Turkish Journal of Zoology

Volume 22 | Number 3 Article 11

1-1-1998

Some Aspects of Reproductive Biology of Euryglossa orientalis(Bl. & Schn.)in North Arabian Sea Along The Coast of Karachi, Pakistan

Mohammed Atiqullah KHAN

Tr. J. of Zoology
22 (1998) 241-249

Some Aspects of Reproductive Biology of *Euryglossa orientalis* (Bl. & Schn.) in North Arabian Sea Along The Coast of Karachi, Pakistan

Mohammed Atiqullah KHAN

Marine Reference Collection and Resource Centre, University Karachi 75270 PAKİSTAN

S.M. Shamsul HODA

Deparment of Zoology, University of Karachi, Karaci 75270 PAKİSTAN

Received: 10.12.1996

Abstract: In *Euryglossa orientalis*, sexual maturity was separated into seven stages. Size at sexual maturity was observed at 182 mm TL in males and 178 mm TL in females. A male-female ratio of 1.00:1.60 was determined (0.385:0.615). This species has two spawning seasons in Pakistani waters. The ist spawning season starts in September and the second in February. Fecundity ranged from 9922 to 83891 with a mean value of 36361.

Key Words: *Euryglossa orientalis*, Reproductive biology, Karachi coast.

Kuzey Arap Denizi, Pakistan Karaçi Sahilindeki *Euryglossa orientalis* (Bl. & Schn.) (Dilbalığı)'in Üreme Biyolojisi Hakkında

Özet: Dilbalığı, *Euryglossa oreintalis*'de eşeysel olgunluk yedi evre halinde ayırt edilmiş ve ilk eşeysel olgunluğa erkeklerin 182 mm, dişilerin 178 mm total boyda eriştikleri gözlenmiştir. Erkek-dişi oranı sırasıyle 1.00:1.60 ve 0.385:0.615'tir. Dilbalığının Pakistan sularında iki yumurtlama mevsimi vardır ve birincisi Eylül ayında ikincisi ise Şubat ayında başlamaktadır. Fekondite 9922 ile 83891 arasında değişmekte olup ortalama olarak 36361'dir.

Anahtar Sözcükler: *Euryglossa orientalis*, Üreme biyolojisi, Karaçi sahili.

Introduction

Euryglossa orientalis (Bl. & Schn.) plays an important role in the commercial and subsistence fisheries in Pakistan, constituting nearly 0.47% of the total catch (12-13). Studies of their fisheries and biology have recevied little attention in Pakistan whereas different aspects of the reproductive biology of other flat fishes in the region are well documented (1-3, 6-8, 14, 17, 19, 21).

The objective of this study was to describe some of the biological aspects of maturity, the spawning time, gonosomatic index (GSI), sex ratio, fecundity and ova diameter of *Euryglossa orientalis* of the Karachi coast.

Materials and Methods

A total of 750 specimens of *Euryglossa orientalis* were collected at random at fortnightly intervals from the commercial landings in Westwharf Fishing Harbour and Korangi Creek during the period April 1987 to June 1988. Each specimen was measured, accurate to 0.1 mm, and weighed, accurate to 0.5 g. The gonads were removed, weighed and preserved in 10% Formalin. Ovarian dimensions were determined following the method of Hiekling and Ratenberg (11). The gonosomatic index (GSI) was determined to be percentage of the ratio of gonad weight to fish weight. Fecundity was determined using the gravimetric method (18), and involved counting the number of mature eggs from a mature ovary of known weight. The fecundity was determined as follows:

$$F = W_{ov}\left(\frac{N_1}{WS_1} + \frac{N_2}{WS_2}\right)$$

where W_o = the total weight of the ovary, N_1 and N_2 = the number of ova and WS_1 and WS_2 = The weight of the sample from the lobe of the mature ovary Statistical analysis of the biological data was carried out according to the method of Zar (25).

