

Reproductive Biology and Proximate Chemical Composition of the Filamented Barb, *Puntius filamentosus* in the Victoria Reservoir

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ABSTRACT. This study investigated the reproductive biology and proximate chemical composition of *Puntius filamentosus*, an indigenous minor cyprinid fish species which occur in abundance in the Victoria Reservoir. Analysis of the reproductive biology revealed that the overall ratio of males to females was 2:1. The body condition of females peaked in March and September prior to the rise in female gonadosomatic index (G.S.I.). Being a fish of riverine origin *P. filamentosus* is potamodromous. Sexually mature fish move upstream following onset of heavy rain and subsequent rise in water level in order to reproduce successfully. No fry were found in the sampling area confirming that it does not spawn in the reservoir. Female G.S.I. was significantly correlated ($r=0.63$; $p<0.02$) to water level. Fecundity varied between 161 to 927 and was most significantly correlated with body weight. Analysis of nutrient composition of the edible flesh (16.5% protein, 3.3% lipid, 0.6% ash and 0.1% crude fibre) indicated that this fishery resource could be made use of in different ways for income generation. Due to its high protein and low lipid content *P. filamentosus* could profitably be utilized for direct human consumption in cooked or dry form, or else, used to enhance the nutritional quality of fish meal based aqua feed. *P. filamentosus* is a popular aquarium fish in Sri Lanka and could also be used for the ornamental fish trade. This study therefore, highlights the value of this untapped fishery resource, which could profitably be exploited in the future by introducing a small meshed gill net fishery to the Victoria reservoir.

INTRODUCTION

The filamented barb *Puntius filamentosus*, is an indigenous minor cyprinid species which occurs in large quantities in the Victoria reservoir, but has not been commercially exploited hitherto. Ajith Kumara and Amarasinghe (1999) showed that this species could be differentially exploited in this reservoir using small mesh (< 52 mm) gill nets without harming juvenile tilapias or the existing commercial gill net fishery. Moreover, recent investigations (Amarasinghe *et al.*, 2000) using production per biomass ratio, have shown that these fish stocks have potential to withstand heavy fishing mortality, and hence to sustain productive fisheries.

Very little information is available on *P. filamentosus* in Sri Lanka. Except for short term studies on the food and feeding habits (Adamicka, 1983; Hofer and Schiemer, 1983; Schiemer and Hofer, 1983; Pathirana and Jinadasa, 1994; De Silva *et al.*, 1996) no information is available on the reproductive biology or the nutrient

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composition of the edible flesh of this species. This investigation therefore, is directed towards studying important aspects of the reproductive biology and proximate chemical composition of the edible flesh of *P. filamentosus* in order to promote its future utilization.

MATERIALS AND METHODS

Study site

The Victoria (7° 15'-7° 19' N; 80° 39'-80° 48' E) is a large, deep, recently impounded (1984) upland hydropower reservoir constructed by damming the trunk stream of the Mahaweli, by a unique double curvature arch dam. The reservoir lies 438 m above mean sea level at full supply (De Silva, 1992).

The area selected for sampling was Ambagahalanda (Fig.1), a major fish landing site of the Victoria reservoir. Samples were collected monthly along a length of about 75 m from January to December 2002 using hook and line and gillnets (< 52 mm mesh size).

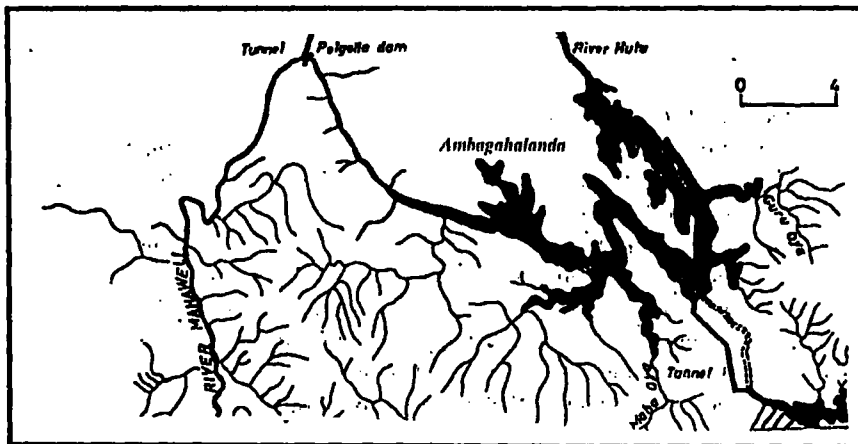


Fig. 1. The Victoria Reservoir.

