

ON MACROSCOPIC PECULIARITIES OF THE GONADS OF
LETHRINUS BUNGUS (EHRENB)

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ABSTRACT

The youngest male or female is about 16 cm in body length. All males, longer than 22 cm, are sexually mature and this case prevails only in females longer than 24 cm.

L. bungus has a long spawning season. The average gonad index is the highest in June (2.41X) and July (2.54X) for the female and for the male in May (2.57X) and June (2.72X). Egg is pelagic, with the higher average in June (386 μ) and July (403 μ). The largest eggs measured only about 450 μ in diameter.

The absolute fecundity varies from 212 thousands for 21.5 cm length to 552 thousands for 24.5 cm length. A relation between length or weight and fecundity was calculated. Variation of gonad index together with change in relative fecundity is postulated.

Females much greatly outnumbered males which constituted, on the average only 23X within the fish samples examined.

Variation in the nature of spawning along with the gonadal morphological peculiarities has been discussed for four lethrinids viz. *Lethrinus bungus*, *L. nebulosus*, *L. variegatus* and *L. mahsena* from the Red Sea.

INTRODUCTION

Lethrinids are among the fishes of important economic value in the Red Sea area. According to Salem (1971), seven species of lethrinids were recorded in the neighbourhood of Al - Ghardaqa. These are *Lethrinus nebulosus* (Forssk.) [Shoo'ur*], *L. mahsena* (Forssk.) [Mehsena*], *L. bungus* (Ehrenb.) [Bungus*], *L. leutjanus* (Lacep.) [Sharkasa*], *L. harak* (Forssk.) *L. variegatus* (Cuv. & Val.) [Drainy*] and *L. miniatus* (Forssk - Schn.) [Khermeya*].

Lethrinids are coral fishes and they usually swim in numbers from few to many. On the whole, the different species vary in abundance in the area of Al-Ghardaqa. Thus, *L. harak* is rare and only one museum specimen is available. *L. miniatus* comes next and few specimens were recorded. *L. mahsena* is more common species in our area. In turn, specimens of *L. variegatus* and *L. bungus* are small, while *L. nebulosus*, *L. mahsena*, *L. miniatus* attain a considerable size (Salem, 1971).

MATERIAL AND METHODS

The fish samples adopted in this work were caught from the northwestern region of the Red Sea by the fishermen of the Marine Biological Station at Al - Ghardaqa. For data

analysis and further studies, these samples were dealt with in the same way as before mentioned in a preceding study (Latif and Salem, 1989).

The present work is part of the program directed to the study of the biology of lethrinids in the Red Sea in the vicinity of Al - Ghardaqa and deals with the morphological features of the gonads as parameters for the sexual cycle and reproductive peculiarities in general.

RESULTS

A - SEXUAL MATURATION:

Analysis of the onset of maturity was based on examination of 231 females and 92 males during the period from May to August. As seen in Table 1 (Fig. 1), no mature females or males were recorded among fishes smaller than 16 cm in length. But in longer fish, maturity is prevailing with increase in its magnitude with the growth in length, and to greater extent with the male than the female. In other words, for 16-17.8 cm length range, only about 4% of females is sexually mature as compared with about 24% for the male. Also, among 20-21.9 cm long, 56% and 90% of females and males are respectively mature. Collective maturation prevailed within 22-23.9 cm length range for males and no longer males were recorded. Females more than 24 cm in length. On the whole, 50% maturity prevailed at a median length of 19 cm for male as compared with about 21 cm for female.

