

Biology & Fishery of *Leiognathus brevirostris* (Valenciennes) from the Palk Bay & the Gulf of Mannar

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Age and growth, reproduction, food and feeding habits, and fishery of *L. brevirostris* from the Palk Bay and the Gulf of Mannar are described, based on material collected from commercial catches landed by different fishing gear during 1969. Life span of the species is about 2 yr, attaining a size of about 60 and 120 mm at the end of 1st and 2nd yr respectively. Female fish matures at about 63 mm and the male at 68 mm when they are just about 1 yr old. Female produces a maximum number of 16243 eggs. The species spawns throughout the year with intense spawning in May/June and October/November. Individual fish appears to spawn twice in an year. Diatoms, copepods, *Lucifer*, nematodes and polychaetes form important food of the species. The Commercial fishery is based on 1 and under 2 yr old fish, the dominant size range being 62 to 105 mm. Fishing grounds are confined up to 12 m in the Palk Bay and 25 m in the Gulf of Mannar. Females appear to be caught in greater numbers than males. Since the species is short lived and breeds at the end of 1st yr, the present methods of exploitation appear to leave enough brood for replenishment of the stock and ensure maximum utilization of the resource.

FISHES of the family Leiognathidae, popularly called the silver-bellies contribute substantially to the fishery in the Palk Bay and the Gulf of Mannar. Important species in these areas include *Leiognathus jonesi*, *L. dussumieri*, *L. brevirostris*, *L. bindus* and *Secutor insidiator*. Hitherto, investigations on this group of fishes from India have been few¹⁻¹⁰. However, a detailed study of the biology and fishery of *L. brevirostris* has not been attempted so far. The present paper deals with the age and growth, reproduction, and food and feeding habits of this species.

Age and Growth

Age and growth of the fish was determined by length frequency analysis as no clear seasonal marks were found on otoliths, cleithrum and supra-occipital bones (hard parts).

Length Frequency Distribution

Samples of the fish caught in trawl nets, shore seines and gill nets were obtained from Palk Bay (Mandapam, Pamban and Rameswaram) and Gulf of Mannar (Mandapam, Vedalai and Maraikyarpattanam) during 1969. Males and females were treated separately in order to find out differences in growth, if any, sex-wise. Fish from different places and different gear were also treated separately. They were grouped into 5 mm size groups by total length, and the progression of the modes studied. Since the species spawns almost throughout the year, progression of the modes was followed over short periods to obtain average monthly rate of growth

from which approximate sizes at different ages were calculated.

Mandapam (Palk Bay)—Data were collected from March to November 1969 (Fig. 1).

Male: Size range was 63 to 115 mm with modes at 80, 90 and 100 mm in March, 58 to 117 mm with a single mode at 95 mm in April, and 43 to 117 with modes 75, 90 and 100 mm in May. In May, small fishes entered the commercial catches in large numbers. Size range was 58 to 112 mm with modes at 70 and 85 mm in June, 48 to 122 mm with modes at 85 and 105 mm in July, and 48 to 117 mm with modes at 65, 90 and 105 mm in August. Young fish entered the commercial catches in August also. In September, the size varied from 53 to 112 with modes at 65, 80 and 90 mm and in November, 68 to 97 mm with a single mode at 75 mm.

Rate of growth was estimated by the following shift in the modes: mode at 80 in March to 90 in May; 90 in March to 95 and 100 in April and May respectively; 55 in May to 65 and 80 in July and October respectively; 70 in June to 85, 90 and 95 in September, October and November respectively; and 75 in May to 85 and 90 in July and August respectively. The above shift suggests a rate of growth of 5 mm/month.

Based on the above trend in growth at a rate of 5 mm per month after the fish entered the fishery, it could be assumed that in 1 yr the fish attains a size of at least $12 \times 5 \text{ mm} = 60 \text{ mm}$. But the rate of growth before it entered the fishery must have been faster than the growth after it entered the fishery and hence the size should not be less than 60 mm at the end of 1st yr.

