SOME OBSERVATIONS ON THE BIOLOGY OF THE RIBBON FISH *EUPLEUROGRAMMUS MUTICUS* (GRAY)

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ABSTRACT

In the Kakinada area *Eupleurogrammus muticus* is landed in small quantities in the commercial catches. Occurrence of a total of 245 post-larvae and juveniles of the length (S.L.) range 43-136 mm collected during March 1966 to April 1971 is reported. The phylogenetic significance in the loss of the caudal fin of the genus *Eupleurogrammus*, during ontogeny is discussed. Food and feeding habits, length-weight relationship, relative condition factor, size at sexual maturity, spawning and fecundity are studied.

INTRODUCTION

Except for the description of eggs and larvae (Delsman 1927) tentatively referred to *Eupleurogrammus muticus* (Gray) and some biological notes (James 1967), there appears to be no other published information on the biology of this ribbon fish. In the course of work on the biology and fishery of the ribbon fishes of the Kakinada area, it was observed that while *Trichiurus lepturus* dominated, *E. muticus* is present in small quantities in the commercial catches. The results of a study on the biology of this species are reported here.

MATERIALS AND METHODS

Based on weekly or bi-weekly observations and by sampling 20-100% of the fishing units at the 3 landing centres (See Table 1), monthly and annual estimates of the catch were made. All the fishing units conducted operations off Kakinada (Lat. E 82°—20' to 30'; Long. N 16°—40' to 17°—10') at depths of 5-30 metres. The sample collected on each observation day consisted of 25-50 unsorted ribbon fish. Among them *E. muticus* were either nil or available in very small numbers. For this reason, the biological data for the period March 1966 to April 1971 were pooled and analysed monthwise. Age and growth could not be studied by length-frequency analysis as the total number of fish measured was only 779 (including post-larvae). Examination of otoliths did not reveal growth checks to be of use in age determination. The post-larvae were collected exclusively from trawlnet meshes. From March 1966 to December 67, every month 3-4 sea-trips were made on board the trawlers to collect the post-larvae. In subsequent years the collections were sporadic and during many months no attempt was made to collect them. Three post-larvae measuring 43, 66 and 111 mm in length were deposited in the Reference Collection Museum of the Central Marine Fisheries Research Institute and bear registration No. CMFRI-F, 126|372 b.

Standard length of the fish was measured throughout. Food was studied by the Points method and depending upon the fullness, each stomach was classified as gorged, full, ¾ full, ½ full, ¼ full and traces and allotted 100, 80, 60, 40, 20 and 2 points respectively. The length-weight relationship was studied of 96 females in the size range 33.6-68.6 cm and of 84 males in the size range 22.6-68.7 cm by the least square method using the formula $\log W = \log a + b \log L$ where W is the weight of fish in grams and L the length in centimetres and 'a' and 'b' are constants. The relative condition factor was calculated by the formula $K_n = W/aL^b$ or $W/\hat{W}$, $\hat{W}$ being the estimated fish weight. From the individual values the mean K_n was calculated monthwise and also sizewise. For maturity studies the I.C.E.S. scale was followed. In measuring ova diameter the procedure adopted by Prabhu (1955) was followed and 300 ova were measured in each individual from the middle of the right ovary. James (1967) stated that the distribution of ova in the anterior, middle and posterior regions of the ovary is uniform. Gonad index (G.I.) was constructed in females by the formula G.I. = ovary weight X 10^2 |fish weight. The usual gravimetric method was followed in fecundity studies. Ovary weight was measured to the nearest 0.1 g for G.I. and to the nearest 0.001 g in fecundity studies.

THE FISHERY

Table 1 shows that the contribution of *E. muticus* to the ribbonfish fishery at the 3 landing centres is meagre. At Dummulapeta where non-powered boats operated boat-seines, gill nets and shore-seines the catch of *E. muticus* varied from nil in 1969 to 4101 kg in 1967 and it formed up to a maximum of 3.73% of the total ribbonfish catch. At Uppada where similar craft and gear operated, the catch of *E. muticus* varied from 418 kg in 1970 to 19, 801 kg in 1969 and its percentage in total ribbonfish landings varied from 0.50 to 9.97. It was observed that generally boat-seines got higher catch rates of *E. muticus* than the other two types of nets at both the landing centres. It would appear that good catch of *E. muticus* in 1969 at Uppada was mainly due to the operation of boat-seines in July 1969 when 1360 units landed 16,184 kg of this species while at Dummulapeta there was total cessation of boat-seine operation in the same month. At Kakinada Fishing Harbour, where mechanised boats operated otter trawls, the catch of *E. muticus* varied from 420 kg in 1967 to 1129 kg in 1969 and it formed up to 2.07% of total ribbonfish catch. From Table 1 it is obvious that except at Dummulapeta, peak catches of *E. muticus* were obtained during July-August period. Even at Dummulapeta the maximum catch was in 1967, during July and August. In the commercial catches *E. muticus* has a size range of 18-68 cm.