Table 1
Variation in sexual
maturation with length

Length group (cm)	% Mature	
	Female	Male
14 - 15.9	0	0
16 - 17.9	4.4	23.5
18 - 19.9	10.0	50.5
20 - 21.9	56.2	90.0
22 - 23.9	85.7	100.0
>24	100.0	0

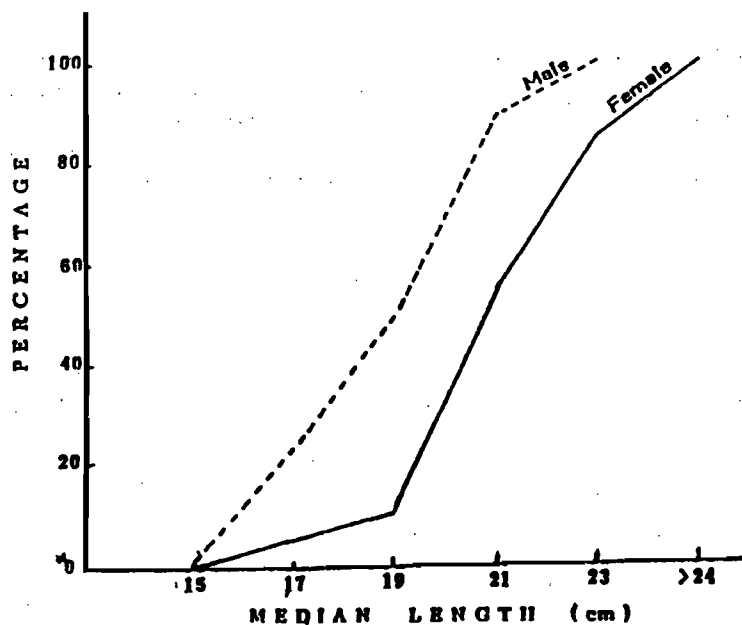


Figure 1: Sexual maturation versus length

TABLE 2
Gonad index and egg diameter in females (>19 cm) of *Lethrinus bungsus*

Months	No. of fish	Gonad Index (%)		Egg Diameter (u)	
		Average	Range	Average	Range
January	19	0.37	0.05-0.60	68	69-106
February	3	0.34	0.25-0.44	76	74- 81
March	5	0.57	0.20- .92	92	81-115
April	14	0.80	0.11-1.54	100	64-403
May	12	1.82	0.21-3.12	342	115-419
June	7	2.41	0.20-3.23	386	95-426
July	6	2.54	0.18-3.42	403	377-437
August	18	1.02	0.10-3.78	318	64-451
September	15	0.91	0.02-2.81	272	60-431
October	20	0.32	0.01-2.49	119	64-391
November	45	0.34	0.10-0.66	77	63-166
December	11	0.25	0.03-0.43	78	51-152

B - GONAD INDEX (Fig. 2)

Based on the preceding results for following the level of gonadal development along the annual sexual cycle, the gonad index (G. I.) was calculated for females > 19 cm and for males > 18 cm in standard length. Thus:

1- For the female, the average G. I. increased slightly along the period from January to April and numerically from 0.37 to 0.80%. Thence follows an abrupt increase to 1.82% in May, further to 2.41% in June and 2.54% in July. This is followed by a considerable decline in August (1.02%) and September (0.91%). In the last quarter of the year, G. I. varies within narrow limits or between 0.25% in December and 0.34% in November.

The lowest G. I., within the limits of the monthly samples, varied from 0.01% to 0.25%. The maximum values, on the other hand, varied from 0.43% to 0.66% along the period November, December, January and February. Afterwards follows an increase to 1.54% in April and further to 3.12% in May. In the following three months, the maximum G. I. recorded is more than 3% but in September and October, this variable decreased to almost 2.8 and 2.5% respectively.

2- For the male (Table 3), the average G. I. is about 0.14% in the first quarter of the year, with maximum values ranging from 0.24 to 0.31%. April exhibited a slight

TABLE 3
Gonad index of males (> 18 cm) of
Lethrinus bungus.

MONTHS	No. of fish	Gonad Index (%)	
		Average	Range
January	9	0.14	0.3 -0.31
February	2	0.15	0.06-0.24
March	4	0.14	0.06-0.26
April	3	0.58	0.04-0.92
May	13	2.57	0.31-4.02
June	5	2.72	0.15-3.62
July	3	1.47	0.87-1.86
August	4	0.45	0.05-1.04
September	2	0.57	0.32-0.82
October	11	0.21	0.02-0.64
November	29	0.11	0.01-0.26
December	8	0.10	0.02-0.20