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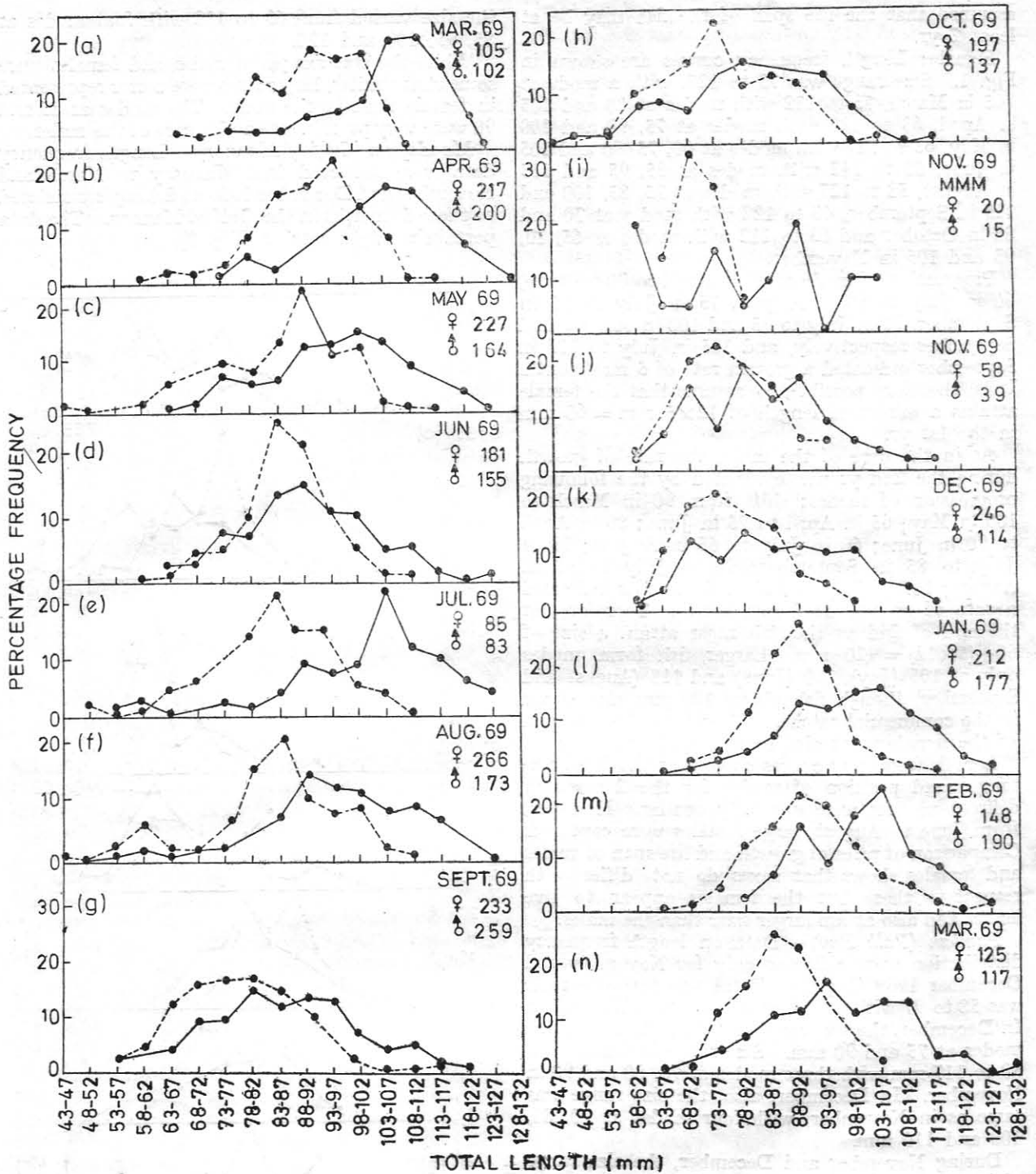


Fig. 1 — Length frequency distribution of *L. brevirostris* from Palk Bay [Trawl catch; a to i, from Mandapam; j and k, from Pamban; and l to n, from Rameswaram. ●—●, male and ●---●, female. Numbers indicate fish counted]

Rate of growth after completion of 1st yr was estimated by tracing a few conspicuous modes above 60 mm for short intervals. Shift in the mode at 80 in March to 90 in May and 105 in August; 90 in March to 95 and 100 in April and May respectively; 85 in July to 90 in August indicated a rate of growth of 5 mm in a month during the course of 2nd yr. The length at the end of 2nd yr on this basis, must be $60 + (5 \times 12) = 120$ mm. But the

maximum size of fish as a group in the commercial catches is represented by the mode at 105 mm (August), which according to the above growth rate, should be 1 yr 9 months. Therefore, the commercial catches which are composed of fish from about 65 to 105 mm should be about 1 yr to 1 yr 9 months old. Though fish measuring 120 mm do not form distinct modes, since fish of this size and above also occur in the commercial catches, it could be

assumed that the life span of the fish may be at least 2 yr.

Female: Length frequency curves are shown in Fig. 1. Size range was 73 to 127, with a mode at 105 in March, 73 to 132 with modes at 80 and 105 in April, 63 to 127 with modes at 75, 90 and 100 in May, 63 to 127 with modes at 60, 75, 90 and 105 in June, 53 to 142 with modes at 65, 95 and 115 in August, 58 to 127 with modes at 75, 85, 100 and 115 in September, 48 to 122 with modes at 70 and 85 in October and 63 to 112 with modes at 65, 80, 95 and 105 in November.

Progression of mode at 80 in April to 90 in June, 60 in July to 65 in August, 75 in July to 85 in September, 90 in July to 95 and 100 in August and September respectively, and 105 in July to 115 in September indicated a growth rate of 5 mm/month. It is, therefore possible, to assume that the female attains a minimum length of $12 \times 5 \text{ mm} = 60 \text{ mm}$ in the 1st yr.

As in the case of the male, the rate of growth during the 2nd yr was estimated by the following progression of modes: shift from 90 in March to 100 in May; 65 in April to 75 in June; 80 in April to 90 in June; 60 in July to 65 in August; 75 in July to 85 in September; 90 in July to 95 in August; 105 in July to 115 in September indicated a rate of growth of 5 mm/month. Therefore, at the end of 2nd yr the fish must attain a size of $60 + (5 \times 12) = 120 \text{ mm}$. Larger fish form modes only at 105 (July), 110 (June) and 115 (August and September) though fish above 120 mm also occur in the commercial catches. Therefore, the life span of the female must also be at least 2 yr.

Length frequency curves show that the total size ranges and position of modes for the 2 sexes in different months were generally similar. However, from June to August, large females were captured. Comparison of rates of growth and life span of males and females shows that sexes do not differ with respect to these but the females appear to live longer and also attain larger sizes than the males.

Pamban (Palk Bay)—Data on length frequency distribution were collected only for November and December 1969 (Fig. 1). Total size range in male was 58 to 97 with a single mode at 75 in November. In December, the size range was 58 to 102 with two modes at 75 and 90 mm. Size range in female was 58 to 117 mm with three modes at 70, 80 and 90 in November. In December, also, the size range was same as in November, with four modes at 70, 80, 100 and 110 mm.