TABLE 1. *Ribbonfish landings and percentage composition of* E. muticus *in it during 1966-71 of the Kakinada area.*

Landing centre	Type of nets	Year	Total catch in k g.	Ribbon fish catch in kg. (% in total fish)	*E. Muticus* catch in kg. (% in ribbon fish)	Peak months of *E. muticus*	Remarks
Dummu-lapeta	boat-seines, gill nets and shore-seines	1966	1304,804	19,486 (1.48)	536 (2.75)	May	
		1967	1710,244	109,840 (6.42)	4,101 (3.73)	July & August	
		1968	1025,657	20,784 (2.03)	433 (2.08)	May	
		1969	1414,663	9,600 (0.68)	nil ..	nil ..	
		1970	950,402	21,793 (2.29)	560 (2.57)	March	
		1971	506,310	20,652 (4.08)	176 (0.85)	March	11 months data only
Uppada		1967	970,077	265,447 (27.36)	9,664 (3.64)	July-August	10 months data only
	—do—	1968	1908,137	323,098 (16.93)	7,881 (2.44)	May, July-August	
		1969	1593,218	198,544 (12.46)	19,801 (9.97)	July	
		1970	969,414	51,406 (5.30)	418 (0.81)	July-September	
		1971	648,855	98,716 (15.21)	494 (0.50)	July	8 months data only
Kakinada Fishing Harbour	otter trawls	1967	792,403	23,892 (3.01)	420 (1.76)	July-August	
		1968	1679,260	76,483 (4.55)	898 (1.17)	August & October	
		1969	1300,229	54,457 (4.19)	1,129 (2.07)	July, August and September	
		1970	1456,322	59,391 (4.08)	645 (1.09)	July, August and September	
		1971	2308,677	236,230 (10.23)	1,116 (0.47)	August	

THE POST-LARVAE AND THEIR OCCURRENCE

The post-larvae bear general resemblance to the adult fish (Fig 1) and the diagnostic characters of the species such as the presence of median lateral line, 3 dorsal spines and pelvics and the origin of anal fin below D 38-42 are evident in the material. However, they still retain an important larval character, namely the caudal fin (Fig 1A). Post-larvae up to 70-80 mm length also showed serrations on the frontal, the pelvics and the anterior margin of the 3 dorsal spines. The pelvic spine is transformed into a scale like structure, characteristic of the species, when the post-larvae reach 65-85 mm length. Identification is further confirmed by Alizarin staining of 4 post-larvae of the length 43, 55, 58 and 65 mm which gave the following range for the meristic characters studied: total vertebrae 190-193; precaudal vertebrae 39-41; caudal vertebrae 151-153; dorsal fin rays III, 142-146; dorsal extends up to vertebrae number 145-149; anal fin rays i + I, 115-119; anal extends up to vertebrae number 155-160 (in the 43-mm specimen only precaudal vertebrae counted as calcification is incomplete in the post-caudal region). In the 66-mm specimen (Fig. 1. A) the rays at the caudal fork are filamentous and some of them measured 8.3 mm. The caudal fin has 6 thickly pigmented lobe-like projections, 3 above and 3 below the elongated middle rays. The 'lobes' contain a number of rays packed compactly. At the time of shedding of the caudal fin the 'lobes' break up

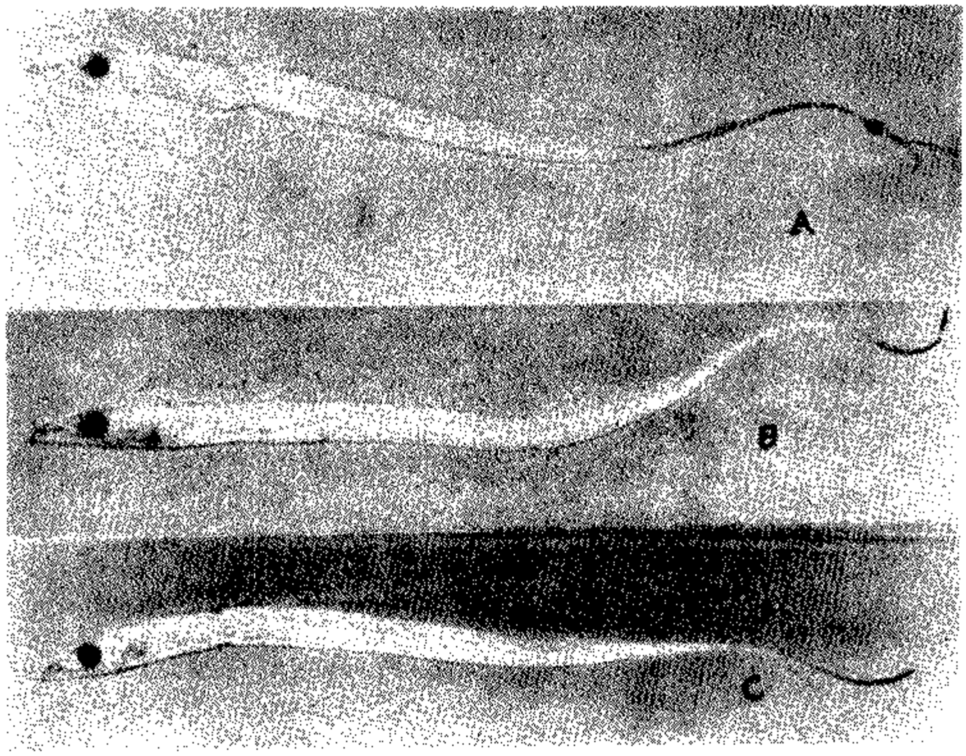

FIG. 1. A. 66-mm post-larvae showing caudal fin, with elongated middle caudal fin rays.
B. 100-mm post-larva showing the caudal fin partly shed.
C. 117-mm juvenile without caudal fin.