Reproductive biology

A minimum of thirty *P. filamentosus* were collected monthly from the same sampling site, except in June-July and November-December, when there were very few fish in the sampling area. On each sampling occasion, the total length and weight of each fish was recorded. The fish were dissected, sexed, and the gonads were removed and weighed to the nearest 0.01g. Seasonal variations in the mean monthly gonadosomatic index (G.S.I.) taken as the percentage of the ratio between gonad weight and body weight was used to determine the reproductive pattern. Correlations were obtained between the female G.S.I. the annual rainfall and the water level. The mean monthly condition factor ((total weight/ total length³) x 100) for males and females was estimated throughout the study period.

The ovaries of each female in the monthly samples were staged according to a maturity scale similar to that described by Jhingran and Pullin (1985). For fecundity studies 15 ovaries in stage V were preserved in Gilson's fluid in small vials, shaken and kept in the dark. When the eggs were well separated, the number of yolked eggs in each ovary was counted. Correlations were obtained between fecundity and total length, body weight and gonad weight.

Proximate chemical analysis

Five fish were filleted and a portion of muscle devoid of skin and bone was taken. It was weighed to the nearest mg and dried to a constant weight at 100°C, and the moisture content was calculated. The proximate composition was determined using standard techniques (AOAC, 1980). Sample analysis for each fish was carried out in duplicate. Protein content was determined by the micro-Kjeldhal method, lipids by Soxhlet extraction and crude fibre using the fibre extraction apparatus. The ash content was determined by burning a known weight of the dried muscle at 550°C for 12 h in a muffle furnace. For determination of proximate composition five fish (minimum acceptable number) were used.

RESULTS AND DISCUSSION

Reproductive biology

Males predominated the *P. filamentosus* population in the Victoria reservoir with an overall male: female ratio of 2:1 during the study period. Fluctuations in the monthly female:male sex ratio of *P. filamentosus* showed that except for November when there was a preponderance of females, males predominated during all other months (Fig. 2). Deviation of the sex ratio from the expected 1:1 ratio such as seen in *P. filamentosus* has been observed in several other fish species as well, in some populations males predominating while in others females predominate (De Silva, 1995). Monthly changes in body condition of male and female *P. filamentosus* indicate that in males, fluctuations in body condition were not as marked as in females (Fig. 3). In females, two distinct peaks occur in March and September, preceding the rise in female G.S.I. (Fig. 4).

This study indicates that *P. filamentosus* does not breed in the newly created reservoir environment. During peak breeding in June-July, and November to December when female G.S.I. was highest (Fig. 4) there were very few *P. filamentosus* in the sampling site. The monthly samples, consisting of sexually mature males and females were collected upstream of the river Hulu indicating that *P. filamentosus* is potamodromous, actively migrating upstream for spawning after the onset of heavy rains in April and the North east monsoonal rains in October (Fig. 4), and subsequent rise in water level. Intensive sampling conducted each month in the sampling site inferred complete absence of *P. filamentosus* fry, indicating that *P. filamentosus* does not spawn in the littoral of the reservoir. The damming of rivers alters the natural riverine environment and converts the riverine or lotic environment to a lacustrine or lentic one. The survival of *P. filamentosus*, a fish of riverine origin, in the Victoria reservoir therefore, appears to have achieved through its ability to use suitable spawning habitats upstream of the river Hulu (Fig. 1).

Water level fluctuations play a major role in determining habitat suitability and reproductive success of fish species in the Victoria Reservoir. Seasonal changes in water level are linked to the rainfall pattern, since after heavy rain in April and November, the water level rises as the reservoir fills up (Fig. 4). Water level fluctuations are also related to drawdown of water for hydropower generation. Female G.S.I. is significantly correlated to water level ($r = 0.63$; $p < 0.02$) but not to rainfall ($r=0.22$; $p > 0.05$). Peaks in female G.S.I. occur in June-July and November-December following the rise in water level. Since sexually mature fish were collected during this period upstream of the Hulu river, it suggests that the rising water probably stimulates gonad ripening and the upstream migration for spawning.

Fecundity varied between 161 to 927 for fish having body length and weight of 10.7-13.4 cm and 13.5 - 30.1 g respectively. The statistical relationships of fecundity to various parameters revealed that fecundity is best correlated to body weight (Table 1).