During November and December, the size range of females was larger than that of males and hence more modes were represented in the former than in the latter.

Rameswaram (Palk Bay)—Length frequency data were collected from January to March 1969 (Fig. 1). Size of male varied from 68 to 117 with a single mode at 90 in January, 63 to 127 with a single mode at 90 mm in February, and 68 to 112 with a single mode at 85 mm in March.

Size range in female was 63 to 127 with modes at 90 to 105 in January, 78 to 127 with two modes as in the previous month in February. In March,

the size varied from 63 to 132 with four modes at 85, 95, 100 and 120.

While the size ranges of males and females were somewhat similar, larger sizes were better represented in female than in the male. The modes at 85 and 90 were very prominent in the case of the males.

Mandapam (Gulf of Mannar)—Length frequency data were collected from January to March and November and December 1969 as fishing is restricted to these 5 months in the Gulf of Mannar. The data pertain to night catches (Fig. 2).

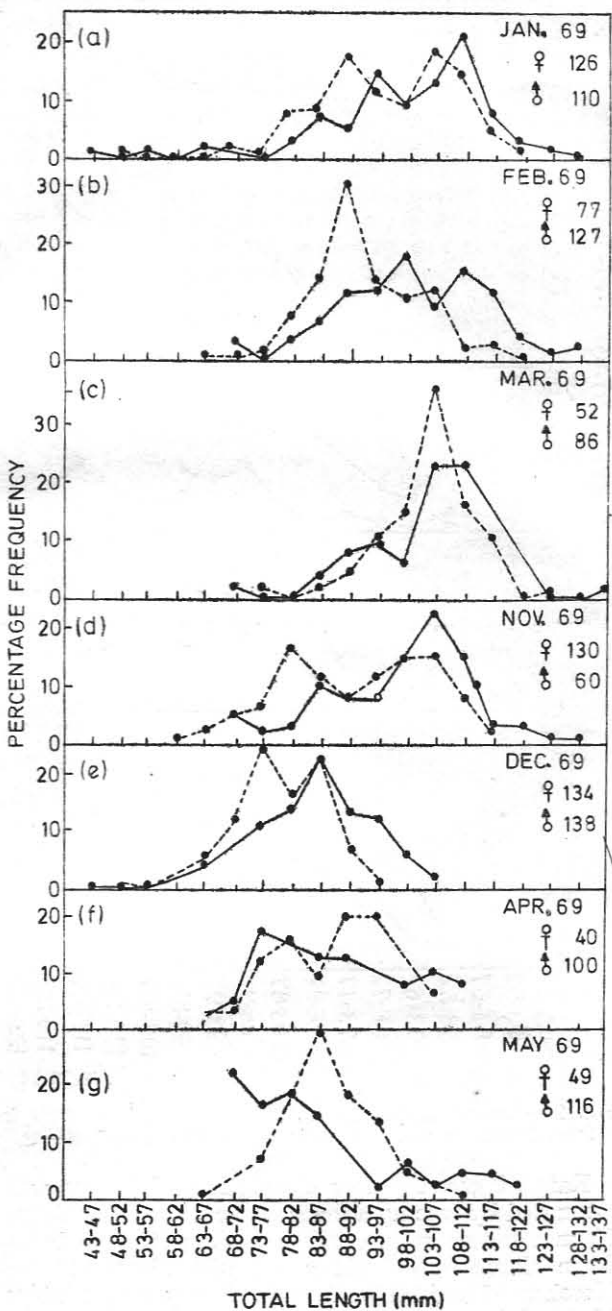


Fig. 2—Length frequency distribution of *L. brevivirois* from Gulf of Mannar [a to e, from Mandapam, trawl catch, and f and g, from Vedalai, drift net catch. ●—●, male and ○---○, female. Numbers indicate fish counted]

Male: Size varied from 48 to 122, with modes at 70, 90 and 105 in January, 63 to 122 with modes at 90, 105 and 115 in February, 68 to 117 with modes at 75 and 100 in March, 68 to 117 with modes at 80 and 100/105 in November, and 68 to 117 with modes at 75 and 85 in December.

Female: Size varied from 43 to 132, with modes at 55, 65, 85, 95 and 110 in January, 68 to 132 with modes at 90, 100 and 110 in February, 68 to 137 with modes at 95 and 105 in March, 58 to 132 with modes at 70, 85 and 105 in November, and 63 to 127 with a single mode at 105 in December.

In all the 5 months, total size range for the females was larger than that for the males and the positions of the modes were also different. The modes in higher sizes were more prominent in the female than in the male.

Modes in the length frequency curves for the male could not be traced except the one at 100 mm in November which moved to 105 mm in December, showing a rate of growth of 5 mm in a month.

In the case of female, the mode at 85 in January can be traced to 90 in February and 95 in March, and another at 95 in January to 100 in February and 105 in March, showing a growth rate of 5 mm in a month.

Thus, the growth rate of fish during the 2nd yr of life from Gulf of Mannar is similar to that of fish from the Palk Bay.

Vedalai (Gulf of Mannar)—Length frequency data were collected in April and May 1969 from shore seines and drift nets. The data pertain to night catches and are treated separately by net.

Drift net catches: In April, the size of male varied from 63 to 107 with modes at 80 and 90. In May, the size varied from 63 to 112 with a single mode at 85 (Fig. 2). In April, the size of female varied from 63 to 112 with modes at 75, 90 and 105. In May, the size varied from 68 to 122 with modes at 80, 100 and 110. The size range was wider and the number of modes greater in the case of female compared to the male. Position of the modes for the two sexes were also different. The single conspicuous mode in the case of male in May was significant.