TABLE 2. *Occurrence of the post-larvae and juveniles of* E. muticus. (*Also shown is the size at which caudal fin is shed.*)

Month	66 Mar	Apr	Jun	July	67 May	July	Sep	68 Apr	69 Apr	Sep	71 Aug	Pooled	Number with caudal fin	% with caudal fin
Length in mm														
41-50	—	—	2	—	1	41	—	3	—	—	1	48	48	100
51-60	1	1	1	—	1	30	—	2	2	1	—	39	39	100
61-70	—	—	1	—	1	34	1	9	3	2	—	51	51	100
71-80	—	2	—	—	—	16	—	6	2	2	7	35	35	100
81-90	—	1	—	1	—	10	—	4	—	3	8	27	27	100
91-100	—	1	3	—	—	5	—	9	1	3	6	28	28	100
101-110	—	—	3	1	—	1	—	5	—	—	3	13	13	100
111-120	—	—	—	—	—	1	1	2	—	—	—	4	3	75
121-130	—	—	—	—	—	—	—	1	1	—	—	2	1	50
131-140	—	1	—	—	—	—	—	1	1	—	—	3	—	—
Total	1	6	10	2	3	138	2	42	10	11	25	250	245	
Min. size	54	56	44	85	45	43	63	45	60	51	48	43	43	
Max. size	—	136	105	102	69	111	113	133	131	96	108	136	121	

exposing the rays and are usually shed first, followed by the middle, filamentous rays. The caudal fin is still retained by 50% of the specimens in the 121-130-mm size range (Table 2) and completely shed beyond this size range. As per the terminology suggested by Jones (1967), specimens up to 130-mm length may be called post-larvae after which length they pass into the juvenile stage with the loss of caudal fin. The smallest specimen without caudal fin measured 117 mm (Fig. 1. C) and the largest specimen with caudal fin partly shed, measured 124 mm.

In 1966 the post-larvae occurred during March, April, June, and July (Table 2). In 1967 they were available during May-July and September. During the subsequent years they were collected in April, August and September. On the whole, the post-larvae occurred from March through September during different years. The 41-50-mm group occurred in April-August, the 51-60-mm group were collected in all the months except August, the 61-70-mm group was available during April-July and September, the 71-80- and 81-90-mm groups were recorded in April and July-September. The 91-100-mm group was present in April and June-September collections while the 101-110-mm group occurred during April and June-August. Thus all the length groups up to 110 mm were collected for 4-6 months during different years.

Post-larvae: A high percentage (22%) of empty stomachs was encountered. Cannibalism was not noticed. Average feeding intensity was 23.6 points which showed that the stomachs were more than a quarter full. Among the gut contents

FOOD

(Fig. 2A), fish were dominant, mostly represented by anchovy larvae. The calanoid copepods ranked second and were represented by *Euchaeta marina*, *Rhincalanus cornutus*, *Eucalanus* spp, *Paracalanus* spp etc. Prawns, mostly penaeids, were represented by their larval forms.

Juveniles: The incidence of empty stomachs was low (6.8%). Cannibalism was observed in 2 specimens, measuring 40.9 and 42.5 cm length. Average feeding intensity was 31 points which indicates that the stomachs were 3|8 full.

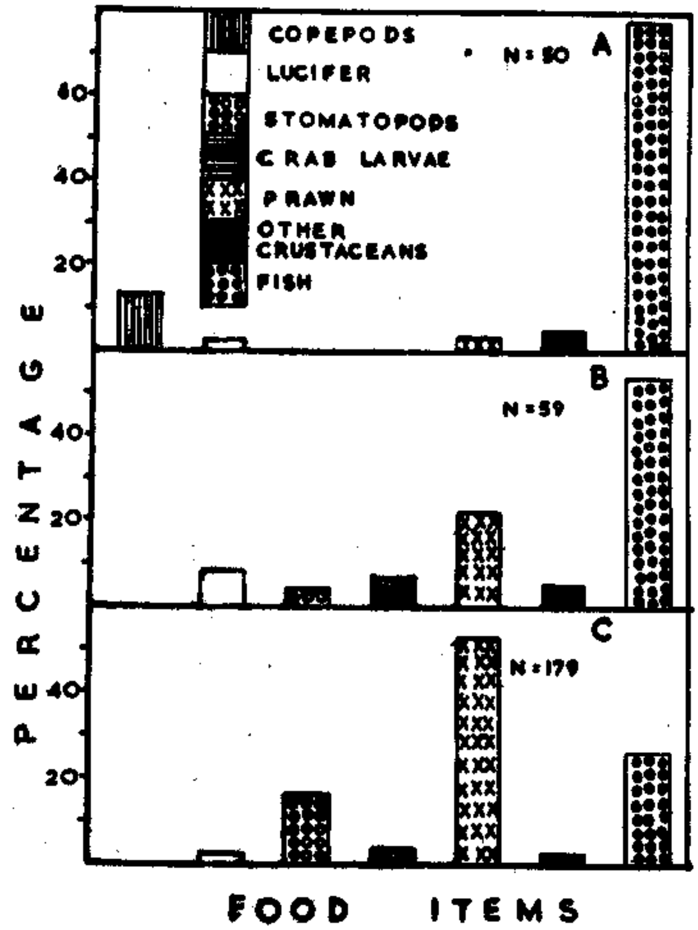

FIG. 2. Histogram showing the food items of the ribbon fish, *E. muticus*.
A. Post-larvae (mean size 74 mm);
B. juveniles (mean size 305 mm);
C. adults (mean size 539 mm).

Among the important food items (Fig. 2 B) fishes (larval and juvenile forms of clupeoids, carangids etc.) ranked first followed by prawns (*Acetes* spp. and post-larvae and juveniles of penaeids), *Lucifer* and crabs.

