE 2

Pattern of insertion of fin-supports of D_1 D_2 dorsal finlets, anal and anal finlets between vertebral spines.

S. No. of spines	2 & 3	3 & 4	4 & 5	5 & 6	6 & 7	7 & 8	8 & 9	9 & 10	10 & 11	11 & 12	12 & 13	13 & 14	14 & 15	15 & 16	16 & 17	17 & 18	18 & 19	19 & 20	20 & 21	21 & 22	22 & 23	23 & 24	24 & 25	25 & 26	26 & 27	
D_1	1	1	2	1	1	1	1	1	1	1																=11
D_2											1	1	2	2	2	2	1	1								=12
Dorsal finlets																			1	1	1	1	1	1	?	=6+?
Anal												1	2	2	2	2	2	1								=12
Anal finlets																			1	1	1	1	1	1	?	=6+?

The disappearance of ray, as in D_1, has not been observed in the second dorsal fin including finlets. However, the last one or two rays of D_2 may get modified as finlets so as to increase their (finlets) number to 7 or even 8. Conversely, a condition where the anteriormost finlet does not get differentiated but remains as the 13th ray of D_2 is also sometimes seen. An intermediate state where a finlet, though formed, remains attached to D_2 by a membrane is also not uncommon. There are not many specimens with me showing such external modifications. Hence it is difficult to state whether these external modifications affect the structure of internal fin-supports. Moreover, such external modifications are generally met with in large adults where there is a tendency for one or two anterior baseosts of the finlets to fuse with its axonost. The typical formula is, $D_2, \frac{12+6}{(i)+xi+vi}$

The dorsal fin may thus have a total complement of 30 rays in postlarval fish. The number gets reduced to 29 in young fish of 50 mm. Consequent to the disappearance of 1—3 lepidotrichia the number may reach a minimum of 26 in large fish above 230 mm. However, it should not be understood that there is a constancy in the number in fish of comparable sizes. But the endoskeletal structures are always 29. They exhibit such a continuous nature that the fish appears to have a *single* dorsal fin. Nevertheless a noticeable difference in the shape and arrangement of the endoskeletal system does exist (Table 2).

Anal fin and finlets :

The anal fin has 13 rays followed by 6 finlets. However, the corresponding 13 + 6 endoskeletal parts can be counted only in postlarvae and early juveniles. The first ray is much smaller than the second (Fig. 1, A_1). It is easily distinguishable in postlarval specimens. In a young fish, 50 mm in length the ray appears as a spinous stump whereas in a fully grown adult measuring 200 mm it may not be seen unless the fish is cleared and dyed. The identity of its fin-support also gets lost when the fish is about 50 mm in length, possibly because of its coalescence with the second. This fin-support is conspicuously big also (A_1i). In fish above 50 mm there are only 12 + 6 fin-supports.

The structure and pattern of arrangement of anal fin-supports (including those of finlets) resemble those of D_2 with slight difference. The first fin-support (which is probably the product of fusion of two supports) is inserted between the spines of the 13th and 14th vertebrae, as against the 12th and 13th dorsally. It is a one-piece bone in contrast with the two-piece system of its dorsal counterpart. Between the next five successive pairs of haemal spines there are two each, and the last one is immediately below its dorsal counterpart between the spines of 19th and 20th vertebrae. The transformation of fin-rays into finlets and *vice-versa* referred to in the case of the dorsal may be repeated here also. The formula is: $A, \frac{I.12+6}{(i).xii+vi}$ where I & (i) represent respectively the spinous stump of ray and its fin-support which subsequently gets fused with the second one.

Behind the posteriormost fin-supports of both dorsal and anal finlets, between the spines of 26th and 27th vertebrae there is a skeletal structure resembling a baseost (B_{30}). But no corresponding fin-ray has been traced even in the postlarvae.

EVALUATION

As mentioned at the outset, this work was designed to test the utility of fin-ray studies in separating the races in *Rastrelliger kanagurta*. It was obseved that the number of rays in the first dorsal fin decreases with increase in size of fish. The total complement of D_2 with finlets and anal with filnets always remains constant. When an increase or decrease in the number of finlets is occasionally found this is invariably accompanied by a corresponding decrease or increase in the rays of D_2 and anal, as the case may be. Whatever these external modifications are the number of fin-supports remains constant—29 dorsally and 18 ventrally. The differences in the first dorsal counts between authors might have been partly due to the fact that they examined different size groups.

According to de Beaufort (1951, p. 209), Steindachner and Döderlein (1884) observed that the last dorsal spines sometimes disappear in older specimens of *Scomber colias* without leaving a trace. Jones and Silas (1964a, p. 12) say that such a tendency is seen in certain other scombroids also. However, they do not seem to have observed this phenomenon in *Rastrelliger*. They and Jones and Rosa Jr. (1965, p. 1:1) describe the genus thus: "spinous first dorsal and soft rayed second dorsal separated by distance equalling length of base of former". Similarly Jordan and Evermann (1926) have delineated species of sail fish on the basis of interspace between D_1 and D_2. It is thus seen that considerable importance is attached to this interspace in distinguishing species, which character is variable depending on the age, as has been shown now.