Results

Maturity stages:

Seven stages of maturity were identified the general physical characteristics, size of organs relative to the body cavity, colour and GSI values are given in Table 1.

Table 1. Maturity stages and gonosomatic index (GSI) values in male and female of *Euryglossa orientalis.*

No.	Stages	Testes	Ovaries
I.	Virgin immature	Testes pale whitish, asymmetrically bilobed. Right (ventral) lobe larger than the left (dorsal) one. Size of fish less than 110 mm TL GSI=0.12±0.026	Ovaries transparent, whitish, asymmetrically bilobed. Right lobe larger than the left lobe, occupying less than half the body cavity. Ova diameter 0.069 mm. GSI = 0.551±0.200.
II.	Developing virgin maturing virgin)	Small pale whitish, asymmetrically bilobed, semi-translucent, occupying about half(1/2) the body cavity. GSI = 0.164±0.022.	Small, whitish, asymmetrically bilobed, semi-translucent, occupying about half of the body cavity. Ova diameter = 0.217 mm. GSI = 0.568±0.046.
III.	Developing	Testes whitish, asymmetrically bilobed, translucent, occupying a little more than half of the body cavity. GSI = 0.180±0.012.	Ovaries yellowish, asymmetrically bilobed occupying a little more than half of the body cavity. Ova diameter =0.441 mm. GSI = 0.845±0.145
IV.	Maturing	Massive, creamy white, translucent, asymmetrically bilobed occupying 2/3 of the body cavity. GSI = 0.201±0.018.	Massive, yellowish, translucent, asymmetrically bilobed, about 2/3 of the body cavity. Ova diameter=1.001mm. GSI = 1.450±0.344.
V.	Mature	Enlarged creamy white, asymmetrically bilobed, occupying 3/4 of the body cavity. GSI = 0.215±0.018.	Enlarged, yellowish or yellow, asymmetrically bilobed, occupying 3/4 of the body cavity. GSI = 3.059±0.584.
VI.	Ripe (running)	More enlarged, creamy white, asymmetrically bilobed, occupying 3/4 of the body cavity. GSI = 0.231±0.074.	More enlarged, yellowish or birght yellow, asymmetrically bilobed, occupying 3/4 of the body cavity. GSI = 3.059±0.584.
VII.	Spent	Creamy wnite, elongated but shrunken and slightly wrinkled, no milt on pressure, asymmetrically bilobed, occupying 1/2-2/3 of the body cavity. GSI = 0.148±0.033	Yellowish, elongated but shrunken and slightly wrinkled, occupying nearly 2/3 of the body cavity, occasionally a few large ova. Ova diameter - NİL. GSI = 0.927±0.386

Table 2a. Mean GSI of male *Euryglossa orientalis* in different months.

Month	N	$\bar{X}$	S.E.	Confidence limits	
				Minimum	Maxsimum
May, 87	23	0.174	0.031	0.110	0.238
June	27	0.155	0.030	0.094	0.216
July	18	0.142	0.019	0.102	0.182
August	4	0.146	0.015	0.098	0.194
September	35	0.178	0.018	0.142	0.214
October	27	0.139	0.015	0.109	0.169
November	38	0.182	0.009	0.164	0.200
December	51	0.209	0.009	0.191	0.227
January, 88	49	0.208	0.009	0.190	0.022
February	49	0.231	0.013	0.205	0.257
March	18	0.188	0.019	0.148	0.228
April	36	0.156	0.015	0.126	0.186
May	29	0.145	0.010	0.125	0.165
June	17	0.160	0.008	0.143	0.177
Total	421	0.172			

Table 2b. Mean GSI of female*Euryglossa orientalis* in different months.