Adults: Only 5.4% of the fish had empty stomachs. Cannibalism was absent. The average feeding intensity was poor (15.6 points) and the stomachs were less than a quarter full. The fish showed marked preference for prawns (*Acetes* spp. and Penaeids) followed by fish, mostly juveniles of *Stolephorus* spp, *Sardinella* spp. (Fig. 2 C). Stomatopods ranked third and were represented by alima larvae only.

LENGTH-WEIGHT RELATIONSHIP

The logarithmic regression equations obtained are as follows:

Males: $\log W = -4.2705 + 3.5560 \log L$

Females: $\log W = -4.1491 + 3.4848 \log L$

Analysis of covariance (Snedecor 1961) of the two regression equations showed (Table 3) that both the slopes and elevations do not differ significantly. Hence the sexes were combined and the resultant regression line is shown in figure 3 and represented by the equation:

$$\log W = -4.2165 + 3.5233 \log L$$

The correlation coefficient for the regression was found to be 0.986 (d.f. = 178, r 5% = 0.147 and r 1% = 0.192) which is significant.

The t test was applied to see whether the regression coefficient (b) differs from 3. The value of t was 37.47 (d.f. = 178, t 1% = 2.58 and t 5% = 1.96); hence the regression coefficient is to be regarded as significantly different from 3.

TABLE 3. *Comparison of the regression lines of the length-weight relationship of* E. muticus

	d.f.	Σx^2	Σxy	Σy^2	b	Deviations from regression *d.f.*	S.S.	M.S.
Within								
Males	83	0.6052	2.1521	7.8674	3.5560	82	0.2145	0.002616
Females	95	0.4633	1.6145	5.8877	3.4848	94	0.2615	0.002782
Pooled (within)						176	0.4760	0.002704
Common	178	1.0685	3.7666	13.7551	3.5251	177	0.4774	0.002697
Slope						1	0.0014	0.0014
Between	1	0.3110	1.0938	3.8484				
Total	179	1.3795	4.8604	17.6035		178	0.4788	
Adjusted means						1	0.0014	0.0014

Comparison of slope: F = 0.52 (d.f. = 1,176) F5% 3.90

Comparison of elevations: F = 0.52 (d.f. = 1,177) 1% 6.78

Condition of the Fish

The Kn values are high in January, March-April, June-July and September (Fig. 4) and low in May, August and December. The fish are mostly mature in May-August and October-November and immature during the other months. The relative condition factor shows correlation with the maturity of the fish in June-August and December. The feeding intensity is high in January-February, September-October and December and low in March-August. The Kn shows correlation with feeding intensity during January, May, August and September.

The relative condition in relation to fish length (Fig. 5) is high at 33 cm, falls steeply at 37 cm and alternately rises and falls until 51-cm length. There is a sharp rise in the Kn at 43 cm and majority of the fish (61.1%) are sexually mature at this length (Fig. 6).

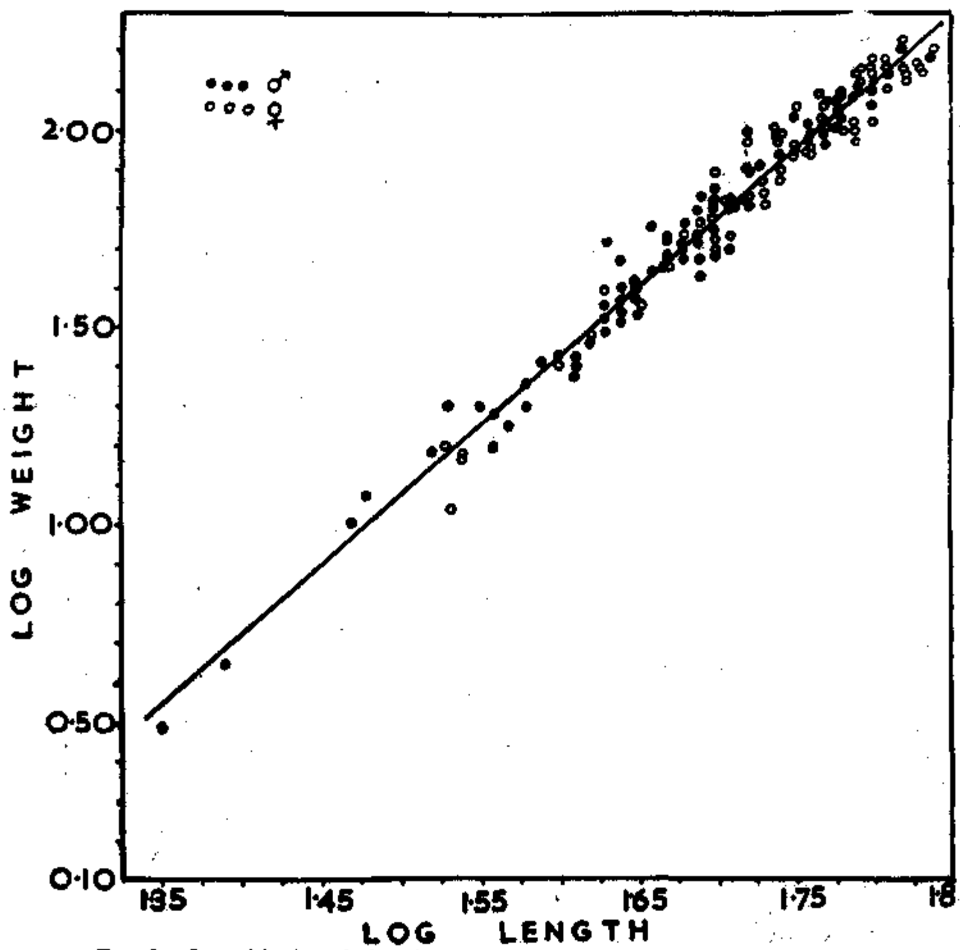

Fig. 3. Logarithmic relation between length and weight in *E. muticus*.