In the case of male, the mode at 80 in April can be traced to the one at 85 in May. This indicates a rate of growth of 5 mm in a month. In the case of female, the modes at 75 and 105 in April are represented at 80 and 110 in May, indicating a growth of 5 mm in a month. This is in agreement with the rate of growth of fish during the 2nd yr of life mentioned earlier.

Shore seine catches: In April, the length in male varied from 68 to 112 with two modes at 90 and 105. In May, the size varied from 83 to 107 with a mode at 90. In April, the size of female varied from 68 to 137 with modes at 80, 90 and 105. In May the size varied from 78 to 117 with modes at 85 and 95. Wider size range and better demarcation of the modes were noticed in the case of females.

The two modes at 80 and 90 in April, in the case of female can be traced to 85 and 95 in May, indicating a progression of 5 mm/month.

Maraikyarpatnam (Gulf of Mannar)—Length frequency data were collected only in April 1969 from shore seine catches. Length in male and female varied from 73 to 107 with a mode at 90 and 78 to 122 with modes at 95, 105 and 115 respectively. Size range was wider and the number of modes greater in the case of female than in the male.

Comparison of the Length Frequency Distribution

Between places along the Palk Bay—In the case of males, while size ranges at all the 3 places were similar, number of modes in the case of samples from Mandapam was larger than in the samples from Pamban and Rameswaram. The mode in November at 75 mm both at Mandapam and Pamban indicates that the same population had been exploited. Length frequency curves for March from Mandapam and Rameswaram show that larger fish were captured at the former place.

Length frequency distribution and position of modes based on samples of female fish collected from Mandapam, Pamban and Rameswaram were found to be generally similar. However, the size range of fish captured at Rameswaram, was much wider compared to that at Mandapam.

Between places along the Gulf of Mannar—While size ranges and modes in the length frequency distribution of male fish caught at Mandapam, Vedalai and Maraikyarpatnam were similar, size ranges were wider and modes larger in number in the case of samples from Mandapam compared to those at other places. Same trend was observed in the case of female also.

A very close similarity was found in the length frequency distribution of fish from Vedalai and Maraikyarpatnam evidently because the two places are separated from one another only by a distance of about 3 km.

Between the Palk Bay and the Gulf of Mannar—Length frequency distribution and the position of modes from all places along the Palk Bay and from all places along the Gulf of Mannar are similar (Figs. 1 and 2). Therefore, the fish captured from both the regions are similar in size and in abundance of particular size groups.

Between different gear—While the size ranges of fish and modes in the length frequency distribution from different gear are similar, a wider size range and a larger number of modes were noticed in the case of trawl catches.

Reproduction

Maturity—Maturity of the species was studied by classifying the gonads into various stages of maturity based on macroscopic and microscopic structure. The methods described by Clark¹¹ and Prabhu¹² for ova diameter studies were followed. The following maturity stages were recognized:

Stage I: Ovaries small, transparent, occupying a very small portion of the body cavity. Ova are not visible to the naked eye, measure a maximum of 9 oc.m.d. (one ocular micrometer division = 0.021 mm). Testes similar in appearance as the ovaries.

Stage II: Ovaries occupy about 1/3 of body cavity, semitransparent, granular ova visible to naked eye,

measure a maximum of 15 oc.m.d., mode of the largest group of eggs at 11 oc.m.d. Yolk deposition visible. Testes semitransparent, occupy about 1/3 of body cavity.

Stage III: Ovaries occupy about 1/2 the body cavity, yellow in colour, ova measure a maximum of 21 oc.m.d., mode of the largest group of eggs at 17 oc.m.d. Ova opaque with full deposition of yolk. Testes occupy about 1/2 of the body cavity, creamy white in colour.

Stage IV: Ovaries occupy about 3/4 of the body cavity, pale yellow in colour, ova measure a maximum of 27 oc.m.d., mode of the largest group of eggs at 23 oc.m.d. Ova semitransparent, perivitelline space visible. Testes creamy white and occupy nearly 3/4 of the body cavity.

Stage V: Ovaries occupy more than 3/4 of the body cavity and semitransparent. Ova large, semitransparent, maximum size 36 oc.m.d., with the mode of the largest group of eggs at 32 oc.m.d. Ova semitransparent. Testes occupy about the same space, creamy white in colour.

Stage VI: Fish in this stage (spawning) were not encountered in this study.

Stage VII: Ovaries small, blood shot, occupy less than 1/3 of the body cavity, maximum size of ova 18 oc.m.d. Testes small, blood shot and occupy less than 1/3 of the body cavity.

Development of ova to maturity — Size distribution of ova in different stages of maturity is shown in Fig 3. Except in stages I and II, ova less than 4 oc.m.d. are not measured, as these are present in all the ovaries, representing the immature stock. In stage I, the ova measure a maximum of 9 oc.m.d. with a great majority of them under 4 oc.m.d. In stage II, a small group of eggs with a mode at 11 oc.m.d. gets separated from the general stock. Ova measure a maximum size of 15 oc.m.d. In stage III, two groups of eggs may be seen with modes at 11 and 17 oc.m.d. the latter representing a further batch separating from the second group. The largest group in stage III with mode at 17 oc.m.d. may be seen at 23 oc.m.d. in stage IV, while the one at 11 oc.m.d. remains stationary. In stage V, 3 modes are seen at 8, 14 and 32 oc.m.d. With the approach of spawning season the largest group of eggs appears to get distinctly separated from all the rest, thereby indicating that the fish spawns for a short duration only. Mode at 14 oc.m.d. is due to a shift forward of the mode at 11 oc.m.d. in stage IV while the one at 8 oc.m.d. is a new one which might merge soon with the one next to it. Stage VI was not encountered in the present study. In stage VII, after the elimination of the ripe eggs, modes seen in stage V at 8 and 14 oc.m.d. are seen at the same positions from which a 3rd group would get separated for the next spawning.

