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New Record of *Trichogaster lalius* (Hamilton, 1822) from Thippagondanahalli Reservoir (Cauvery River Basin)

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A B S T R A C T

Cauvery river system is one of the major freshwater aquatic systems in Peninsular India with a number of tributaries and reservoirs on it. The system inhabits a variety of endemic fish species. Thippagondanahalli Reservoir (TR) is a medium reservoir on Arkavathy River, a tributary of River Cauvery. This report is on the first record of dwarf gourami, *Trichogaster lalius* belonging to the family, Osphronemidae, from the TR. The reservoir is located in Bengaluru South Taluk, Karnataka [13^0 02'41"N 77^0 36'24"E; Area at FRL (Full Reservoir level): 1162.0 ha]. A total of nine specimens of the species were collected from the reservoir during various seasons (pre-monsoon, monsoon, post-monsoon) in 2015-16. It is a species having high value in the ornamental fish industry and a great demand in international market. Population study and proper management practices will help to improve the population of the species; will add on fisherman income and improve their livelihood. Further studies are required to find the parent population of *T. lalius*. The introduction of *T. lalius* in TR may be accidental and the macrophytes in the reservoir being suitable for the inhabitation of the species would have supported in establishing the population.

Introduction

Thippagondanahalli Reservoir, also known as Chamarajasagar, is built at the confluence of the Arkavathy and Kumudavathi rivers, the tributaries of R. Cauvery, 35 km west of Bangalore, India (Figure 1). It is a source of drinking water for western Bangalore and is under the control of Bangalore Water Supply and Sewerage Board (BWSSB). The total catchment area of TR is 1453 km^2. The reservoir has an area of 1162.0 ha at FRL. River Cauvery is one of the most remarkable rivers of peninsular India originating in the Brahmagiri range of the Western Ghats in Kodagu district, Karnataka at an elevation of 4340 m^1. This Cauvery system harbours a good number of endemic and indigenous fishes. Among them, *Labeo calbasu*, *Tor khudree*, *Osteochelius thomassi*, *Schismatorhyncus nukta* and *Systomus sarana* are native to the river. *Garra mullya*,

Hypselobarbus micropogon, Longischistura bhimachari, Mesonoemacheilus pulchellus, Puntius parrah, Salmostoma belachi Gonoproktopterus dubiu and *Labeo kontius* are few endemic species recorded from the river. This river system also harbours exotic fishes such as *Cyprinus carpio, Oreochromis mossambicus, O. niloticus, Clarius garipienus, Ctenopharyngodon idella, Hypophthalmichthys molitrix, Pterygoplichthys disjunctivus* was recorded from the river[2].

The species *Trichogaster lalius,* popularly known as "dwarf gourami" belonging to the family, Osphronemidae is native to south Asia. This species is distributed in the states of Arunachal Pradesh, Assam, Bihar, Manipur, Uttaranchal, Uttar Pradesh and West Bengal[3]. The occurrence of this species has been reported in the lowland Ganges and Brahmaputra basins. Feral populations have been reported from Singapore, the USA and Colombia. The distribution records are shown in Table 1.

Trichogaster lalius is a freshwater ornamental fish species with oblique bands of orange colour from back to the abdomen in males and the females are silver colored. *Trichogaster* spp. shows finnage dimorphism. The male's dorsal fin is longer than the female's and reaches back to the caudal peduncle. It attains a maximum length of 8.8 cm length[4]. It is a hardy species and can breathe air from the surface with the aid of an accessory respiratory organ, the labyrinth[5,6,7]. The mature male is brightly coloured with red and blue bands. The mature female is less colorful but has an attractive silver body. Its bright color and ease-adaptive to captive nature makes it popular for aquarium fish. Colour is considered to be one of the major factors which determine the cost of aquarium fish in the world market. Different varieties in the dwarf fish such as red, neon blue, neo, golden and regular are available in international market. Hence this fish has high economic value in markets and fetches high price in the average of $ 32 for each[8].

The habitats of this fish are slow moving streams, rivulets and lakes with plenty of vegetation. It requires high protein feed for their growth and coloration. The dwarf gourami takes 8 to 12 months to mature in temperate areas like northern India[8].

There are no records on the occurrence of *T. lalius* in the Cauvery river system as well as from other peninsular river basins. The present record may be considered as the first record of *T. lalius* in Cauvery river basin.

Materials and Methods

Seasonal samples for habitat characteristics and fish assemblages were collected by operating multi-meshed experimental gillnet in Thippagondanahalli reservoir during pre-monsoon, monsoon and post-monsoon seasons of 2016-17. *T. lalius* was recorded in littoral and limnetic sites of lentic and intermediate zones during all the three seasons.

A total of nine specimens were collected. Two specimens were taken in live condition to the laboratory and observed in aquarium for their behavior. The rest were fixed in 10% formalin for further studies. The meristic characters were noted and the morphometric measurements were taken using a Vernier caliper to the nearest 0.1mm following the method[9].

The physico-chemical parameters of water viz. temperature, pH, transparency and specific conductivity were recorded by using Standard digital field kit (HQ40d, 582580) and dissolved oxygen and alkalinity were analysed following standard methods[10].

Results and Discussion

The unplanned development in catchment area and increasing urbanization has led to alterations in the drainage pattern and hence reducing inflow in to the TR. The mean depth of this reservoir is approximately 10m. The water temperature was 28°C, Secchi disc transparency, being low due to organic turbidity, was up to 60 cm and pH was highly alkaline (8.5). The dissolved oxygen was in satisfactory concentration (7.6 mg/l) in surface layers but was almost zero below 5m depth. The water was soft with total alkalinity of 230 mg/l and moderate ionic concentration (specific conductivity of 2.82 mS/cm). The reservoir can be classified as eutrophic based on water quality parameter and the occurrence of algal bloom during study period.

