Vidyodaya J. of Sci., (1994) *Vol. 5, No. 1, pp. 175 - 182*

SOME ASPECTS OF BIOLOGY OF THE SNAKEHEAD, *OPHICEPHALUS STRIATUS* BLOCH IN MUTHURAJAWELA, A PEATY SWAMP IN SRI LANKA

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Received on : 17 - 10 - 1994

Accepted on : 01 - 11 - 1994

Abstract

Growth, reproduction and mortality of the snakehead, *Ophicephalus striatus* Bloch, inhabiting the Muthurajawela swamp, a low pH environment in Sri Lanka, were studied using monthly samples collected by angling and indigenous fish traps. The asympototic standard length and growth coefficient were estimated to be 49.5 cm. and 0.194 $year^{-1}$ respectively. These figures were smaller than those estimated for this species in other regions of the country. The estimated total and natural mortality coefficients were 3.7 $year^{-1}$ and 1.7 $year^{-1}$ respectively. The exploitation ratio was 0.5 and indicates that this stock is exploited at the optimum level. The absolute fecundity of the fish ranging from 23.8 cm to 29.5 cm in standard length varied from 3800 to 10800 eggs. These figures are higher than those recorded for *O. striatus* in other regions of Sri Lanka. The relative fecundity ranged from 19 to 38 eggs/g of body weight. The minimum size at maturity for the females and males were 19.5 cm and 24.5 cm respectively. The sex ratio was found to be 1 female : 3.6 males.

Key Words : *Ophicephalus striatus*, growth, mortality, fecundity, exploitation ratio.

Introduction

The snakehead, *Ophicephalus striatus* is one of the most popular freshwater food fishes in Sri Lanka. In the recent past, it has been recorded in significant numbers in the fish catches of minor irrigation reservoirs in the low country (Indrasena 1965).

O. striatus is cultured in many south east Asian countries (Ling 1977) mainly due to the high demand for its palatable white flesh which is claimed to have rejuvenating properties (Wee 1982).

Recent research carried out on *O. striatus* in Sri Lanka include the studies on the use of alternative food sources (De Silva 1989, 1990), food conversion efficiencies in low pH conditions (Wijeyaratne 1989) and feasibility of its aquaculture in swamp conditions (Wijeyaratne 1990). Kilambi (1986) has studied the age, growth and reproductive strategy of *O. striatus* collected from south western region of Sri Lanka. The nesting habits, parental care and the development of young have been studied by Willey (1910).

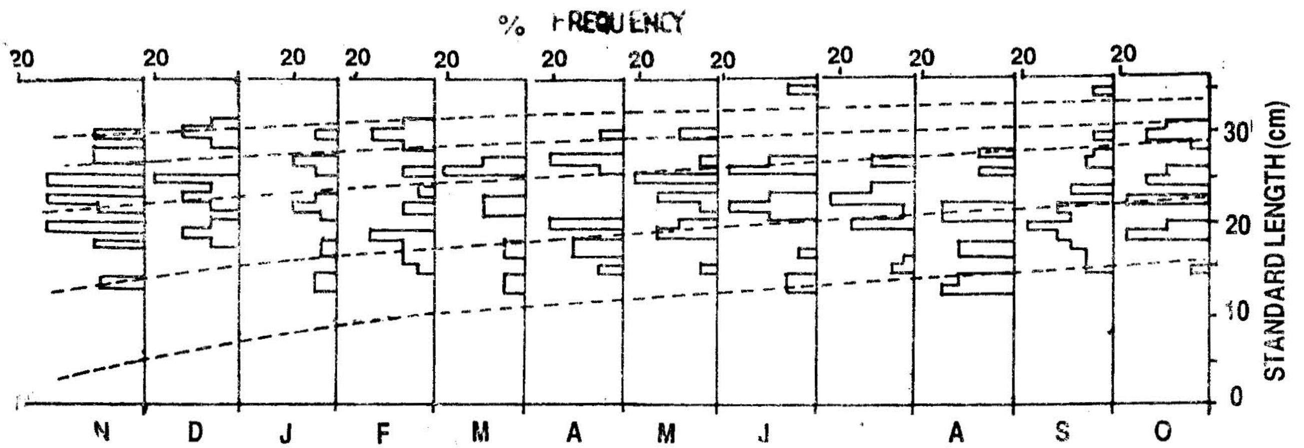
O. striatus is capable of tolerating extreme ecological conditions such as low pH (Varma 1979) and is found in significant numbers in the Muthurajawela swamp, which is a low pH, less productive peaty environment extending for about 3000 ha in the west coast of Sri Lanka. A subsistence fishery for this species by angling and using indigenous fish traps exists in this swamp through out the year.