Spawning — Ova-diameter frequency polygons of stages IV and V indicate, that in addition to the most advanced group of ova, there is at least one group of ova which has undergone half the maturation process and occupying a position about midway between the immature and mature groups of eggs. This group, representing the maturing group of

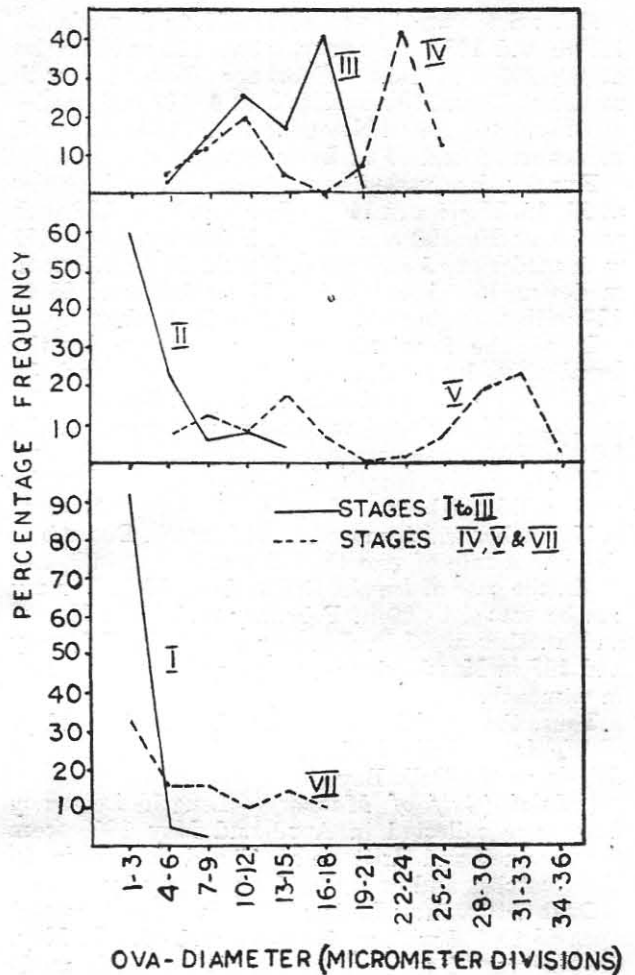


Fig. 3 — Ova-diameter frequency polygons of ovaries of *L. brevivirostris* in various stages of maturity

eggs, is expected to take only about half the time the immature eggs would take to reach the spawning stage. Therefore, the presence of this intermediate group in the ova diameter frequency curve of a very mature fish indicates that the fish must be spawning twice. The clear separation of the mature eggs from the maturing group indicates that the fish spawns only for a short time.

Distribution of maturity stages month-wise is shown in Fig. 4. Data for Palk Bay (Fig. 4A) show that, at these places stages IV and V were not encountered. Majority of the fish were in mature condition (stage III) from January to April, July and August though spent fish occurred in all the months. However, the number of spent fish were significant in May, June, October and November. Data for Gulf of Mannar (Fig. 4B) indicate that stage III occurred in fairly large numbers from January to March and in December. At Mandapam, stages IV and V were also seen to a limited extent. Spent fish were recorded from January to March and November to December, their number being significant in November. Since mature fish occur in a number of months and spent fish were recorded throughout the year both in the Palk Bay