Month	N	$\bar{X}$	S.E.	Confidence limits	
				Minimum	Maxsimum
April, 87	2	3.246	0.009	3.132	3.362
May	18	0.772	0.065	0.635	0.909
June	19	0.720	0.077	0.558	0.883
July	23	0.814	0.112	0.590	1.046
August	7	0.491	0.090	0.271	0.221
September	26	2.002	0.353	1.295	2.749
October	22	1.883	0.325	1.207	2.559
November	17	1.329	0.300	0.693	1.965
December	23	2.098	0.481	1.101	3.095
January, 88	18	1.945	0.410	1.080	2.810
February	16	3.331	0.558	2.142	4.520
March	22	2.311	0.338	1.629	2.993
April	8	0.379	0.093	0.159	0.599
May	29	1.031	0.232	0.556	1.506
June	32	0.942	0.079	0.781	1.103
Total	282	0.554			

Table 3a. Mean GSI of male *Euryglossa orientalis* in different size groups.

Size group (mm)	N	$\bar{X}$	S.E.	Confidence limits	
				Minumum	Maximum
80-89	1	0.007	-	-	-
100-109	3	0.154	0.037	-0.005	0.310
110-119	1	0.489	-	-	-
120-129	1	0.182	-	-	-
130-139	9	0.128	0.000	0.000	0.199
140-149	3	0.170	0.066	-0.114	0.454
150-159	10	0.175	0.038	0.088	0.260
160-169	11	0.111	0.016	0.000	0.146
170-179	21	0.154	0.015	0.123	0.185
180-189	37	0.182	0.027	0.123	0.241
190-199	51	0.186	0.011	0.164	0.208
200-209	56	0.164	0.011	0.142	0.186
210-219	67	0.189	0.009	0.171	0.207
220-229	46	0.187	0.011	0.165	0.207
230-239	47	0.209	0.017	0.175	0.248
240-249	17	0.183	0.012	0.168	0.218
250-259	14	0.174	0.013	0.146	0.202
260-269	6	0.210	0.029	0.136	0.284
270-279	8	0.144	0.019	0.010	0.189
280-289	2	0.158	0.211	-2.522	2.838
290-299	4	0.148	0.040	0.021	0.275
300-309	4	0.152	0.010	0.120	0.184
310-319	2	0.088	0.013	-0.077	0.253
80-319	421	0.172	-	-	-

Ova diameter:

Ova diameter polygons of *E. orientalis* in various stages of maturity are shown in Fig. 1. The ova diameter polygon (frequency) curves of different stages of maturity are based on the measurement of ova from the ovaries of 21 fishes ranging in size from 110 to 270 mm. The ova diameter polygons vary between 0.049 and 1.169 mm. In *E. orientalis*, there is only one peak in the number of eggs from stages III to VI, indicating a single spawning in a year.

Gonosomatic index (GSI):

The GSI is a useful indicator of breeding activity in fishes. The GSI values according to month size-group are depicted in Fig. 2. The GSI values show considerable variation, from 0.01 to 4.0 in females, showing peak values of 2.5 at 260 mm TL and 4.0 at 300 mm TL, while the GSI values of male gonads range between 0.01 and 130 mm TL and 0.02 and 240 mm TL, which is indicative of the fact that the development of the testis does not show significant variation with increases in size (Table 2, Figs. 2a, 2b). The peak GSI values were observed in September and February. There is an abrupt fall in October and March-April. This suggests that there are two spawnings in a year, the first in September and the second in February, for both sexes (Table 2a, 2b, Figs. 3a, 3b).

Size at maturity:

Fish in stage I were considered to be "immature". Stages II and III were defined as "maturing" and IV and VI as "mature". The percentages were calculated for all groups, Fig.3 shows 50% maturation at 182 mm in males and 178 mm in females, indicating that the female

Table 3b. Mean GSI of female *Euryglossa orientalis* in different size groups.