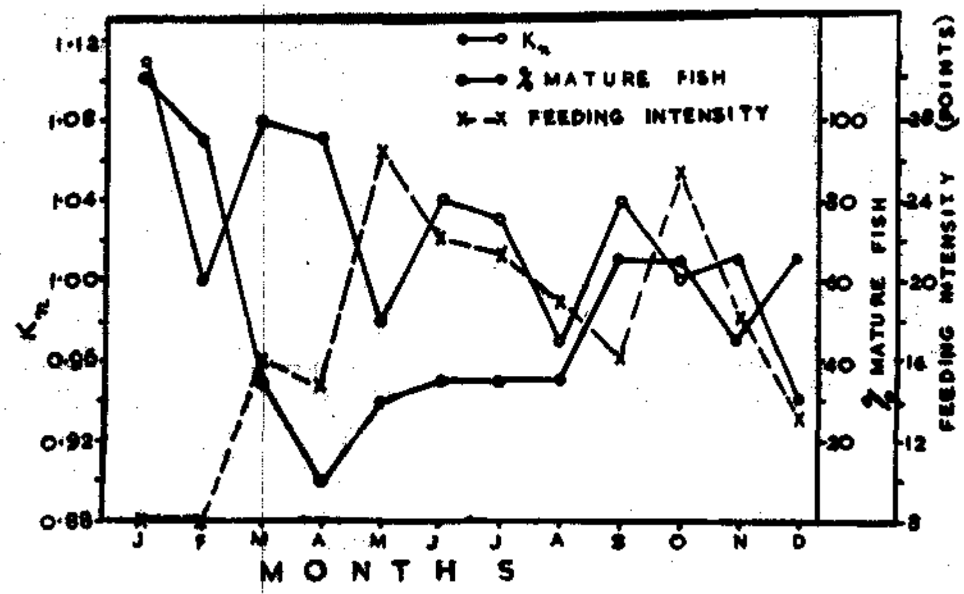

FIG. 4. Monthly fluctuations in the relative condition factor in *E. muticus*.

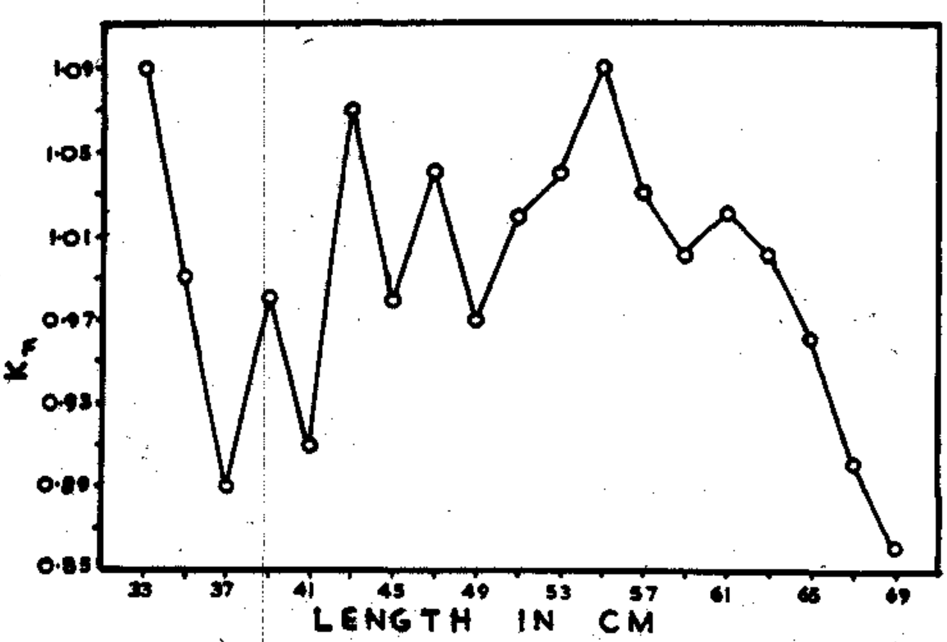

FIG. 5. Mean K_n values at different length in *E. muticus*.

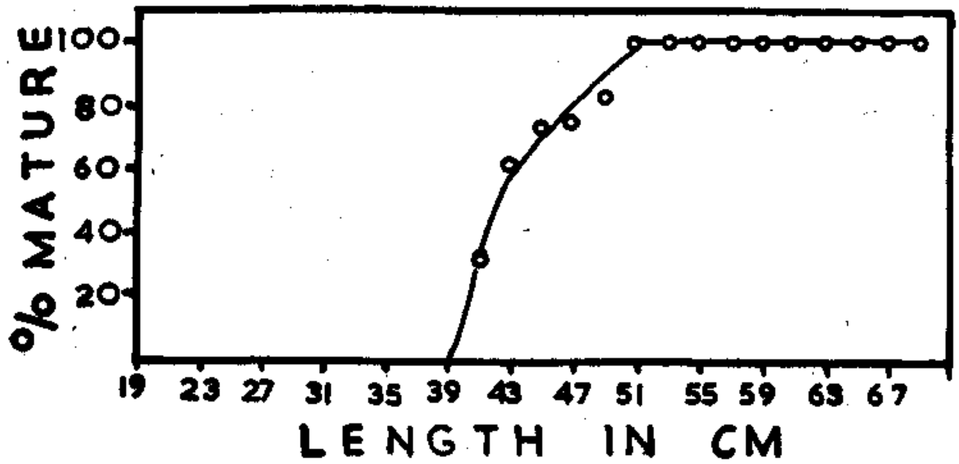

FIG. 6. Size at sexual maturity in *E. muticus*.