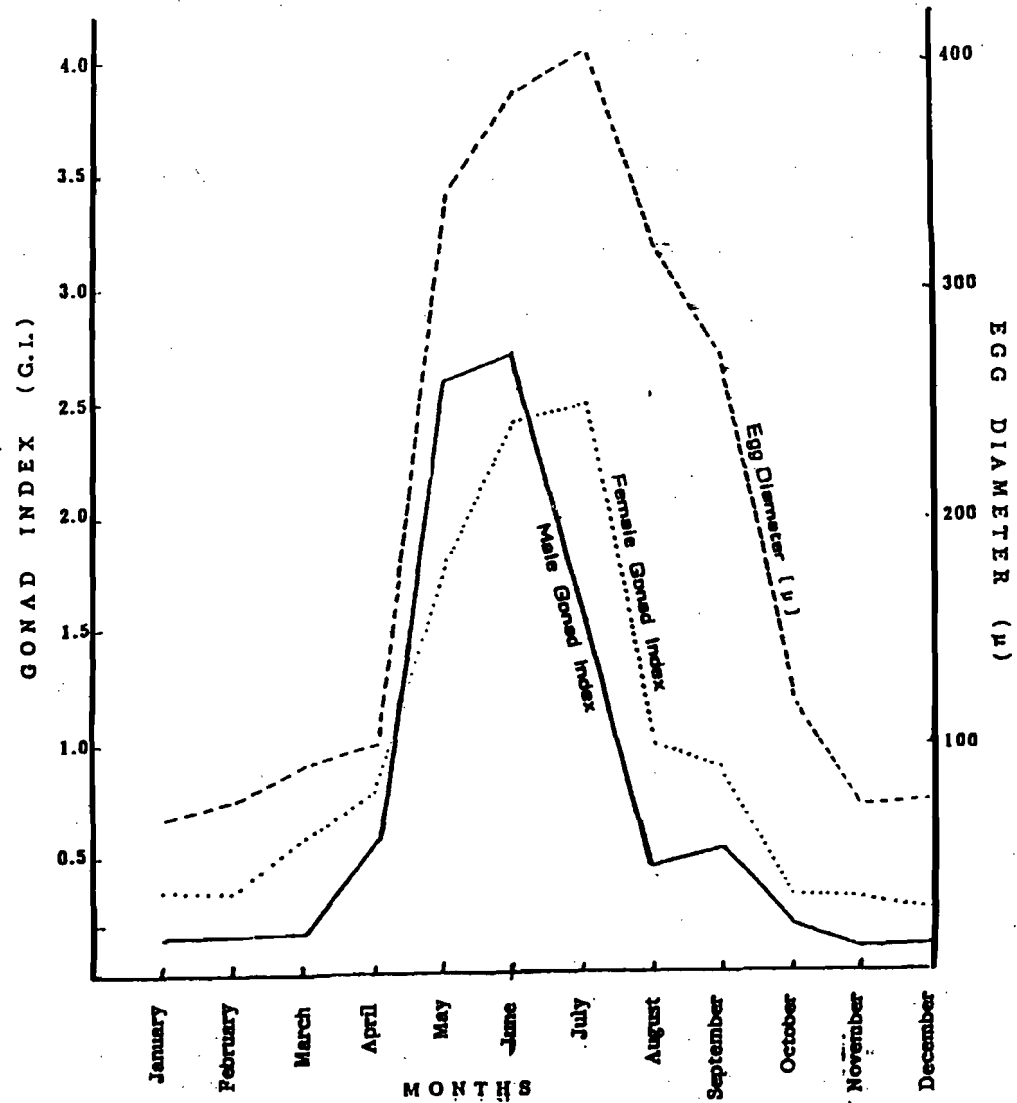


Figure 2: Monthly average gonad index and egg diameter in *Lethrinus bungus*.

increase (0.58%), but followed by abrupt increase in May (2.57%), and further slight increase in June (2.72%). Within these two months, the maximum values among the whole year prevailed and recorded as 4.02% in May and 3.62% in June. A considerable decline appeared in July (1.47%) and further in August (0.45%) which did not vary considerably from September (0.57%). In the third quarter of the year, the maximum value ranged from 0.82% in September to 1.86% in July. In the last quarter of the year, the average ranged from 0.10% to 0.21% and the maximum from 0.20% to 0.64% between December and October.