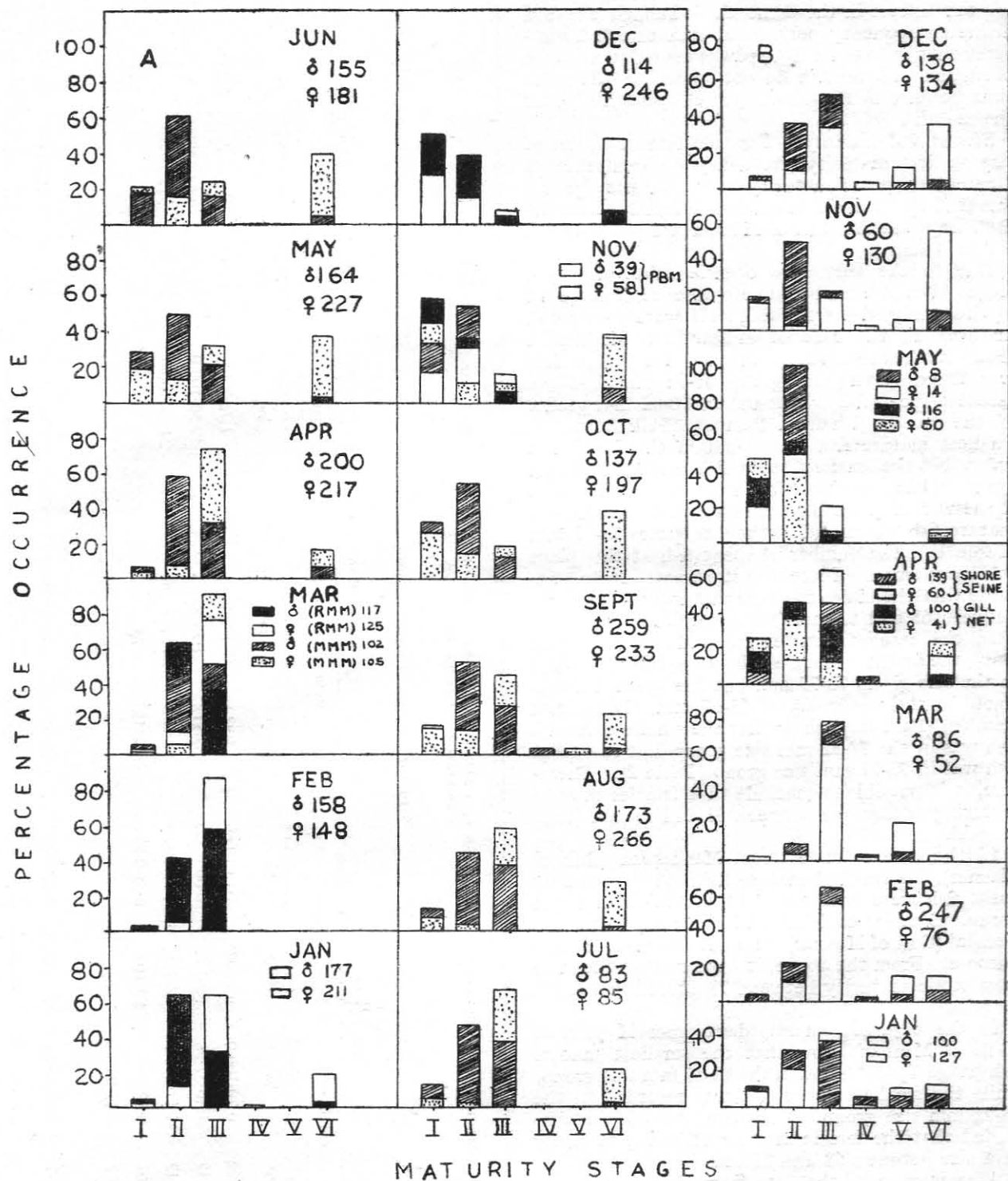


Fig. 4 — Percentage occurrence of females and males of *L. brevirostris* in different stages of maturity during 1969 [A, Palk Bay; B, Gulf of Mannar; MMM, Mandapam; PBM, Pamban; and RMM, Rameswaram]

and the Gulf of Mannar, it can be concluded that the species spawns throughout the year. High percentage of spent fish in May and June and in October and November indicates that intense spawning takes place in these months. Though the ova diameter frequency polygon of a mature fish indicates that individual fish spawns twice, it must be presumed that all fish do not spawn at the same time because of the occurrence of spent fish in all the months.

Size at first maturity — For the determination of size at first maturity, frequency of occurrence of different stages of maturity in various size groups was studied. Results for male and females from the Palk Bay and the Gulf of Mannar are presented in Tables 1 and 2.

Due to the very rare occurrence of fishes in stages IV and V and complete absence of stage VI in this study, fish from stage III were considered mature. In the case of males from Mandapam (Palk Bay), the smallest mature fish (stage III) was found in the size group 68-72 mm and the smallest spent fish was found in 78-82 mm group. In the case of fish from Pamban (Palk Bay), the smallest mature fish was found in the 73-77 mm group and the smallest spent fish in the 78-82 mm group. Data on the maturity of males from Rameswaram (Palk Bay) indicate that the smallest mature fish was found in the size group 73-77 mm (Table 1). The number of spent fish at this place was very small. Therefore, it is possible to conclude that the males must be maturing at any size between 68 and 82 mm (total length).

In the case of females from Mandapam (Palk Bay), the smallest mature fish (stage III) was found in the size group 73-77 mm but the spent fish was found in the size group of 63-67 mm. Data from Pamban (Palk Bay) show that the smallest mature fish was in the 78-82 mm size group and the spent fish was in 73-77 mm size group (Table 2). Therefore, it is possible to conclude that females may be maturing at any size between 63 and 83 mm (total length).

In the case of males from Mandapam (Gulf of Mannar), the smallest mature fish and the smallest spent fish were both found in the 78-82 mm size group. Samples of fish from Maraikyarpattanam and Vedalai (Gulf of Mannar) were not adequate for this purpose. From the above, it appears that the male may attain maturity between 78 and 82 mm (total length).

In the case of females, data from Mandapam (Gulf of Mannar) show that the smallest mature fish (stage V) was found in the 83-87 mm size group, while the smallest spent fish was recorded in the 68-72 mm size group. Therefore, it could be concluded that the female may be attaining maturity at a size between 68 and 87 mm (total length).

A comparison of the data from all places on the Palk Bay and Gulf of Mannar indicates similar trends for both the sexes from both the major areas, the minimum size at maturity for the female being 63 and for the male 68 mm.