SIZE AT FIRST MATURITY

The percentage occurrence of mature fish at 2-cm length groups show (Fig. 6) that 33.3% are mature at 41 cm and majority of fish (61.1%) at 43 cm. Cent percent maturity was attained at 51-cm length. The smallest fish with spent gonads measured 40.5 cm.

SPAWNING

Percentage occurrence of mature fish: While immature fish (stages I & II) were available throughout the year (Fig. 7) mature fish (stages III to V; stage VI being absent in the collections) occurred in considerable proportion during May-November period. Spent fish (stage VII) formed a high percentage during November-March and generally showed spent resting stage while in the spent fish collected during May-October the ovaries were shrunken and often blood-shot, indicating recent spawning. The occurrence of a high proportion of mature fish, particularly stage V, in May-November and spent fish with indication of recent spawning in the same period and the occurrence of a large proportion of spent resting fish during November-March indicate active spawning in *E. muticus* during the May-November period. However, due to nonavailability, only few fish were studied during December-April (Fig. 7) and hence the picture for this period is not clear.

Gonad index: The gonad index is high for 7 months, April to October (Fig. 7) which suggests that spawning in *E. muticus* is spread over this period. This is largely in agreement with the spawning period arrived at by the maturity studies.

Periodicity of spawning in individual fish: In Fig. 8 are given the ova-diameter frequencies of different maturity stages. In all the stages vast majority of the ova present are below 8 m.d. (34 m.d. = 1 mm) and are translucent and invisible

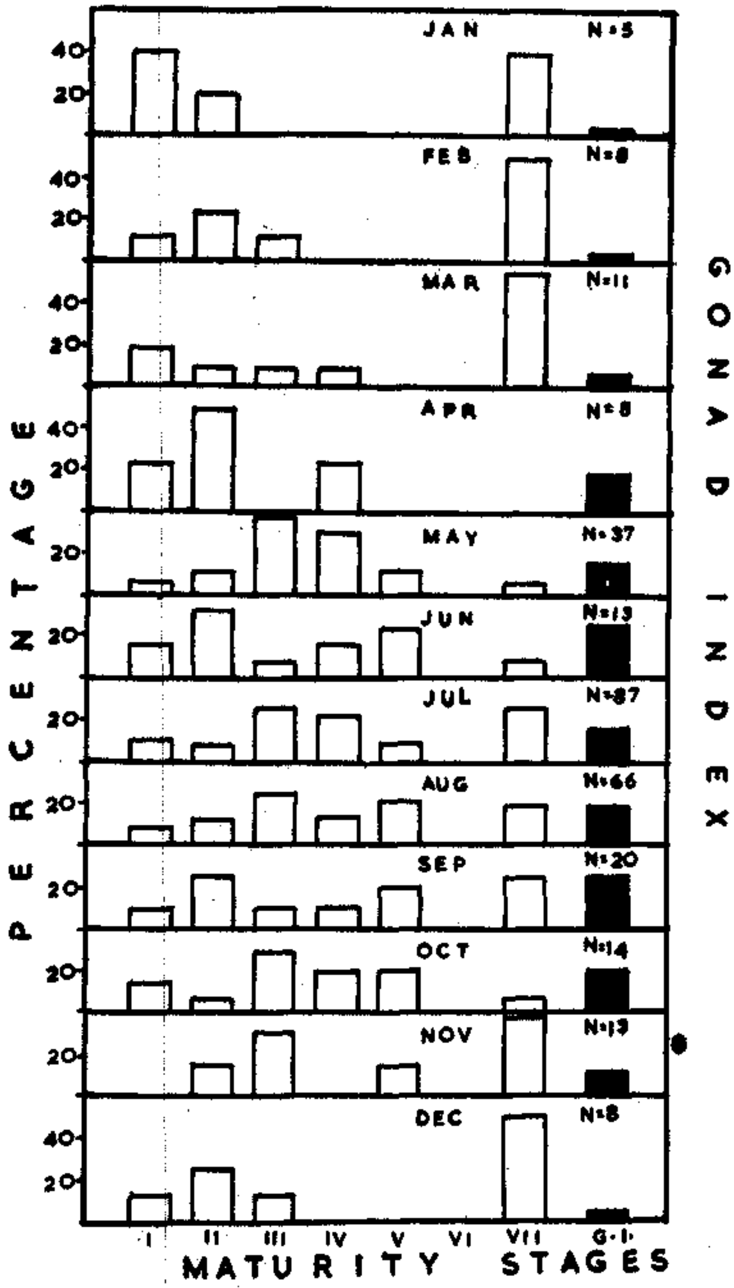

FIG. 7. Percentage occurrence of mature fish, and gonad index during different months in *E. muticus*. N: number of fish studied; G.I: Gonad index.