Recent studies show that *O. striatus* can be cultured in dug-out ponds in low pH swamp environments (Wijeyaratne, 1990). A knowledge on the biology of this species will be very useful for a successful aquaculture programme (Wee 1982). No work has so far been done on any aspect of biology of O. *striatus* in low pH environments. This paper describes the growth rate, mortality rates, fecundity, the minimum size at maturity and spawning season of *O. striatus* inhabiting the Muthurajawela swamp which is characterized with low pH and less productive aquatic habitats.

Materials and Methods

Random samples each consisting of minimum of 50 individuals of *O. striatus* were obtained every month from fishermen's catch of Muthurajawela swamp from November 1990 to October 1991. Fish were transported alive to the laboratory and were freezed. After measuring the standard length and weight, each fish was dissected open and the sex and gonadal maturity stage according to the maturity classification described by Kilambi (1986) were recorded. Mature ovaries were preserved for 1 week in Gilson's fluid (Bagenal and Braum 1968) and fecundity was estimated using volumetric methods. Diameters of eggs of 16 mature ovaries were also measured using a micrometer eye piece.

The monthly length frequency distributions of *O. striatus* were analysed using the COMPLEAT ELEFAN computer programme (Gayanilo *et. al.*, 1989) and the asymptotic length and growth coefficient were estimated. The total mortality coefficient was estimated using the Z equation described by Beverton and Holt (1956). The natural mortality coefficient was estimated using Pauly's (1980) empirical formula. In this estimation, mean environmental temperature was taken as 30°C.



% frequency in each month

Fig. 1. Length frequency distribution for each month, together with estimated growth curves.

Results

The standard length of the fish present in the commercial catch ranged from 12.0 cm to 35.0 cm. The length frequency distribution for each month together with estimated growth curves are shown in Fig. 1.

The absolute fecundity of fish ranging from 23.8 cm to 29.5 cm in standard length varied from 3800 eggs to 10800 eggs. The relative fecundity ranged from 19 to 38 eggs/g of body weight. The statistical relationships of fecundity with body size are given in Table 1. The absolute fecundity was observed to increase significantly with size ($P < 0.05$). The relationships of relative fecundity with standard length and body weight were not statistically significant ($P > 0.05$).

The variation of mature fish in each size group is shown in Fig. 2. The minimum size at maturity for the females and males were found to be 19.5 cm and 24.5 cm in standard length respectively. The sex ratio was observed to be 1 female : 3.6 males.

The frequency distribution of egg diameters is shown in Fig. 3.

The relative abundance of different maturity stages in the samples during the study period is shown in Fig. 4. Spent females were observed in the samples from October to December and from March to May.

Asymptotic standard length and growth coefficient were estimated to be 49.5 cm and 0.194 $year^{-1}$ respectively. The estimated total and natural mortality coefficients were 3.7 $year^{-1}$ and 1.7 $year^{-1}$ respectively. The exploitation ratio was found to be 0.52.