Fecundity — Fecundity of the species was studied by the gravimetric method. For this study, only

TABLE 1 — PERCENTAGE OCCURRENCE OF FEMALES AND MALES OF *L. brevivittis* IN DIFFERENT STAGES OF MATURITY IN VARIOUS SIZE GROUPS (MM) DURING 1969 FROM THE PALK BAY

(Figures represent range values)

Stage	Mandapam				Rameswaram				Pamban			
	Female		Male		Female		Male		Female		Male	
	Size group	Occurrence %	Size group	Occurrence %	Size group	Occurrence %	Size group	Occurrence %	Size group	Occurrence %	Size group	Occurrence %
I	48-122	0 70-100-0	43-102	1-10-100-0	63-92	1-49-50-0	73-93	1-78-7-14	58-97	6-25-85-71	58-97	10-00-100-0
II	58-117	1-40-31-58	58-122	10-00-67-27	63-112	1-75-83-33	63-112	12-50-100-0	58-112	6-45-26-92	63-102	5-88-100-0
III	73-142	4-17-100-0	68-122	4-76-100-0	78-132	28-57-100-0	73-127	24-99-100-0	78-117	2-17-26-67	73-97	4-17-30-0
IV	103-107	0-52	93-102	0-55-0-83	108-112	1-75	—	—	—	—	—	—
V	83-107	0-47-0-64	—	—	—	—	—	—	—	—	—	—
VI	—	—	—	—	—	—	—	—	—	—	—	—
VII	63-127	4-35-49-03	78-107	1-67-4-94	73-122	2-78-28-36	93-97	3-61	68-117	7-24-80-0	78-97	3-85-12-5

TABLE 2 — PERCENTAGE OCCURRENCE OF FEMALES AND MALES OF *L. brevisrostris* IN DIFFERENT STAGES OF MATURITY IN VARIOUS SIZE GROUPS (MM) DURING 1969 FROM THE GULF OF MANNAR

(Figures represent range values)

Stage	Mandapam				Gill net				Vedalai			
	Female		Male		Female		Male		Female		Male	
	Size group	Occurrence %	Size group	Occurrence %	Size group	Occurrence %	Size group	Occurrence %	Size group	Occurrence %	Size group	Occurrence %
I	43-97	8.47-100.0	48-107	1.20-100.0	63-102	16.67-100.0	63-92	13.04-100.0	68-97	8.33-100.0	68-87	7.69-100.0
II	63-117	2.04-50.0	68-112	4.17-60.0	68-112	15.38-69.23	68-112	14.28-100.0	78-107	14.28-100.0	78-107	37.50-72.73
III	88-137	14.63-100.0	78-127	6.06-100.0	88-122	16.67-100.0	78-107	5.40-47.05	88-137	25.00-100.0	83-112	22.73-100.0
IV	103-122	2.08-7.69	93-112	1.23-8.33	—	—	—	—	—	—	103-107	12.50
V	83-132	1.69-66.67	98-122	5.71-50.0	—	—	—	—	103-177	4.76-14.28	—	—
VI	—	—	—	—	—	—	—	—	—	—	—	—
VII	68-122	7.14-58.54	78-117	1.43-15.0	83-177	7.69-100.0	78-97	2.17-5.4	88-122	7.14-33.33	88-92	4.54

ovaries in the advanced pre-spawning stage (stage V) were examined. Total weight of the ovary and weight of a subsample of the same were noted. The number of mature ova from the subsample was enumerated and this was raised for the total weight of the ovary to indicate the fecundity. A total number of 13 fish in the size range of 106 to 132 mm total length gave a range of 3646 to 16243 mature eggs.

Sex ratio — Sex ratio in the commercial catches landed at Mandapam and Rameswaram (by trawl nets), Vedalai (by shore seines and gill nets) was analysed in random samples. Data (Table 3) indicate that females predominate over the males in both trawl and shore seine catches. But in the gill net catches, males were in greater numbers than females. However, samples of fish in this case were not large enough to draw positive conclusions.

Food and Feeding Habits

A total of 449 fishes from the Palk Bay and 307 fishes from the Gulf of Mannar were examined for this purpose. The stomach contents were

TABLE 3 — SEX RATIO OF *L. brevisrostris*

Month	Male	Female	Ratio	
			Male	Female
MANDAPAM (PALK BAY) TRAWL NET				
March	102	105	1	1.02
April	200	217	1	1.08
May	164	227	1	1.38
June	155	181	1	1.16
July	83	85	1	1.02
Aug.	173	266	1	1.53
Sept.	259	333	1	1.28
Oct.	137	197	1	1.43
Nov.	15	20	1	1.33
PAMBAN (PALK BAY) TRAWL NET				
Nov.	39	58	1	1.48
Dec.	114	246	1	2.15
MANDAPAM (GULF OF MANNAR) TRAWL NET				
Jan.	100	127	1	1.27
Feb.	127	76	1	0.59
March	86	52	1	0.60
Nov.	60	130	1	2.16
Dec.	138	134	1	0.97
VEDALAI (GULF OF MANNAR) SHORE SEINE				
April	3	60	1	1.53
May	8	14	1	1.75
VEDALAI (GULF OF MANNAR) GILL NET				
April	100	41	1	0.41
May	116	50	1	0.43
Oct.	11	2	1	0.18
RAMESWARAM (PALK BAY) TRAWL NET				
Jan.	177	211	1	1.19
Feb.	158	148	1	0.93
March	117	125	1	1.06

examined qualitatively and quantitatively. For quantitative estimation, points (volumetric) method as given by Hynes¹³ was adopted. Each food item in the stomach was allotted certain number of points based on its volume and taking into consideration both the size of the fish and the fullness of the stomach. The results are given in Tables 4 and 5. While typical planktonic organisms in the diet indicate plankton feeding habits of the species, more or less consistent occurrence of sand grains throughout the year and the occurrence of benthic organisms show that the fish resorts to the bottom as well. Of the phytoplankton, *Coscinodiscus* and *Pleurosigma* were important, especially from the Palk Bay. Copepods, nematodes and polychaetes were prominent items in a number of months. Bivalves and gastropods were represented only occasionally, while *Lucifer* was found in minor quantities more frequently. In most fishes, in all the months, a great part of the stomach contents

was constituted by semidigested, unidentifiable matter. There were no significant seasonal variations in the food, as all items of food occurred throughout the year. The quantitative data also do not indicate appreciable changes. Similarly no significant change in the diet with increase in the age of the fish was discernible from the qualitative data.