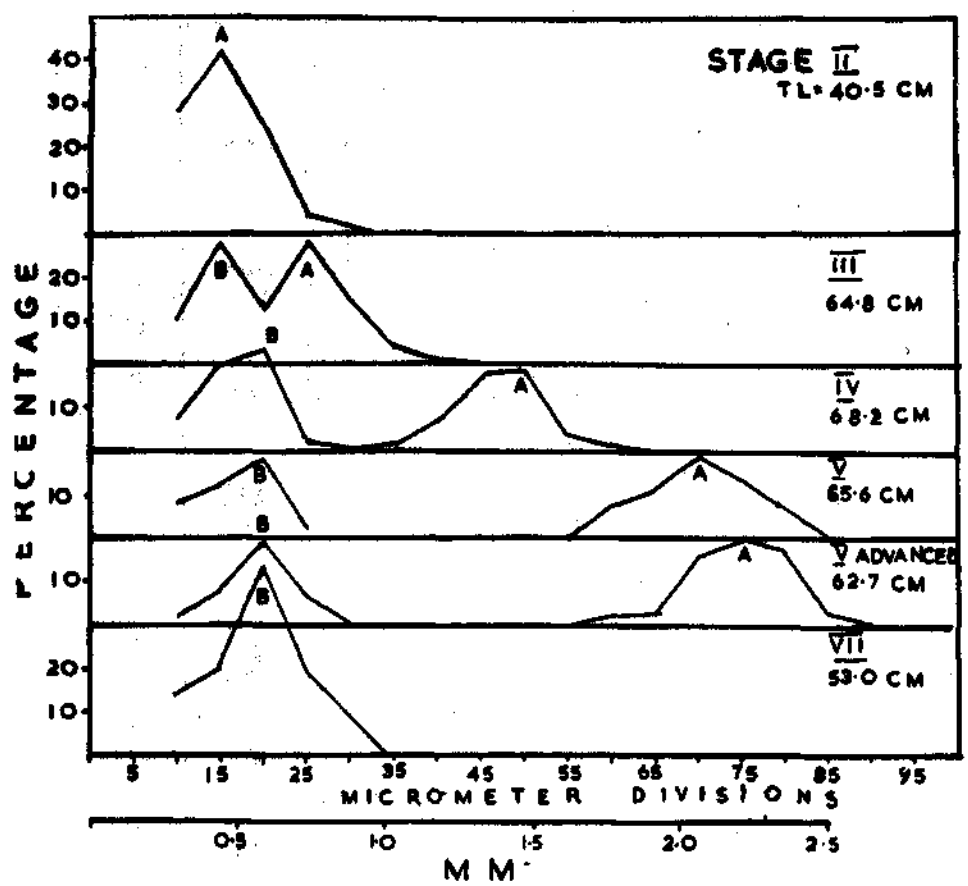

FIG. 8. Ova-diameter-frequency distribution at different stages of maturity in *E. muticus.*

to the naked eye. They form a mode around 5 m.d. and are not represented in the ova diameter polygons. Also stage I, which is exclusively formed of such ova, is not shown in the figure. In stage II there is a mode at 15 m.d. In the next stage two modes are discernible, 'A' at 25 m.d. and 'B' at 15 m.d. In stage IV while 'A' rapidly moved to 50 m.d., 'B' progressed to 20 m.d. In stage V mode 'A' moved to 70 m.d. and 'B' remained stationary at 20 m.d. In an advanced stage V ovary, 'A' progressed to 75 m.d. and some ova were fully transparent suggesting that spawning of this group of ova is imminent. Both in this stage and in the spent cndition (stage VII) mode 'B' remained stationary at 20 m.d. The compact nature and the sharp differentiation of mode 'A' from 'B' indicates that in individual fish the duration of spawning for group 'A' ova will be of a very short time. Since group 'B' remained stationary, concurrent with the rapid development of group 'A', it is reasonable to assume considerable time lag for group 'B' ova to increase in length and spawn after the shedding of group 'A' ova.

In the absence of knowledge about this time lag it is difficult to answer the question about the number of times an individual fish spawns during the season. Since the spawning period in *E. muticus* is prolonged and extends for the major part of the year (see discussion) the possibility for an individual fish to spawn more than once during the spawning season cannot be ruled out. Also the prolonged spawning period can be explained by assuming that different individuals spawn during different times which gives a picture wherein the spawning time in an individual fish will be of a short duration but the spawning period for the population is a prolonged one.

FECUNDITY

In Table 4 are given the number of mature ova from 25 fish. Fecundity varied from 2362 to 4853 ova per fish and generally increased with the increase in fish length. Fecundity per gram-weight of fish varied from 19.3 to 35.5 ova.

TABLE 4. *Fecundity in* E. muticus

S.N.	Date	Fish length (cm)	Fish weight (gm)	Maturity stages	Ovary weight (gm)	Fecundity	Fecundity per gm weight of fish
1.	30-7-71	50.8	75	IV	4.318	2665	35.5
2.	16-6-70	52.5	75	V	9.005	2362	31.5
3.	25-6-71	53.8	90	V	4.315	2992	33.2
4.	26-7-69	56.1	90	IV	4.080	2690	29.9
5.	23-5-68	57.8	115	IV	3.533	3311	28.8
6.	13-8-66	58.2	108	V	12.682	3365	31.1
7.	29-9-70	58.2	115	IV	6.150	3728	32.4
8.	26-7-69	58.4	105	IV	4.445	3045	29.0
9.	26-7-69	59.2	120	IV	5.145	3718	31.0
10.	23-6-66	59.7	110	IV	3.005	3439	31.7
11.	28-10-68	60.4	123	V	16.500	3652	29.7
12.	26-7-69	60.8	120	IV	4.492	4188	34.9
13.	13-8-66	62.5	120	V	9.823	2825	23.5
14.	25-9-68	62.7	132	V	14.873	2555	19.3
15.	26-7-69	62.7	143	IV	8.094	4853	33.9
16.	19-10-66	63.3	132	IV	4.775	4290	32.5
17.	25-9-68	63.4	155	V	20.930	3394	21.9
18.	26-8-66	64.5	136	V	6.193	4397	32.3
19.	26-7-69	64.7	133	IV	4.901	4387	33.0
20.	22-5-68	65.3	135	V	6.143	4056	30.0
21.	22-5-68	65.3	135	V	6.135	4146	30.7
22.	10-7-70	65.6	175	V	9.215	4151	24.0
23.	7-8-70	66.8	148	V	7.178	4420	29.9
24.	26-7-69	67.3	145	IV	5.893	4653	32.1
25.	16-12-67	68.4	150	III	3.904	4117	27.4