Size group (mm)	N	$\bar{X}$	S.E.	Confidence limits	
				Minumum	Maximum
100-109	1	0.081	-	-	-
120-129	1	0.740	-	-	-
130-139	3	0.255	0.007	0.225	0.285
140-149	3	0.276	0.022	0.182	0.370
150-159	2	0.331	0.014	0.153	0.509
160-169	4	0.362	0.072	0.133	0.591
170-179	5	0.477	0.103	0.191	0.763
180-189	6	0.775	0.217	0.217	1.333
190-199	14	1.156	0.303	0.502	1.810
200-209	24	1.206	0.303	0.579	1.833
210-219	35	1.157	0.146	0.861	1.453
220-229	46	1.354	0.179	0.994	1.714
230-239	32	1.553	0.293	0.995	2.151
240-249	31	1.645	0.312	1.008	2.282
250-259	19	2.000	0.310	1.349	2.651
260-269	24	2.447	0.435	1.547	3.347
270-276	6	2.209	1.352	1.267	5.685
280-289	7	1.086	0.230	0.523	1.649
290-299	10	1.904	0.524	0.719	3.089
300-309	4	3.76	0.960	0.915	6.677
310-319	1	-	-	-	-
330-339	2	4.013	0.800	-6.152	14.178
340-349	1	-	-	-	-
350-359	1	-	-	-	-
100-359	282	1.372	-	-	-

matures earlier than the male. The male also appear to be smaller than the female there was 100% maturation at 280 mm TL in males, this was observed while at 300 mm TL in females (Fig. 3).

Sex ratio:

The overall male and female sex ratio was 0.615:0.385, which is statistically significant when compared with the theoretically expected ratio of 1:1.

Significant differences in the sex ratio were mostly found in the samples taken from November to February and in April (Tables 4, 5). In these months, males outnumbered females, which may be due to differential fishing and breeding.

In respect to size, the sex ratio was significant for the groups in the 170-220 mm TL range, males outnumbering the females in all size-groups except 260-269, corresponding to breeding size, in which females outnumbered males.

Fecundity:

Fecundity counts were carried out on 30 ovaries of *E. orientalis* (Table 6b). The mean fecundity was 38318 values varying from 9922 in a fish measuring 210 mm TL to 83891 in a fish of 278 mm TL. The fecundity per gram of body weight was 124 and per gram of ovary, 2989. The log-log relationships between fecundity (F) and total length (TL), weight of the fish (Wf), weight of an ovary (Wov), right ovary length (LROV) and left ovary length (LLOV) were determined using the least-squares method (Table 6a, 6b).

Months	Ratio M:F	Proportion of male	x^2 (Chi-square)
April, 87	15:05	0.750	5.000
May	23.18	1.561	0.609
June	32:22	0.592	1.851
July	19:23	0.452	0.381
August	04:07	0.363	0.818
September	37:26	0.587	1.920
October	30:20	0.577	1.230
November	38:17	0.691	8.018*
December	52:23	0.722	11.213*
January, 88	55:20	0.743	16.550*
February	52:16	0.765	19.058*
March	18:22	0.450	0.400
April	42:09	0.807	21.353*
May	31:29	0.516	0.066
June	18:32	0.360	3.920
Total	466:291	0.615	40.455*

Table 4. Sex ratio of *Euryglossa orientalis* in different months.

* Significant at 95% level of confidence.

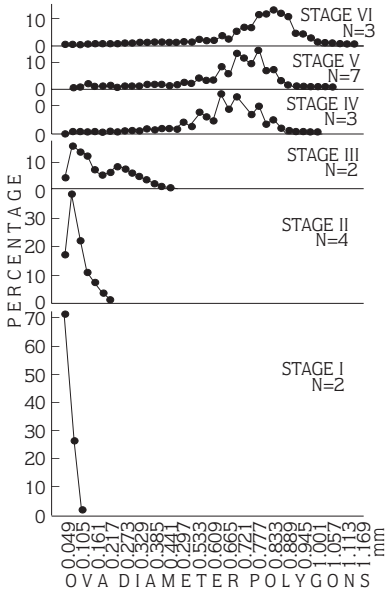

Figure 1. Ova diameter polygons for *E. orientalis*

Discussion

A single prominent peak in ova diameter was recorded between stages III and VI, indicating a single spawning in the year (Fig. 1). This observation of one spawning in a definite short period may be related to indivadials spawning only once in each season in Clupeoid fishes (9) and in the solenette *Buglossidium luteum* (20).