Murakami and Hayano (1956, p. 1004) found that the two species of Japanese mackerels, *Pneumatophorus japonicus* and *P. tapeinocephalus* showed differences in the number of rays of D_1 in relation to the total number of fin-supports. Their Tables 5 & 6 (p. 1000) show the differences in the number of rays between small sized and large-sized mackerels. This finding was corroborated by Tamura and Ko (1955, p. 107). Abe and Takashima (1958, p. 4) separate *P. japonicus and P. tapeinocephalus* based on the differences in number of the fin supports. Kramer (1961, p. 436) who studied the development of *Pneumatophorus diego* gives the meristic counts *exclusive of juveniles* and *adults,* The longest specimen in his data measures only 18.90 mm (standard length). Kramer does not seem to have studied the variation in number between the rays and the connecting supports.

As regards dorsal and anal finlets, the present study shows that the typical number should be regarded as 6, and not 5. Matsui also (u.d., p. 60) has observed six finlets, but only in larvae. To quote him: "an important difference between the adult and larva of *Rastrelliger* is that the adult usually has five finlets on the dorsal and anal fins .... Finlet counts are usually six for the larvae and juveniles. The last two finlets fuse to a single base at sometimes after the fish has attained a standard length of 90 mm and before a length of 174 mm". Actually no such fusion takes place in the specimens examined by the author. These two finlets continue to remain separate. Day (1878, p. 251), Manacop (1956, p. 90), Hardenberg (1956), and Jones and Silas (1964b, p. 267) had also sometimes observed 6 finlets in *Rastrelliger kanagurta*. But whether the two posteriormost finlets which are very close have been counted as two is doubtful. Manacop counts six dorsal and anal finlets only in two specimens out of the 77 examined by him, and 5/6 in 3 specimens. Hardenberg "found sometimes more than five finlets either behind the dorsal or behind the anal, never both dorsally and ventrally". Jones and Silas found 6/5 finlets in only one out of the 31 specimens examined from the Andaman sea. A close scrutiny of Plate LIV, Fig. 4 of Day, where the fish is drawn with 6 dorsal finlets will show that the anteriormost finlet has no counterpart on the ventral side. In all such specimens where these authors have counted six finlets there would, perhaps, have been 7 finlets, the anteriormost finlet presumably being a modified ray of D_2 or anal. The possibility of a fin-ray of the second dorsal or anal growing out into finlet is not uncommon in scombroid fishes. In the case of *Rastrelliger brachysoma* this has been particularlly pointed out by Hardenberg. (*op. cit.*)

The other species of *Rastrelliger* or the related genus of *Scomber* have not been examined during the present study. Differences as those noted by Abe and Takashima (1958, p. 4) in *Pneumatophorus japonicus* and *P. tapeinocephalus* may not exist among species of *Rastrelliger*. The Quarterly report of C.M.F.R.I. (1964, p. 8) states that "osteologically tne Indian mackerel and *Rastrelliger brachysoma* are essentially similar and no pronounced differences are noticed". But, according to Holt (1959, p. 50) "a study of the characters of *Rastrelliger neglectus* and *kanagurta* in the Philippines showed that statistically significant differences between mean values exist between them in the number of rays of the anterior dorsal or ventral* fins and in the number of finlets". In this connection, it is interesting to read the note under *Rastrelliger brachysoma* in de Beaufort (1951, p. 210). He says: "I have examined the type in Bleeker's collection in the Leiden museum. It has not 5, as stated by Bleeker, but 6 finlets behind dorsal

*anal ?

and anal". It would be worthwhile to check up whether this type specimen has 7 finlets on either side in the light of the observations made here.

Several specimens in different size groups and from different parts of India have been examined during the present study. The observations do not support the view that the variability in the number of rays in the dorsal and anal fins can be employed in identifying populations, in view of the fact that there is no corresponding variability in the internal fin-supports.

There is much scope for an embryological study of these fishes. The homology of a skeletal structure behind the fin-support of the posteriormost finlet needs thorough study. The question whether it may be an additional endoskeletal structure where the lepidotrich has failed to develop or disappeared during growth, has to be examined. Again, the absence of interspinous bones corresponding to the first rays of the first dorsal and anal fins has to be explained. The comparatively stouter first interspinals in these cases may suggest that there might have been a coalescence of the two endoskeletal structures. Kramer (1961, p. 413) believes that such a fusion takes place in *Pneumatophorus diego*. If this is true, 31 fin-supports could, possibly, be counted on the dorsal side. This gains importance considering the fact that the fish has 31 vertebrae. Detailed embryological studies on these lines might throw fresh light on the general morphology of the median fin-supports and their relation to the axial skeleton. It may be recalled here that "Gegenbaur (1870) and Cope (1890) regarded the median fin radials as derivatives of the axial skeleton which may become secondarily separated off and specialised. Gegenbaur, indeed, considered them to be merely extensions of the neural and haemal spines. According to Cope the several pieces of each ray were simultaneously developed in unes of maximum strain, extended originally from neural arch to fin-base, middle 'axonost', and distal 'baseost'. The axonost afterwards being separated from the spine, became the 'inter-spinal' of Cuvier which together with the baseost supports the fin-base".†

SUMMARY

The dorsal and anal fins of *Rastrelliger kanagurta* (Cuvier) were studied in a wide range of size and from different places on the coast of India. It was found that the number of rays of the first dorsal decreases with increase in size of fish, the endoskeletal structures remaining constant. Hence it would not be correct to use this character in delimiting races. It was also observed that *Rastrelliger kanagurta* has six dorsal and anal finlets and not five as recognised. Instances of increase or decrease in the number of finlets were noticed but this was always made up by a corresponding decrease or increase in the number of D_2 or anal fin rays.

†quoted from Geodrich (1958, p. 89)

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