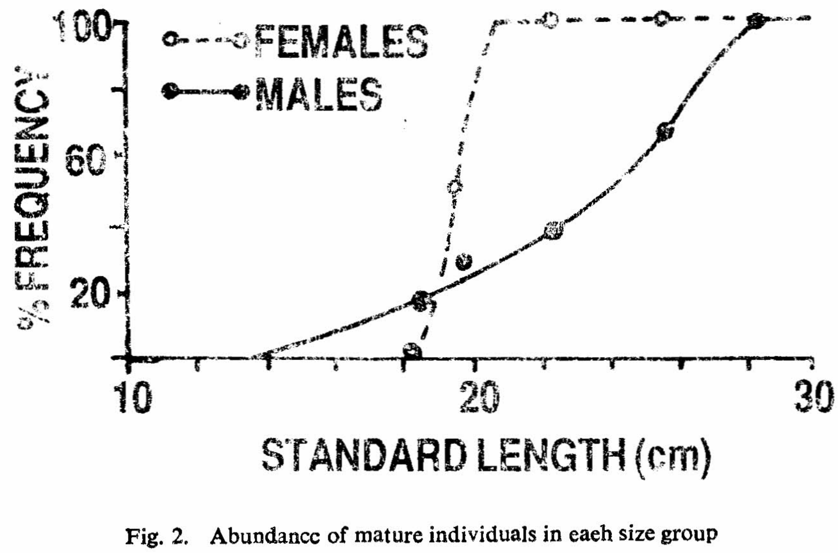


Fig. 2. Abundancc of mature individuals in eaeh size group

Discussion

The values for absolute fecundity observed in the present study are higher than those recorded by Kilambi (1986) for fish collected from south western region of Sri Lanka. This may be an adaptation for extreme ecological conditions of the Muthurajawela swamp to ensure the survival of more offspring. The values observed in the present study are close to those recorded in South India (Alikunhi 1953). Although no significant correlation between fecundity and body size has been recorded for *O. striatus* from south western region of Sri Lanka (Kilambi 1986), the regression equations between absolute fecundity and size parameters such as standard length and body weight calculated in the present study were statistically significant at 5% level (Table 1). Therefore, the standard length and body weight could be used to estimate the absolute fecundity of mature individuals of this stock in the Muthurajawela swamp. However, the relative fecundity did not show a significant relationship with the standard length and body weight ($P > 0.05$).

The percentage abundance of mature individuals in different size groups indicates that the females of this stock attain sexual maturity within a smaller size range than the males (Fig. 2). In addition, the values calculated for minimum size at maturity indicate that the females of this stock become sexually mature at a smaller size than that of the males. Similar observations have been made for diadromous fish species such as *Valamugil cunnesius* in brackishwater environments of Sri Lanka (Wijeyaratne and Costa 1988).

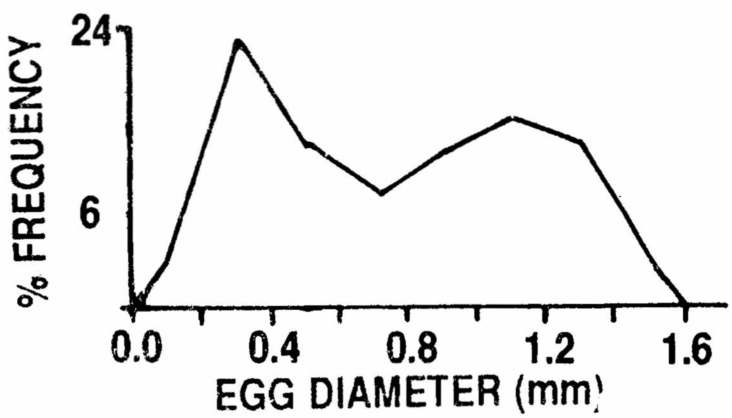


Fig. 3. Diameter distribution pattern of eggs.

The sex ratio in the catches was found to be unbalanced in favour of males. However, this does not indicate that the males outnumber the females in the population. It is possible that the males are more active and get caught in the gear in higher numbers than the females.

Egg diameter distribution pattern (Fig. 3) indicates that *O. striatus* in the Muthurajawela swamp is a single spawner which shed eggs in one batch during the spawning season. However, in south west region of Sri Lanka, partially spent females have been recorded during the spawning season (Kilambi 1986).

