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Note

Egg production in the threatened seabass, *Lates calcarifer* (Bloch) along Tuticorin coast, Gulf of Mannar

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ABSTRACT

The total annual potential fecundity of mature *Lates calcarifer* (n = 47) of 855 to 1,255 mm range along Tuticorin coast in Gult of Mannar was estimated. The lowest fecundity was observed to be 3.85 x 10^6 and highest 30.18 x 10^6 eggs. The fecundity was positively correlated with the length and weight of the fish.

Lates calcarifer or tropical seabass is a large sized centropomid teleost inhabiting coastal, brackish and freshwaters of the Indo-Pacific region. It is one among the valuable species for aquaculture and is commercial as well as sport fisheries in the region. It exhibits a complex life history and is a protandric hermaphrodite (Lal, 1992; Guaigven *et al.,* 1994).

L. calcarifer is one among the threatened brackishwater fish species of India (Mahanta *et al.,* 1994). Information on life history traits and biology is essential to have an effective conservation strategy for this fish. At present, such information is not well documented for the species from Indian waters. The available information and issues related to fishery, distribution and aquaculture of *L. calcarifer* in India have been reviewed by Kasim and James (1987) and James and Marichamy (1987). The necessity for a detailed study on its biology to develop its commercial culture has already been emphasised (Bensam and Nammalwar, 1991).

The present report highlights the total annual potential fecundity of *L. calcarifer* studied along the Tuticorin coast. Gulf of Mannar. An attempt is also made to draw comparison between the results reported from the other geographical areas.

Female *L. calcarifer* were collected from commercial catches made mainly through gill net, shore seine and hooks and line fishing. The ovaries were dissected out and weighed to the nearest gram. The ovarian stage was assessed microscopically and confirmed through histological examination (Lal, 1992).

The present work was carried out as part of a programme on reproduction in *L. calcarifer,* covering aspects of biology and gametogenesis, based on assessment of 923 specimens. Out of the total,

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184 specimens were obtained during the peak breeding seasons (October-December 1987, 1988) and proportion of fishes at stage 4 and 5 (Lal, 1992) was 41.9 %. Fecundity data was obtained by subsampling method (Greeley *et al.*, 1987) for 47 *L. calcarifer* with ovaries in maturity stage 5. Three subsamples of 200 mg each were excised from the anterior, middle and posterior regions of the ovaries after cutting open through tunica albuginea. The yolky eggs were separated on a glass slide in a drop of 1 % formalin in 0.8 % NaCl and counted. Values of the subsamples were averaged and multiplied with a factor (weight of paired ovaries in g $\times$ 0.2) to get the total fecundity estimate for each fish. The fecundity estimate alongwith total length (mm) and body weight (kg) were transformed to logarithms. Through the simple linear least square method, fecundity was regressed over total length and body weight fitting the equation log Y= a+b log X.

Fecundity estimates of *L. calcarifer* in the length range of 855 to 1,275 mm exhibted the lowest value of 3.85 x 10^6 and the highest of 30.18 x 10^6 eggs. Fecundity (F) was found to increase with body weight (W) and total length (L) Figs. 1 & 2. The relationships derived are as follows.

$$\text{Log F} = 1.4143 \log W + 4.6552 \ (r^2 = 0.68)$$

$$\text{Log F} = 2.8903 \log L + 7.684 \ (r^2 = 0.74)$$

The fecundity estimates reveal high egg producing capacity of *L. calcarifer*. The fish is said to be one of the high fecund fishes having maximum eggs upto 32 x 10^6 (Papua New Guinea; Moore, 1979) and 46 x 10^6 (Gulf of Carpentaria; Van Diemen Gulf; Davis, 1984 a). The high fecundity is an adaptation to realise better reproductive potential; particulary in species with no parental care. Reproductive potential depends upon the number of eggs that are fertilised and hatched and the environmental conditions to which the offsprings are exposed (Ogutu, 1988). Davis (1984a) opined that the extremely high fecundity can enable *L. calcarifer* to maintain recruitment through available limited number of females. The females are derived through sex inversion from males and some may not start egg production before 8 years old (Davis, 1984 a). Besides this, all the females do not undergo ovarian recrudescence every year (Moore, 1982). It is approximately 23 per cent in the area under study (Lal, 1992).

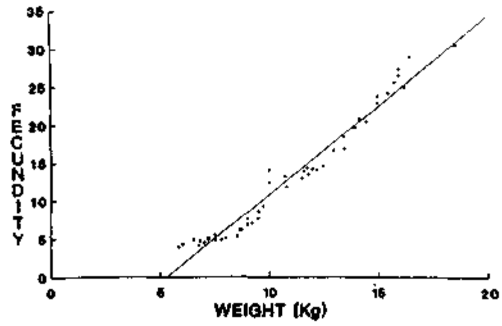

Fig. 1. Relationship between fecundity ($\times 10^6$) and body weight (kg) of *L. calcarifer*.