Fishery

L. brevirostris occurs along with other species of leignathids in the Palk Bay and the Gulf of Mannar contributing to the fishery. They occur abundantly in the coastal waters up to about 12 m in the Palk Bay and 25 m in the Gulf of Mannar.

The commercial catches include *L. brevirostris* ranging in size from 38 to 142 mm, the dominant size range in the fishery being 65 to 105 mm. The life span of the species has been estimated to be about 2 yr. The species attains a size of 60 and

TABLE 4 — RELATIVE IMPORTANCE OF FOOD ITEMS IN THE STOMACH CONTENTS OF *L. brevirostris* FROM PALK BAY

(Values are expressed in per cent. Figures in parentheses indicate number of fish examined. Samples obtained from trawl nets only)

	Rameswaram			Mandapam								Pamban		
	Jan. (39)	Feb. (30)	March (20)	March (20)	April (40)	May (50)	June (30)	July (40)	Aug. (40)	Sept. (50)	Oct. (40)	Nov. (10)	Nov. (10)	Dec. (30)
Semidigested matter	50.70	42.52	50.70	50.40	46.09	56.15	47.47	43.73	47.67	46.71	62.63	54.16	38.18	10.45
<i>Coscinodiscus</i>	1.63	2.07	—	0.81	—	0.25	0.59	0.16	0.19	1.54	0.54	—	2.72	0.90
<i>Fragilaria</i>	5.60	14.94	16.19	13.41	15.61	10.00	8.90	10.35	6.97	5.59	3.29	4.16	10.90	9.91
<i>Pleurosigma</i>	9.81	2.04	0.70	1.62	2.01	6.92	17.21	18.69	14.92	16.40	4.39	9.72	4.54	0.90
Copepods	13.31	18.81	11.97	9.75	8.31	3.33	2.96	5.50	5.81	2.31	3.29	2.77	12.72	6.78
Crustacean remains	6.76	8.87	7.04	13.82	13.35	6.41	3.26	7.67	9.88	12.54	8.24	15.27	14.54	10.85
<i>Lucifer</i>	0.93	1.47	—	0.81	1.51	0.51	—	0.50	0.38	0.57	—	—	—	—
Nematodes	3.97	2.04	0.70	1.62	3.52	7.43	6.82	5.00	4.06	4.05	0.54	4.16	0.90	1.80
Polychaetes	1.40	5.91	7.74	3.65	3.02	1.02	0.29	1.66	2.32	0.38	—	—	3.63	1.35
Fish scales	2.57	1.77	3.52	1.62	3.02	1.79	2.96	1.33	1.93	1.35	4.94	2.77	3.63	2.26
Sand grains	3.27	2.04	1.40	2.43	3.52	6.15	9.49	4.84	5.62	8.49	12.08	6.94	8.18	13.12
Bivalves	—	—	—	—	—	—	—	0.59	—	—	—	—	—	—
Gastropods	—	—	—	—	—	—	—	0.29	0.19	—	—	—	—	—

TABLE 5 — RELATIVE IMPORTANCE OF FOOD ITEMS IN THE STOMACH CONTENTS OF *L. brevirostris* FROM GULF OF MANNAR

(Values are expressed in per cent. Figures in parentheses indicate number of fish examined)

	Mandapam			Vedalai					Mandapam	
	Jan.	Feb.	Mar.	April		May		Oct.	Nov.	Dec.
	Trawl net			Shore seine	Gill net	Shore seine	Gill net	Gill net	Trawl net	
	(50)	(30)	(30)	(40)	(40)	(10)	(30)	(7)	(30)	(40)
Semidigested matter	54.34	65.96	60.50	77.04	82.63	81.25	84.11	81.57	53.91	87.35
<i>Pleurosigma</i>	—	—	—	—	—	—	—	—	0.46	—
Copepods	5.32	3.14	4.50	0.54	0.59	2.08	0.93	—	11.52	10.66
Crustacean remains	13.16	11.51	18.00	3.82	1.79	—	—	—	17.05	12.50
<i>Lucifer</i>	0.28	—	1.00	—	—	—	—	—	0.46	0.36
Nematodes	4.48	1.04	—	0.54	—	—	0.93	—	1.38	0.36
Polychaetes	3.08	2.09	3.00	3.27	2.39	4.16	0.93	5.26	2.76	2.57
Fish scales	0.84	1.57	0.50	1.63	0.59	2.08	0.93	2.63	1.38	1.10
Sand grains	12.60	8.37	8.00	12.02	11.37	10.41	11.21	10.52	6.91	9.55
Blue green algae	5.88	6.28	4.50	1.09	0.59	—	0.93	—	4.14	5.51

120 mm at the end of 1st and 2nd yr respectively. Therefore, commercial catches are composed of fish above 1 yr and under 2 yr in age.

Minimum size of maturity for the species appears to be about 63 mm for the female and 68 mm for male, which are about 1 yr old. Since only fish above this size are mainly exploited, most fish would have spawned at least once and hence, recruitment is not expected to be seriously affected. This is further ensured by prolonged spawning habits of the species. Females are fished more than the males. As the species is short lived, from the commercial point of view, it is advisable to fish all the sizes available.

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