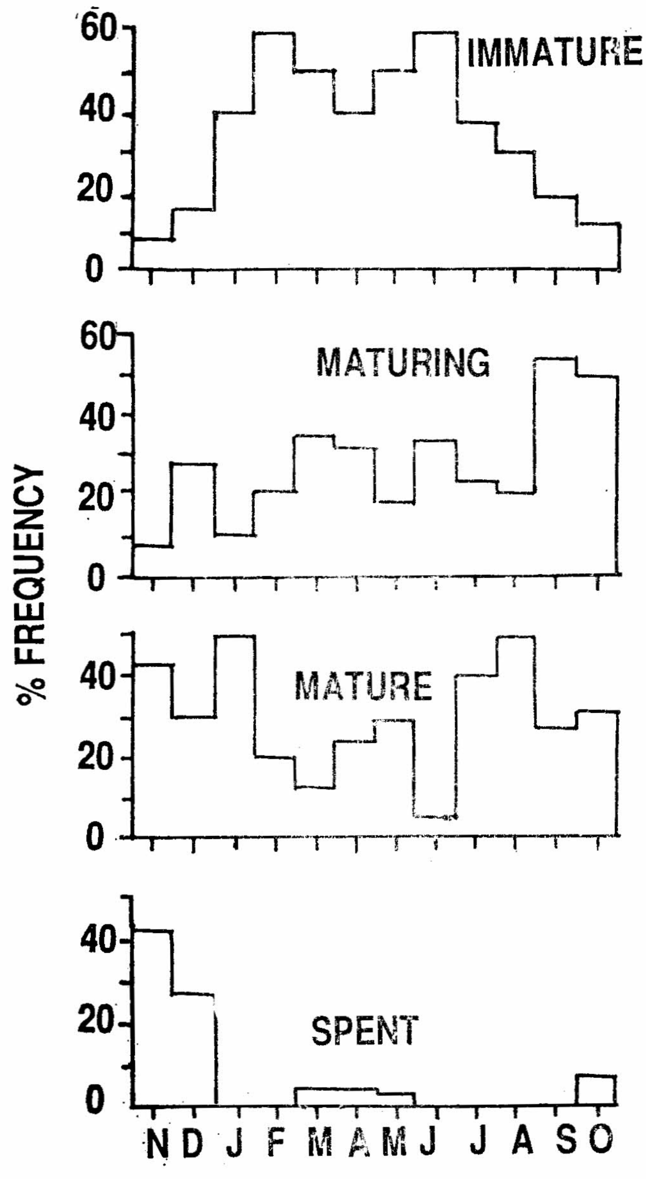


Fig. 4. Seasonal abundance of individuals of different maturity stages.

The presence of spent females in the catches from October to December and from March to May (Fig. 4), indicates that in the Muthurajawela swamp, *O. striatus* spawns during the intermonsoonal periods. Kilambi (1986) has also observed a minor spawning season for this species in November and December. However, the spawning season from May to September recorded for the fish inhabiting south western region of Sri Lanka (Kilambi 1986) was not observed during the present study. In southern India, Alikunhi (1953) has reported that the main spawning season is from November to January while Parameswaran and Murugesan (1976) have reported that to be from February to November. In northern India, the breeding season has been recorded to be from June to October (Qasim and Qayyum 1961). The heavy rainfall during the intermonsoonal periods may have stimulated *O. striatus* in the Muthurajawela swamp for spawning.

The values for asymptotic length and growth coefficient estimated in the present study are smaller than those recorded for the same species in India (Bhatt 1970) and south western region of Sri Lanka (Kilambi 1986). This indicates that the rate of growth of *O. striatus* in the Muthurajawela swamp is smaller than that in other regions. This is probably due to low productivity and extreme ecological conditions prevailing in this peaty swamp.

The optimum rate of exploitation of fish stocks is considered to be 0.5 (Gulland 1976). The exploitation ratio of 0.52 calculated in the present study indicates that *O. striatus* in the Muthurajawela swamp is exploited at the optimum level. The fishery of this species in this swamp is of very small scale and is mainly done at subsistence level. Any increase in fishing effort may adversely affect the existing stock.

Table 1.—Statistical relationships of fecundity with body size.

F	=	$27.12\ Wt + 71.78\ (r = 0.8617\ ;\ P<0.05)$
F	=	$0.1896\ SL^{3.2}\ (r = 0.7861\ ;\ P<0.05)$
RF	=	$0.0038\ Wt + 26.45\ (r = 0.0502\ ;\ P>0.05$
RF	=	$20.9001\ SL^{0.8}\ (r = 0.0344\ ;\ P>0.05)$
F	=	Absolute fecundity (in number)
RF	=	Relative fecundity (in number per g of body weight)
Wt	=	Body weight of fish (in g)
SL	=	Standard length (in cm.)

Acknowledgements

This study was carried out as part of a major investigation on the feasibility of aquaculture of *O. striatus* in the Muthurajawela swamp funded by the International Foundation for Science, Sweden (Research Grant : A/847-2).

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