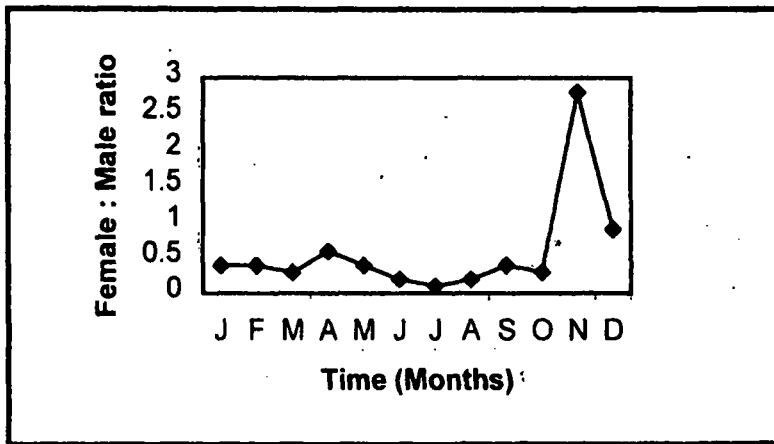


Fig. 2. Monthly variation in female : male sex ratio of *P. filamentosus* during the study period.

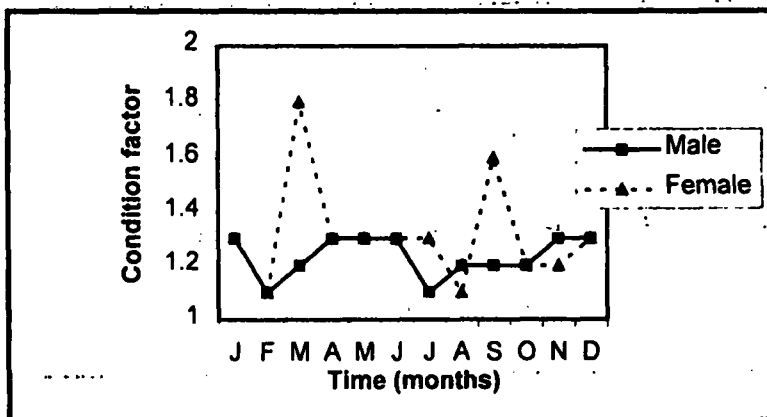


Fig. 3. Monthly variation in female and male condition factor of *P. filamentosus* during the study period.