Discussion

Recently, James (1967) observed a rudimentary caudal fin in a 50-mm specimen of *E. glossodon*. James believed that the name *E. intermedius* has priority over *E. glossodon*, but recently Wheeler (1971) has shown that the former is a junior synonym of *E. glossodon*. The post-larvae of *E. glossodon* in the possesion of the present author also show the caudal fin, which is shed in 61.8%, 97.6% and cent percent of the spcimens in the size range (S.L.) 51-60, 61-70 and 71-80 mm respectively. Th presence of caudal fin in both the species of *Eupleurogrammus* demonstrates their close relationship. Tucker (1956) writes "authors have regarded the ecaudate genera "as degenerate" simply because of their lack of a caudal fin. This is a very hasty and unwise opinion; in fact, *Eupleurogrammus* is one of the most advanced". Further he pointed out that the loss of the caudal fin is a character at work in evolution among the members of Trichiuridae. Applying Recapitulation Theory to the observations made here on the caudal fin in the ontogeny of *Eupleurogrammus*, the present study conclusively proves that fishes which possess caudal fin in adult stages are primitive with respect to that character, when compared to those which lack caudal fin. The present study therefore supports Tucker's view that *Eupleurogrammus* is one of the most advanced and that the loss of the caudal fin depicts an evolutionary trend in Trichiuridae. In the generic diagnosis of *Eupleurogrammus*, Tucker (1956) and James (1967) stated that caudal fin is absent. In the light of the present study it would be appropriate to state that caudal fin is present in the young stages and absent in the adults.

Even though the post-larvae were collected from bottom trawls, they are pelagic in habitat as revealed by the planktonic nature of their gut contents and were obviously caught in the nets at the time of hauling. Similar conclusion was reached by Narasimham (1972 b) in the case of the young stages of another ribbon fish, *Trichiurus lepturus* of the length range 37-120 mm.

Studies on the food and feeding habits of other ribbon fishes showed that the medium sized juveniles and adults are essentially carnivorous in nature with marked preference for bony fishes and crustaceans and even resorting to cannibalism on a few occasions (Prabhu 1955; James 1967; Vijayaraghavan 1951). In the present study *E. muticus* showed similar feeding habits.

The regression coefficient in the length-weight relationship of *E. muticus* was found to be significantly different from 3. In other ribbon fishes studied James (1967), Gupta (1967 and 1968) and Narasimham (1972a) observed that the regression coefficient is significantly different from 3. In all the cases the weight of the fish increased at a higher rate than the cube of length.

In the present study the relative condition factor showed correlation for some months both with the feeding intensity and sexual cycle. In other ribbon fishes studied, Gupta (1967 and 1968) and Narasimham (1972a) observed that the fluctuations in the Kn values during different months are influenced to a certain extent by feeding intensity or sexual cycle, while James (1967) could not relate them to any known factors.

A 59.5-mm specimen of *E. glossodon* was believed by James (1967) to be 2 months old. In *T. haumela* (= *T. lepturus*) Prabhu (1955) stated that within one and half months after spawning the post-larvae reach a length of 70-90 mm with which view the present author (Narasimham 1972b) agreed. On the assumption that in the earlier stages *E. muticus* shows comparable growth rate and by tracing back the different size groups given in Table 2, the spawning period was determined as February-August. This has advanced by 3 months of the spawning period indicated by the maturity studies. Since only a few fish were period was determined as February-August. This has advanced by 3 months the spawning period indicated by the maturity studies. Since only a few fish were used in the maturity studies during December-April, it may be possible to conclude that *E. muticus* may spawn for the major part of the year extending over February-November. However, as the data are pooled for different years and as spawning is closely related to environmental conditions which may differ between years, it is possible that the species may not spawn all through the 10 months every year.

The absence of fish in spawning condition in commercial catches together with the absence of eggs and larvae referrable to *E. muticus* in the plankton samples collected on a number of occasions from the fishing ground by a ½-metre plankton net made of fine organdy cloth indicate that the present fishing grounds (5-30 m in depth) are not the spawning grounds of *E. muticus*. However, the post-larval collections for a period of time indicate that the species spawns off Kakinada in the offshore waters. Similar conclusion was reached by the present author (Narasimham 1972b) in the case of *T. lepturus* and James (1967) in *E. glossodon*.

By studying the ova-diameter frequency of a single specimen of *E. muticus* James (1967) stated that the species spawns more than once a year. This possibility was borne out by the present study. Other ribbon fishes studied, namely, *E. glossodon*, *T. lepturus* and *Lepturacanthus savala* are also believed to spawn more than once a year (James 1967 and Tampi *et al.* 1971).

In two specimens of *E. muticus* measuring 49.5 and 60.0 cm S.L. a total of 1327 and 2087 mature ova respectively were counted by James (1967). In the present study 50.8 cm fish has 2665 ova, 59.7 cm fish 3439 ova and 60.4 cm fish 3652 ova. Thus the fish studied by the present author seems to be more fecund.

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