The peak GSI value at 260 mm TL and above occurred together with 90-100% gonadal maturation. Two peaks in GSI values, in September and February (Figs. 2a, 2b), sugesst two spawnings in a year, but the ova diameter frequency curves indicate only one. Such phenomena have also been observed in the poor cod-*Trisopterus minutus* (5).

The sex ratio of females to males in the overall sample was 1.0:1.8 but females were comparatively more abundant in small sizes (10) of the Goa coast, while in this study it was found to be 1.0:1.6 along the Karachi coast. Significant x^2-values were observed during the period November to February and in April, showing males outnumbering females. A signficant x^2-value was

Table 5. Sex ratio of *Euryglossa orientalis* in different size groups.

Size group (mm)	Ratio M:F	Proportion of male	x^2 (Chi-square)
80-89	01:00	-	-
90-99	-	-	-
100-109	03:01	0.750	1.000
110-119	01:00	-	-
120-129	01:01	0.500	0.000
130-139	09:03	0.750	3.000
140-149	03:03	0.500	0.000
150-159	10:02	0.833	5.333*
160-169	13:05	0.722	3.555
170-179	24:05	0.827	12.488*
180-189	40:06	0.870	25.130*
190-199	53:15	0.779	21.235*
200-209	65:25	0.722	17.777*
210-219	77:37	0.675	14.030
220-229	54:48	0.529	0.352
230-239	52:33	0.612	4.247*
240-249	17:31	0.354	4.083*
250-259	15:19	0.441	0.470
260-269	08:25	0.242	8.757*
270-279	08:06	0.571	0.285
280-289	02:07	0.222	2.777
290-299	04:04	0.500	0.000
300-309	04:04	0.500	0.000
310-319	02:01	0.666	0.333
320-329	-	-	-
330-339	00:02	-	-
340-349	00:01	-	-
350-359	00:01	-	-
80-359	466:291	0.615	40-455*

* Significant at 95% level of confidence.

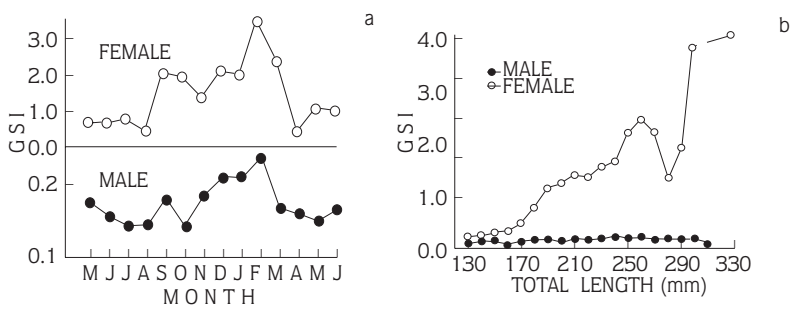

Figure 2. Mean GSI values occoding to (a). season, (b). size-group

observed at 170-220 mm TL, which is indicative of sexual maturity at these lengths. A significant x^2 value at 260-269 mm may indicate 90-100% maturation and the fact females outnumbered the males at these lengths. 50% maturation occurred at 182 mm TL in males and 178 mm TL in females.

Tables 4 and 5 show that the total observed male=female ratio of 0.615:0.385 differens significantly from the theoretically expected ratio of 1:1. the overall sex ratio of females to males was 1.0:1.8 (10) in fishes of the Goa coast, while in this study it was found to be 1.0:1.6. The 1:1 sex ratio may also be affected by selective fishing in different seasons and schooling behaviour in feeding and spawning grounds (16, 22, 23).