C - FECUNDITY:

FECUNDITY - LENGTH RELATION (Table 4).

The relation between fecundity and length within the limits of the samples available is described by the equation:

$$F = 107.84 L - 2150.65$$

where F is the fecundity or number of eggs in thousands; the length of fish in cm.

Table 4
Fecundity versus length

Absolute Fecundity Length (cm)	Fecundity Empirical	(1000) Calculated	Relative Empirical	Fecundity Calculated (1000)
21.5	212	168	9.9	7.8
22.0	229	222	10.4	10.1
23.0	264	330	11.5	14.4
23.3	280	362	12.0	15.5
24.0	410	438	17.01	18.25
23.0	427	330	18.6	14.4
23.4	421	373	18.0	15.9
24.5	552	491	22.5	20.0

For the length range between 21.5 cm to 24.5 cm, the number of eggs ranged empirically from 212 thousands eggs to 552 thousands as compared with a range of 168 thousands to 491 thousands respectively.

FECUNDITY - WEIGHT RELATION (Table 5).

The number of eggs ranged from 212 thousand to 552 thousand with the growth in weight from 267 gm to 375 gm. The relation between these two variables was found to be described by the equation:

$$\text{Log } F = -4.3654 + 2.7501 \log \text{ wt}$$

where F = fecundity as thousand eggs,
wt = weight of fish in gm.

The calculated number of eggs ranged from 203 thousands for fish of 267 gm to 516 thousands for fish of 375 gm in weight.

Table 5
Fecundity versus weight

Weight (gm)	Fecundity Empirical	(1000 eggs) Calculated	Relative Empirical	Fecundity (no/gm) Calculated
267	212	203	794	760
295	229	267	776	905
302	264	285	874	943
310	280	306	903	987
327	410	355	1253	1086
340	427	395	1255	1162
350	421	427	1203	1220
375	552	516	1472	1376

FECUNDITY - AGE RELATIONS:

The number of eggs ranged from 212 thousands to 264 thousands with an average of 242 thousands for age group III, as compared with a range of 279 - 552 thousands, with an average of 419 thousands for age group IV.

GONAD INDEX VERSUS RELATIVE FECUNDITY:

A direct relationship exists between the relative fecundity (R. F.) per one cm body length or 1 gm body weight

and the gonad index (G. I.). The average G. I. value shows that R. F./ gm increases from 10.7 thousands to 20.7 thousands and R. F./ gm increases from 8.3 hundreds to 11.3 hundreds with the development of G. I. from 2.87 to 3.52%.

TABLE 6
G.I. versus R.F.

Gonad Index	Relative Fecundity	
	per cm (1000 _g)	per gm (100 _g)
2.87	10.7	8.3
3.12	13.7	9.6
3.52	20.7	11.3

D - EGG DIAMETER (E.D.)

For following the pattern of the E.D. along an annual sexual cycle, females > 19 cm long were dealt with. As seen in Table 5 (Fig. 2), the average E.D. increases slightly or from 68 to 100 u, along the period from January to April. Thence followed an abrupt increase to about 340 u in May, followed by slight increase in June (about 385 u) and July (about 405 u). Afterwards followed a gradual decline in the average E.D. in August (about 320 u) and further to September (about 270 u). A considerable decline appeared in October (about 120 u). Valuables of November and December are comparable to those in the early part of the year (about 75 u).

Needless to mention that due to the fact that some fishes among the examined samples had not yet attained their sexual maturity the minimal E.D. is less than 100 u in most parts of the year. The maximum E.D., on the other hand, ranges from about 80 to 115 u in the first quarter of the year, to more than 400 u along the period from April to September. In October, the maximum G.I. was recorded as 390 u. For November and December, the values were much lower, ranging from about 150 to 165 u. On the whole, the prevalence of the maximum value together with the highest average G.I. shows that the spawning season extends along May / September period, with the peak in July and the minimum in September.

