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## Sex composition of the fringe scale sardine, *Sardinella fimbriata* (Cuvier and Valenciennes, 1847) from Karwar waters, Karnataka

**RG Kudale, JL Rathod**

### Abstract

Sex composition of fringe scale sardine *Sardinella fimbriata* (Cuvier and Valenciennes, 1847) has been studied from Karwar waters, Karnataka. Sex ratio was calculated for different months and size groups of the fish were tested by using Chi-square ( $\chi^2$ ) test. The ratio for different months and size groups of males to females was found to be 0.97: 1.02 and 1.02: 1.03 respectively. The test of significance revealed that in January, August and December 2012 proportion of males and females varied,  $\chi^2 = 3.2 = 4.642$ ,  $\chi^2 = 4.9 = 1.064$  and  $\chi^2 = 3.36 = 3.665$  ( $P < 0.05$ ) respectively. The Chi-square test for pooled data did not show any significant variation ( $\chi^2 = 1.64 = 0.148$ ,  $P < 0.05$ ). An attempt has been made to study the sex composition of *Sardinella fimbriata*; these findings will help to predict the yield and exploitation of these fish from Karwar waters.

**Keywords:** Fringe scale sardine, *Sardinella fimbriata*, Sex composition, Sex ratio

### 1. Introduction

Karwar is one of the major fish landing centers. Though extensive studies on oil sardines have been carried out from time to time, very little attention is paid on lesser sardines and their fishery. Among the commercial food fishes of the world, clupeids ranks second. In India clupeid fish contributes about a one-third of the marine fish production and are represented by the sardines, anchovies and white baits. Sardines form a major fishery resource among the marine pelagic fin fishes of the Indian seas, of which lesser sardines contributes to lucrative fisheries along the Indian coast and has considerable employment potential. Two species of lesser sardines, *Sardinella fimbriata* and *Sardinella gibbosa* dominate in the commercial catches landed in and around Karwar. Fishery is carried out mainly by the indigenous crafts and gears, which is highly labour intensive. The abundant occurrence of the *S. fimbriata* along the west coast is as a by-catch, which meets the need of food of coastal people and also used as manure. The study on sex ratio gives an idea about sex viability, segregation and aggregation of sexes according to their feeding, breeding or migratory behavior (Dutt, 1959) <sup>[1]</sup>. Information on the fishery and biology of the lesser sardines is chiefly available from the studies carried out by various scientists amongst Chacko (1946) <sup>[2]</sup>, studied the bionomics of the Indian sprat *S. gibbosa*. (Dutt, 1959 and 1961) <sup>[1 & 3]</sup>, done biometric studies on the *Sardinella spp.* *S. fimbriata*, and *S. gibbosa* off Waltair Coast; Bennet (1967) <sup>[4]</sup>, made some observations on the fishery and biology of *S. fimbriata* at Vizhinjam. Sekharan (1968) <sup>[5]</sup>, studied the growth rates of the sardines *S. albella* (Val.) and *S. gibbosa* (Blkr.) from Mandapam area and (Radhakrishnan, 1963a) <sup>[6]</sup>, noted some aspects of the biology of the fringe scale sardine, *S. fimbriata*.

Fishery and the fish Knowledge, about sex composition of the catch helps in understanding whether any differential fishing exists between males and females and if so, it's possible bearing on the fishable stock (Surendra Babu and Neelakantan, 1983) <sup>[7]</sup>. Previously, oil-sardine investigation at Karwar was carried out by (Radhakrishnan, 1969) <sup>[8]</sup>. Similar attempts were made to study the maturity stages of the Indian oil-sardine, *Sardinella longiceps* by (Antony Raja, 1972) <sup>[9]</sup>. So far there have been some earlier reports about distribution, abundance and biological aspects but study on sex ratio of *S. fimbriata* will contribute to the existing knowledge as this fish is most important commercial fish species the details of which are discussed in this research paper.

**2. Materials and Methods:**

Karwar is located at 14° 48' 30" N and 74° 07' 42" E. Fresh and random samples of *Sardinella fimbriata* were collected from the fish landing centre Karwar and Karwar fish market, Baithkol and Majali, during the period between December 2011 to December 2012. The collected fish were brought to the laboratory and were properly cleaned, blotted and studied for the biological details.

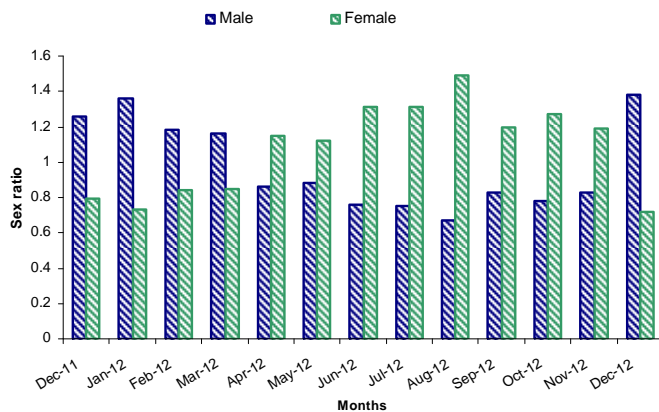
During present study total 1575 fish were examined. Amongst 1415 fish were used for the determination of sex and 160 fish were in-determinate. Length of each fish was measured to the nearest mm. All the fish were cut open and the sex was determined by examining the gonads. The sex ratio was calculated for different months and for specific length groups. The data is pooled, month-wise and length-wise to study the distribution of sexes according to the months and size of fish. The observed sex ratio of males to females was tested against natural ratio 1:1, by Chi-square analysis (Snedecor, 1946) [10].

