

# RARE

## SOME ASPECTS OF BIOLOGY AND POPULATION DYNAMICS OF SELECTED ENDEMIC FRESHWATER FISH SPECIES INHABITING TWO RIVER BASINS OF SRI LANKA.

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## ABSTRACT

According to the World Conservation Union, almost all endemic freshwater fishes of Sri Lanka are threatened. Further they are heavily exploited from most of their natural habitats for ornamental fish industry. Conservation, management and sustainable utilization of threatened species are very important to manifest the tropical aquarium fish industry and biodiversity in Sri Lanka. Therefore, present study was carried out from October 1998 to September 2000 to investigate some aspects of biology and population dynamics of six endemic freshwater fish species namely, *Belontia signata*, *Puntius cuningii*, *Puntius nigrofasciatus*, *Puntius titteya*, *Rasbora vaterifloris* and *Garra ceylonensis* inhabiting the Kalu and Kelani river basins with an objective of recommending suitable strategies for their sustainable utilization, conservation and management. Thirty sampling sites in the two river basins were visited at monthly intervals. Fish were caught using a cast net with 1.0 cm stretched mesh and a fine mesh scoop net and their lengths and weight were measured. About 20 individuals from each species, 1- 4 benthic samples and plankton samples were collected from each site on each sampling day. Water quality parameters such as temperature, dissolved oxygen content, alkalinity, conductivity, pH and turbidity of water at each sampling site were also measured at monthly intervals. Population sizes were estimated at two monthly intervals. Stomach/gut contents, plankton and benthic samples were analyzed qualitatively and quantitatively. Sex, maturity stage and gonado-somatic index, fecundity and egg diameter distributions of the fish were determined. Detailed analyses of the length frequency data were carried out using the FiSAT software package.

All fish species studied were inhabitants of different microhabitats in clear, flowing waters. *P. nigrofasciatus* and *P. cuningii* were co-occurring in shallow,

slow flowing streams while *B. signata* and *P. titteya* were co-occurring in small rivulets with large amount of leaf debris. *R. vaterifloris* was found in heavily shaded, cool, clear streams while *G. ceylonensis* was found in the bottom of rocky pools in streams.

*P. nigrofasciatus* showed wide distribution within the Kalu and Kelani river basins followed by *P. cuningii* and *P. titteya*. *R. vaterifloris* showed restricted distribution and was found only in the Kalu river basin. *G. ceylonensis* showed a wide distribution. The population sizes of *P. cuningii* and *P. nigrofasciatus* were higher than those of other fish species studied. The population sizes of *B. signata* and *P. titteya* in Kelani river basin were high compared to those of the Kalu river basin. *R. vaterifloris* had a very small population size in the Kalu river basin.

The fish species studied showed different feeding and reproductive patterns. The growth parameters were found to be related to availability of food, rainfall and water quality parameters. All fish species studied, except *R. vaterifloris* were omnivorous with different degree of selectivity for different food items and low to moderate dietary overlaps with others. *R. vaterifloris* was a strict carnivore showing a moderate dietary overlap with *G. ceylonensis* and a low dietary overlap with others. They can co-exist with very little or no interspecific competition for food.

Present results indicate that *B. signata*, *P. cuningii*, *P. titteya*, and *P. nigrofasciatus* have a high reproductive potential. *R. vaterifloris* has a low reproductive potential. The mean lengths at 50% maturity of *P. cuningii*, *P. nigrofasciatus* and *P. titteya* were 3.5 cm, 3.3 cm, and 2.6 cm respectively. It was 2.9 cm for *R. vaterifloris* and 6.5 cm for *B. signata*. All the fish species spawn throughout the year with two main spawning peaks which were significantly correlated with the rainfall pattern. The highest fecundity was observed in *B. signata*

and the lowest was recorded for *R. vaterifloris*. The cyprinid species studied were multiple spawners while *B. signata* was a single spawner.

The cyprinid species studied exhibited isometric growth patterns while *B. signata* showed an allometric growth pattern. The condition factors of these fish species were significantly correlated with rainfall. The population parameters of a particular species were highly related with the stream order. Growth of these fish species showed seasonal oscillation with amplitudes ranging between 0.5 and 1.0. In most of the sites, the winter point was in January-March. The low temperature, low availability of food and spawning activities might have independently or in combination affected their growth rates.

The fish species studied showed considerably high ( $> 0.8 \text{ year}^{-1}$ ) growth coefficients, natural mortality coefficients ( $>1.8 \text{ year}^{-1}$ ) and short life spans indicating high turn over rates. These fish have two recruitment pulses per year and their age at length zero was found to vary from  $-0.08$  to  $-0.16$  years.

During the present study none of the fish stocks was exploited at the sustainable levels. Harvesting of *B. signata* using a cast net with 1.0 stretched mesh would be detrimental in the long run because it catches small individuals. When the population sizes and reproductive biology were considered, all fish species studied except *R. vaterifloris* appear to be able to withstand low to moderate fishing mortalities. The optimum size at first capture ( $L_{50}$ ) for *B. signata* was 31 mm. It was 23 mm for *P. cuningii* and *P. nigrofasciatus* and 18 mm for *P. titteya* and *R. vaterifloris*. The optimum  $L_{50}$  was 47 mm for *G. ceylonensis*. The sub optimal exploitation rates ( $E_{0.1}$ ) varied from 0.4 to 0.5 for all species. Therefore, it could be recommended to harvest all these fish species except *R. vaterifloris* using cast nets of stretched mesh sizes bigger than 1.0 cm from the Kalu and Kelani river basins.

Evaluation of the current conservation status of the fish species studied indicated that all species other than *G. ceylonensis* can be considered as threatened. With regards to population sizes of the fish species studied, especially *R. vaterifloris* require immediate adoption of conservation and management measures. Therefore, *in situ* conservation measures are highly recommended. In addition to these, more induced breeding programmes and community awareness programmes should be conducted together with improving the packing and transport techniques and translocation practices.