E - SEX RATIO:

As seen from the following table, the females preponderate over the males in number. The relative frequency, however, varies with length. Thus, the males comprise about 18-19% of fish less than 20 cm body length, about 35% among fish of 20-24 cm length and only 7% for longer fish. Within the limit of the fish samples examined here, the males constituted, on the whole, only about 23%.

TABLE 7
Variation in male's frequency with length

Length range (cm)	>16	16-19.9	20-23.9	> 24
Total number of fish samples	453	378	162	14
No. of males	80	71	57	1
Frequency (%) of males	17.7	18.9	35.2	7.14

DISCUSSION

The study of reproduction is an important item dealing with the biology of fishes. As before mentioned, a number of lethrins of different abundance and size is present in the Red Sea. The gonadal morphological peculiarities behave differently in these diversified species. Such differences can be partly followed from the work of Salem (1971) for *L. variegatus* and *L. mahsena*; Salem (1971) for *L. nebulosus* and the present work for *L. bungus*.

Thus, these species start their first maturity at different lengths. No mature males or females smaller than 9 cm in *L. variegatus* or 16 cm in *L. bungus*. In *L. mahsena* and *L. nebulosus*, males start their sexual maturity at 26 cm length, while females at 30-32 cm length in the two species respectively. Age at first maturity varies from group I in *L. variegatus* to apparently age group II in *L. bungus*, to age group III for *L. mahsena* and to age group III for male and age group IV for *L. nebulosus*.

The eggs of lethrinids are small, pelagic and 450 u in diameter at most. The gonad index shows particular differences among the different species. In *L. nebulosus* and *L. variegatus*, this parameter is relatively higher than in the other two species. The maximum G.I. for these two species could be more than 10% as compared with 5.82% and 3.78% for males or 6.80% and 3.62% for females of *L. mahsena* and *L. bungus* respectively. Their average is less than 3%. The relatively heavier gonads of *L. nebulosus* could be linked with the short spawning season while this could be linked with the small size of *L. variegatus*.

TABLE 8
Gonad index in some Lethrinids

SPECIES	Sex	Highest Average		Highest Maximum	
		Value	Month	Value	Month
<i>L. nebulosus</i>	Female	3.34	May	10.40	May
	Male	3.72	May	11.34	May
<i>L. variegatus</i>	Female	3.72	April	11.91	April
	Male	4.12	April	11.87	April
<i>L. mahsena</i>	Female	2.74	May	5.82	May
	Male	2.10	June	6.80	May
<i>L. bungus</i>	Female	2.54	July	3.78	August
	Male	2.72	June	3.62	June

Fecundity could be another variable with the nature of spawning. *L. nebulosus*, with its short spawning season, is more fecund than others. The fecundity varies on the average from 632 thousands to 3690 thousands and the maximum from 1.7 millions to 4.8 millions with growth from age group IV to VIII. In other words, fish has to deliver a considerable amount of eggs during the spawning-migration. On the other hand, the average varies from 84 thousands to 277 thousands from age group I to age group III in *L. variegatus*. In *Lethrinus mahsena*, the average was calculated as about 161 thousands for age group III and 896 thousands for age group V. For *L. bungus*, the fecundity varies from 242 thousands to 419 thousands for age groups III and IV respectively. Thus *L. nebulosus* compensates the short spawning season through a considerably high number of eggs (than that of the other species) within this limited period.

For maximising the outcome of this period, the males should be properly adapted to such a condition. This is manifested by the fact that the testis is relatively heavier than in other species, reflected on the high gonad index as before mentioned. Also, the frequency of males is much higher than in the other species. In other words, males constituted 50-59% among specimens of *L. nebulosus* caught during its spawning run. For comparison, the average frequency of males for the whole year is only about 43% in *L. variegatus*, about 24% in *L. bungus* and about 26% in *L. mahsena*. Also, females attain a larger size than the males whereby these became fewer, and comprised only about 25% among fish of *L. bungus* longer than 20 cm in length as compared with about 20% for *L. variegatus* longer than 16 cm in length and 26% of *L. mahsena* longer than 30 cm in length.

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