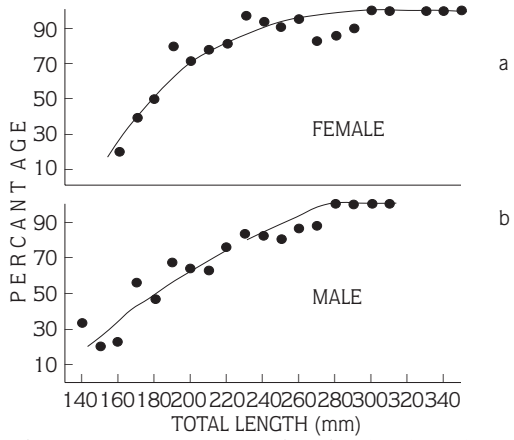

Figure 3. Percentage occurence of (a). females, (b). males in different size-groups

Table 6a. Regression equation for fecundity and total length (TL), weight of fish (W_f), weight of ovary (W_{ov}), lehgth of right ovary (L_{ror}) and length of left ovary (L_{lov}).

Parameters	N	a	b	S.E.a	S.E.b	r	't' for r
F/Tl	30	-6.082	4.389	1.7505	0.7349	0.750	6.0000
F/W_f	30	1.591	1.174	0.3106	0.0399	0.743	5.8749
F/W_{OV}	30	3.321	1.100	0.0793	0.0063	0.934	13.8359
F/L_{rov}	30	-1.100	2.651	1.3730	0.6710	0.598	3.9437
F/L_{lov}	30	1.437	1.093	0.9640	0.5180	0.370	2.1068

Table 6b. Average of fecundity counts according to size-group Euryglossa in orientalis.

Frequency	Length	Average length of fish	Average weight of fish	Average weight of ovary	Average No. of ova	No. of ova/gram weight of body	No. of ova/gram weight of body
1	190-199	197.00	133.00	5.33	18652	140	3519
2	200-209	202.00	13415	4.85	10513	78	2168
4	210-219	211.75	160.77	4.55	9922	62	2181
5	220-229	224.20	194.06	6.94	44484	229	6409
2	230-239	233.50	173.50	7.40	17975	77	2429
5	240-249	243.80	234.58	11.44	29968	123	2619
1	250-259	259.00	264.40	7.81	15135	57	1940
4	260-269	262.50	306.32	14.55	39225	128	2696
1	270-279	278.00	440.50	34.30	83891	190	2446
1	280-289	287.00	348.60	18.20	42341	121	2326
2	290-299	297.00	560.65	18.40	65250	116	3546
2	300-309	302.50	518.00	23.00	82455	159	3585
30	190-309	249.90	289.06	13.06	38318	124	2989

Fecundity increased 4.389 more than length ($F=L^{4.389}$). In many other fish species, such as plaice, 24, fecundity has been reported to increase at a rate 3 times the increase in length, or more haddock (15). High fecundity in *E. orientalis* may be due to bottom habitats, high local productivity and-high temperature. According to Bagenal (4), fish length is more suitable for predicting fecundity in the filed with large samples and time limits.