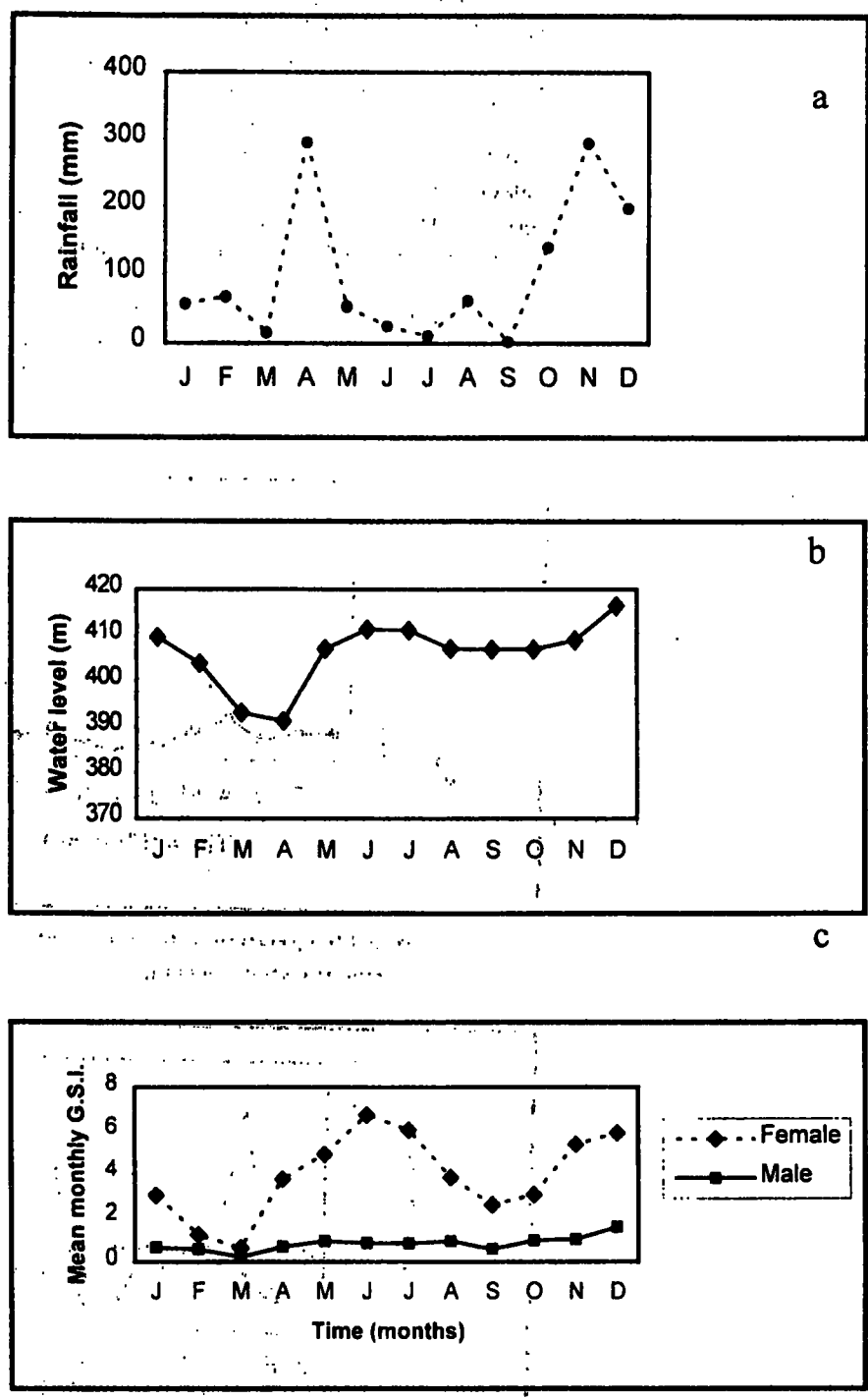


Fig. 4. Seasonal variation in (a) rainfall (b) water level and (c) mean monthly gonadosomatic index (G.S.I.) of *Puntius filamentosus* during the study period.

Table 1. Relationship of fecundity (F) to body weight (W), total length (L) and gonad weight (G). (n=15; n.s.=not significant; r = correlation co-efficient).

Parameter	Regression with fecundity	r	p
Body length (L)	F=-1373.37 + 150.70 L	0.64	<0.009
Body weight (W)	F= -175.14 + 28.86 W	0.71	<0.002
Gonad weight (G)	F= 352.28 + 90.89 G	0.32	n.s.

Proximate chemical composition

Table 2 gives the nutrient composition of the edible flesh of *P. filamentosus*. The nutrient composition compares well with that of tilapia (Table 2), the species which contributes most to freshwater fisheries in Sri Lanka.

The findings of this study indicate that the edible flesh of *P. filamentosus* could be utilized in different ways. The high protein and low lipid content make *P. filamentosus* suitable for direct human consumption either in cooked or dried form. It is particularly suitable for making dry fish due to its low lipid content, since excessive oil in dried fish gives an unpleasant taste and odour with time (Wimalasena and Jayasuriya, 1996). Moreover, the use of minor cyprinid resources from perennial Sri Lankan reservoirs to prepare fish meal based aqua feeds has been shown to be an important and feasible option (Amarasinghe *et al.*, 2000) for reducing the cost of certain aquaculture strategies. The high protein and low lipid content of the edible flesh makes *P. filamentosus* an ideal resource for aqua feed preparation.

Table 2. Comparison of the proximate chemical composition of *P. filamentosus* and Tilapia per 100 g of edible flesh.

	<i>P. filamentosus</i> (Present study)	Tilapia (Wimalasena & Jayasuriya (1996))
Moisture	77.5	78.3
Protein	16.5	17.8
Lipid	3.3	2.3
Ash	0.6	1.1
Fibre	0.1	n.a

(n.a.=not analysed)

Apart from its nutritive value, *P. filamentosus* is also a popular aquarium fish in Sri Lanka, and therefore it is a resource which could be profitably exploited for the aquarium trade.

CONCLUSIONS

Important information has been obtained on the reproductive biology and proximate chemical composition of *P. filamentosus* from this study. Analysis of the reproductive biology revealed that the population at the Victoria reservoir is male dominant with an overall male to female ratio of 2:1. From the present study it is

obvious that *P. filamentosus* is potamodromous, and reproductive success is achieved by mature fish migrating upstream to spawn following heavy rain and subsequent rise in water level. Spawning does not take place within the reservoir. Female G.S.I. was significantly correlated to fluctuations in water level ($r = 0.63; p < 0.02$). In the Victoria reservoir seasonal fluctuations in water level are drastic, and appear to play a significant role in inducing a seasonal reproductive pattern in *P. filamentosus*. Fecundity of *P. filamentosus* varied between 161 to 929 for fish having 10.7-13.4 cm total length and 13.5 to 30.1 g weight. Fecundity was best correlated with body weight. Studies on the proximate chemical composition of the edible flesh showed that the high protein and low lipid content make it suitable not only for human consumption, but also as an excellent resource for dry fish production and fish meal preparation. Since *P. filamentosus* is a popular ornamental fish in Sri Lanka, it is a resource which could be exploited for the aquarium trade as well. This study therefore, highlights the possibility of profitably utilizing this untapped fishery resource in the future by introducing a small meshed gill net fishery to the Victoria reservoir.

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