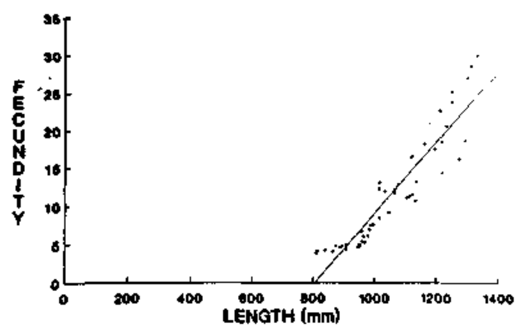

Fig. 2. Relationship between fecundity (10^6) and total length (mm) in *L. calcarifer*.

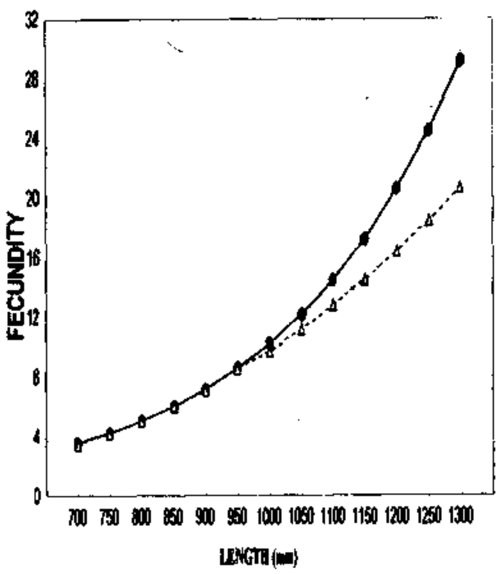

Fig. 3. Comparison of fecundity estimates ($x10^6$) against length of *L. calcarifer* computed from fecundity-length relationship of present study (- -) and Davis, 1984 (-•-)

L. calcarifer in the study area is an annual breeder and no evidence indicating multiple spawning is encountered through histological examination, oocyte size frequency and alkali labile phosphorous profiles (Lal, 1992). Therefore, the fecundity estimates represent the total annual potential fecundity.

The fecundity increases with the body size as reported in most of the teleosts studied (Beverton and Holt, 1957; Moore, 1982; Ogutu, 1988).

Although the larger size classes are more fecundable these exhibit consider able variability in egg counts. Data from Gulf of Carpentaria and Van Diemen Gulf also suggest similar conditions (Davis, 1984 a).

Studies from different areas depict overlap in the range of fecundity estimates, nevertheless differences exist. The overlap can probably be linked to variabilities within the populations. Dunstan (1959) has found a fecundity of 8.5 x 10^6 (n = 2) and 17 x 10^6 eggs in 19 and 22 kg fish from Queensland. Wagsomnuk and Maneewongs (1974) reported 2.1 to 7.1 million eggs in the weight range of 5.5 to 11.0 kg. In Chilka lake, the total annual fecundity was placed in the range of 4.5 x 10^6 to 6.6 x 10^6 egg (n=7) in the length range of 700-900 mm (Patnaik and Jena, 1976). The Population from Papua New Guinea is reported to produce eggs in the range of 2.3 x 10^6 to 32.2 x 10^6 (n = 21) from the wt. range of 7.7 to 20.8 kg. Davis (1984 a) reported the maximum fecundity from Gulf of Carpentaria (n = 18); sexually precocious population (n = 4) and Van Diemen Gulf (n = 7) upto 46 x 10^6 eggs (total n =29), from the fish in the length range 480-1,350 mm.

Fecundity was computed from total length-fecundity relationship of the present study and that of Davis (1984 a) for 700 to 1,300 mm length range with 50 mm class. Both the estimates agree closely upto 950 mm length class. Above this the estimates of current study are lower than that for Gulf of Carpentaria and Van Diemen Gulf (Fig. 3). Davis (1984 a) plotted with his data the data of Patnaik and Jena (1976) and Moore (1982). Estimates of Patnaik and Jena (1976) were found to agree closely but that of Moore (1982) were lower. The reason for this low estimates was attributed to the reported multiple spawning of the fish in Papua New Guinea (Moore, 1982). Due to the limited number of observations as well as the length range by Patnaik and Jena (1976) the variability could not become apparent. The lower estimates in the present study probably reflects the variability between the populations from different geographical areas, as no evidence of occurrence of multiple spawning activity has been encountered (Lal, 1992). Variations have been reported in *L. calcarifer* not only between different geographical areas but even within the same area for various biological parameters (Moore, 1982; Lal, 1992). Davis (1984 b) reported a sexually precocious population within the Gulf of Carpentaria where the fish is reported to reach the same body size in different years both within or between different rivers. The differences have been attributed to different environmental conditions to which the fish may get exposed in the long life cycle. This can be true for fecundity also. Shaklee *et al.* (1990) identified fourteen different genetic stock of *L. calcarifer* from western Australia, northern territory and Queensland. Since the same size classes can have a different age even within population of *L. calcarifer* (Davis, 1987), it is quite probable that age may also contribute towards variability in fecundity for the same size classes. The variability in the fecundity may not make it possible to use the estimates from one population to another for fishery as well as for hatchery management. It appears that if the fish from one population is transplanted to a new area, it will be appropriate to reconfirm its biological characteristics in the new environment.

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