References

1. Bagenal, T.B. Annual variation in fish fecundity. J. mar. biol. Ass. U.K., 36:377-82, 1957.
2. Bagenal, T.B. The fecundity of clyde plaice. J. mar. biol. Ass. U.K., 37-304-13, 1958.
3. Bagenal, T.B. The fecundity of English channel plaice. J. mar. biol. Ass. U.K., 39:249-54, 1960.
4. Bagenal, T.B. Aspect of fish fecundity. In:S.D. Gerkinğ (Ed.), Ecology of Fish Production. Blackwell Scientific Publ., pp. 75-101, 1978.
5. Cooper, A. The reproductive biology of poor cod, Trisopterus miniatus L., whiting, Merlangus merlangus L., off the west coast. Indian J. Mar. Sci., 9:19-24, 1983.
6. Darracott, A. Avaliability, morphoemtric, feeding and breeding activity in a multispecies, demersal fish-stock of the Western Indian Ocean. J. Fish. Biol., 9 (6):1-16, 1977.
7. Datta, N.C. and M. Das. Reproductive organs of Cynoglossus arel with special refeirence to asymmetry. Proceedings of the National Academy of Sciences, India, 55(B):192-95, 1985.
8. Davedass, P., P.K. Mahadevan, P.N. Pillai and K. Munyandi. Observation on some aspects of biology and fishery of Psetodes erumei (Bloch) at Porto Hovo. Ind. J. Fish., 24(2):62-8, 1977.
9. Dharmamba, M. Studies on the maturation and spawning habits of some common clupeoids of Cawsons Bay, Walter. Indian J. Fish., 6(2):374-88, 1959.
10. Dwivedi, S. and M.R. Menezes. A note on the morphometry and ecology of Brachiusus orientalis (Bl. & Schn.) in the estuaries of Goa. Ind. J. Fisheries, 1(4):80-83, 1974.
11. Hickling, C.F. and E. Rutenberg. Ovary as an indicator of spawning period of fishes. J. mar. biol. Ass. U.K., 21:311-17, 1936.
12. Hoda, S.M.S. Reflection on fishery production. Pakistan. Agric., 10(5):50-55, 1987.
13. Hoda, S.M.S. Fishes from the coast of Pakistan. Biologia Pakistan, 34(1):1-38, 1988.
14. Hoda, S.M.S. and B. Khalil. observation on the biology of Cynoglossus bilineatus (Lacep) and C. arel (Bl. & Schn.) from the Karachi, Sindh coast. proceedings of the Arabian Sea Living Marine Resources and Environment, pp. 309-30, 1995.
15. Hodder, V.M. Fecundity of Grand Bank haddock. J. Fish. Res. Bd. Can., 20:1465-87, 1963.
16. Lasiak, A. Aspects of the reproductive biology of the Australian mullets. Account of the fishery and preliminary statement of biology of Mugil dobula Gunther. Bull. Count. Sci. Ind. Res. Melb., 157:98, 1982.
17. Majid, A., H. Adhami and Anis Amad. Some aspects of the biology of Indian Halibut (Psetodes erumei) in North Arabian Sea along the coast of Pakistan. Scientific Khyber, 9(11):93-102, 1996.
18. MacGregor, J.S. Fecundity of the Pacific sardine (Sardenops caerula). U.S. Fish and Wild Service. Fish. Bull., 121:427-49, 1957.
19. Melkikov, Y.S. Distribution and soma biological properties of three flatfish species (family Psettodidae and Bothidae) near the western coast of the Indian Peninsula. J. Khth., 21(6):154-57, 1981.
20. Nottage, A.S. and E.J. Perkins. The biologğy of solenette, Buglossidium luteum (Risso) in the solway fish. J. Fish. Biol., 22:21-27, 1983.
21. Rajaguru, A. Biology of two co-occuring tongue sole fishes Cynoglossus arel and C. lida (Pleuronectiformes: Cynoglossidae) from Indian water. Fish. Bull. U.S., 90:328-67, 1992.
22. Sarojini, K.K. Biology and fishery of the grey mullet of Bengal. 2. Biology of Mugil cunnesius (Val.). Indian J. Fish., 5:56-76, 1958.
23. Silva, E.I.L. and S.S De Silva. Aspects of the biology of grey mullet, Mugil cephalus L., Adult populations of coastal logoon in Sri Lanka. Fish. Biol., 19:1-10, 1981.
24. Simpson, A.C. The fecundity of the Plaice. Fish Invest., M.A.E.F. (U.K.) (2:Sea fish), 17(5):1-27, 1951.
25. Zar, H.Z. Biostatistical analysis. Prentice-Hall, Inc., Englewoods Cliffs, N.Y., pp. 1-620, 1974.