**3. Results and Discussion:**

Much work has not been done with regard to the lesser sardines at Karwar coast, though they contribute as considerable share to the total marine fish production.

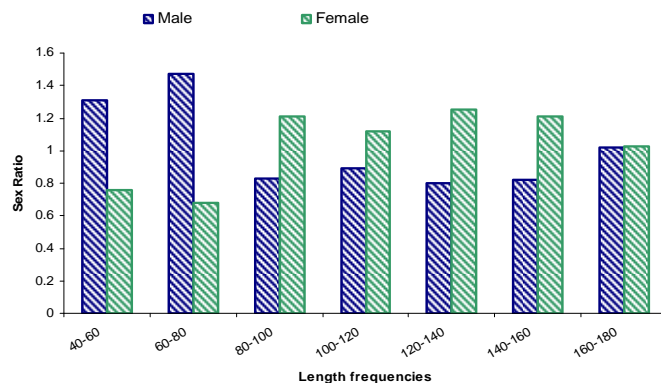
The data on sex ratio for each month showed that from December to March number of males exceeded, i.e. males outnumbered females, which coincided with the active spawning season (Fig.1). Similar observation was reported in *Katsuwonus pelamis*, males were more in number than females in 541- 620 mm length sizes (Raju, 1964) [11]. Preponderance of males may be due to the aggressiveness of the males during spawning (Wade, 1950) [12]. Females outnumber the males amongst the juveniles and spawners, while the males slightly predominate than females after spawning in *S. longiceps* (Hornell and Nayudu, 1923) [13].

In present investigation the ratio of males to females was found to be 0.97: 1.02 similar results were also reported by earlier workers. The male and female in-determinate of lesser sardines *S. albella* and *S. gibbosa* exhibited a ratio of 1.12: 1 and 1.46: 1 in Mandapam waters (Bennet, 1967) [4]. The *Hilsa ilisha* exhibited a male to female ratio of 1: 1.87 in the commercial catches along East Coast of India (Ramakrishnaiah, 1972) [14]. Male were more numerous among the immature forms but the condition is reversed among the spent oil-sardines (Radhakrishnan, 1969) [8]. In the present study the ratio for different months and size groups of males to females was found to be 0.97: 1.02 and 1.02: 1.03 respectively. But in larger size groups females dominated in the catches. Critical value of Chi-square ( $X^2$ ) = 1.64 = 0.148; 0.05; 1 D. F. Sum of 13 Chi-square ( $X^2$ ) = 21.41, the table value for Chi-square n-1; 5% (13-1=12); 12; 0.05% = 21.026. Month wise there was non-significant difference in the sex ratio of *S. fimbriata*. The flat fish *Cynoglossus semifasciatus* has a sex ratio of 1: 1.3 (Seshappa and Bhimachar, 1955) [15]. Pooled data over a period of years shows that the sex ratio is 1: 1.29 of males to females. In present study it is observed that in the months of December to March, large number of males was found as compared to females, this may be because the male fish mature well in advance than female and may move to the spawning grounds so as to ensure maximum fertilization of the eggs, similar observations were made in *Mugil parsia* (Sarajini, 1957) [16].



**Fig 1:** Monthly variation in the sex ratio of *Sardinella fimbriata* during December- 2011 to December- 2012

In the size group wise ratio, 60- 80 mm and 80- 100 mm, the male as to female ratios were 1.31: 0.76 and 1.47: 0.68. In higher length sizes more number of female was recorded 100-120 mm; 120- 140 mm; 140- 160 mm and 160- 180 mm, the male as to female ratios were 0.83: 1.21; 0.89: 1.12; 0.80: 1.25; and 0.82: 1.21 respectively (Fig.2). Critical value of Chi-square ( $X^2$ ) = 5.19 = 7.289; 0.05; 1 D. F. and the sum of 6 Chi-square ( $X^2$ ) = 31.15, table value for Chi-square ( $X^2$ ) n-1, 5% (6-1=5); 5; 0.05% = 11.070. Size group wise there is significant difference in the sex ratio of *S. fimbriata*. In *K. pelamis* comparison between 541- 620 mm. length sizes, male were more than the females (Raju, 1964) [11]. Similar observations were made; as there is dominance of males in the 140- 150 mm size group size group and of females in the 170-190 mm size group due to their faster growth during the June-October period (Antony Raja, 1972) [9]. In *Johnius belangerii* male to female ratio was 1: 1.26 in the commercial catches. It is observed that, as the length of fish increases the number of female also increases. Since the differences in the number of males and females are significant beyond 110 mm. According to Sarojini, 1957 [16], male and female fish congregate in separate schools while moving to the spawning grounds. It is possible that there is breeding migration in the species (Kusuma Neelkantan, 1983) [17]. Preponderance of one sex in a population is because of sexual difference in growth rate, the faster growth rate leads increasingly to the less loss from predator this influences the sex ratio (Qasim, 1957) [18]. Thus the information on the sex ratio of *S. fimbriata* will be helpful to exploit fishery resources on sustainable basis.



**Fig. 2:** Length frequency (mm) wise variation in the sex ratio of *Sardinella fimbriata*

#### 4. Conclusion

The data on sex ratio in relation to size groups suggest that males outnumbered females from December to March (80-100 mm size groups), which coincided with the spawning season. For rest of the months females were comparatively more than that of males. The Chi-square test values for pooled data showed significant variation ( $\chi^2 = 5.19 = 7.289$ ,  $P < 0.05$ ). Study of sex composition will provide an idea about their abundance.

#### 5. Acknowledgements

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