The reservoir is organically polluted and the habitat has high algal density abundance of macrophytes such as *Echhornia*, indicate the heavy organic pollution.

T. lalius is unresponsive in gill modification during acidic condition because of the high protein expression and enzyme activity of vacuolar-type H+-ATPase (Huang C. Y and Lin, H. C. 2011). According to the present study, highly alkaline water of TR may support the growth of *T. lalius*.

During the sampling, we have recorded the specimens belonging to the genus *Trichogaster* in the size range of 4.2 to 4.9 cm in total length and 1.5 to 3.7 g in weight. Maximum size reported is 8.8 cm length[4]. The fishes were identified as *Trichogaster* based on the characters such as egg shaped and strongly compressed body, small mouth - strongly protrusible, lips normal, pre-orbital denticulate, soft dorsal and anal rounded; caudal fin rounded to truncate, scales large: 27 or 28 in longitudinal series; anal fin densely scaled, scales covering fin to tips of the posterior spine meristic characters of fin such that D XV-XVII/7-10, A XVIII/13-17, P 10. Coloration of the body mainly scarlet, crossed by oblique bands of pale blue, fins with scarlet spots or bars; anal fin with red mark[11].

The meristic and morphometric characters of the collected specimens, described in the Table 2 and 3, were compared[9] and concluded that the specimens are *T. lalius* Figure 2.

Five farms raise dwarf gouramis commercially in Singapore. Four different varieties of dwarf gouramis are raised on these farms- red neon dwarf, neon dwarf, golden dwarf and regular dwarf gouramis[8]. In international market gourami fetches high prizes because of its colour and behaviour. Colour is considered to be one of the major factors which determine the cost of aquarium fish in the world market and hence gouramies have a high economic value[12].

Spawning behavior of this fish needs lot of vegetation. Male guards the floating bubble-nest where the eggs are laid, about 600 in number. Hatching takes place in 12 to 24 hours while the male parent continues to protect the nest.

In about three days, the developing larvae become free-swimming and leave the nest[13]. Male guards the floating bubble-nest where the eggs are laid, about 600 in number. Hatching takes place in 12 to 24 hours while the male parent continues to protect the nest. In about three days, the developing larvae become free-swimming and leave the nest (Riehl and Baensch, 1991).

The habitat of this fish is mainly slow moving streams, and lakes, it needs lot of vegetation for their population establishment and hiding nature.

Table.1 Distribution of *T. lalius*

S. No	Species	Distribution	Authors
1	*T. lalius*	Beki River, Barpeta, Assam	Kalita and Sarma, 2015
2	*T. lalius*	Belda, Paschim Medinipur, West Bengal	Paul and Chanda, 2015
3	*T. lalius*	River Island Majuli, India	Hazarika and Bordoloi, 2015
4	*T. lalius*	Central and Eastern Regions of India	Awasthi *et al.*, 2015
5	*T. lalius*	Subansiri river drainage, Northeast India	Bakalial *et al.*, 2014
6	*T. lalius*	South Tripura	Mandal and Barman, 2014
7	*T. lalius*	Bangladesh; India, Nepal; Pakistan	Vishwanath, 2010
8	*T. lalius*	Bangladesh	Islam *et al.*, 2015
9	*T. lalius*	Brahmaputra River, Bangladesh	Galib, 2015
10	*T. lalius*	Padma River, Bangladesh	Joadder *et al.*, 2015
11	*T. lalius*	Tamilnadu	Raghunathan *et al.*, 2005; Knight, 2010; Daniels and Rajagopal, 2004

Table.2 Meristic characteristic of *T. lalius*

Meristic Data	Numbers
Dorsal fin Spines + Branched rays	XVI-XVII 7-8
Anal fin Spines + Branched rays	XVI-XIX 13-14
Pectoral fin rays	8-9
Caudal fin rays	16-18
Lateral line scales	29-32

Table.3 Morphometric measurements of *T. lalius*

Measurements	Mean (g/mm)	Range (g/mm)
Weight of fish(g)	2.43±0.21	1.50-3.70
Total length	46.27±0.97	42.44-49.70
Standard length	37.29±0.78	34.03-40.65
Head length	11.13±0.40	9.77-13.48
Head depth	14.51±0.39	12.46-15.81
Inter orbital width	5.30±0.23	4.30-6.42
Snout length	2.66±0.06	2.43-2.95
Eye diameter	3.49±0.10	3.02-3.89
Body Depth	19.10±0.73	17.46-19.90
Body width	5.98±0.33	4.72-7.78
Dorsal fin base length	20.71±0.47	18.28-22.71
Pectoral fin base length	2.01±0.19	1.43-2.96
Anal fin base length	21.13±0.62	19.16-25.03
Caudal peduncle depth	6.47±0.30	5.25-8.05
Pelvic fin extension	31.81±0.58	29.40-34.53
Distance between snout and dorsal	15.07±0.39	13.83-17.41
Distance between dorsal and caudal	4.13±0.20	3.34-5.06
Dorsal-pectoral distance	12.24±0.24	11.28-13.23
Dorsal-pelvic distance	17.53±0.34	16.21-19.21
Dorsal-anal distance	18.06±0.97	16.09-19.45
Inter-nares width	3.14±0.18	2.45-3.97
Pre-anal distance	17.69±0.40	16.47-19.89

Fig.1 Thippagondanahalli Reservoir, Arkavathy river basin
(Star indicate the locality of *T. lalius*)

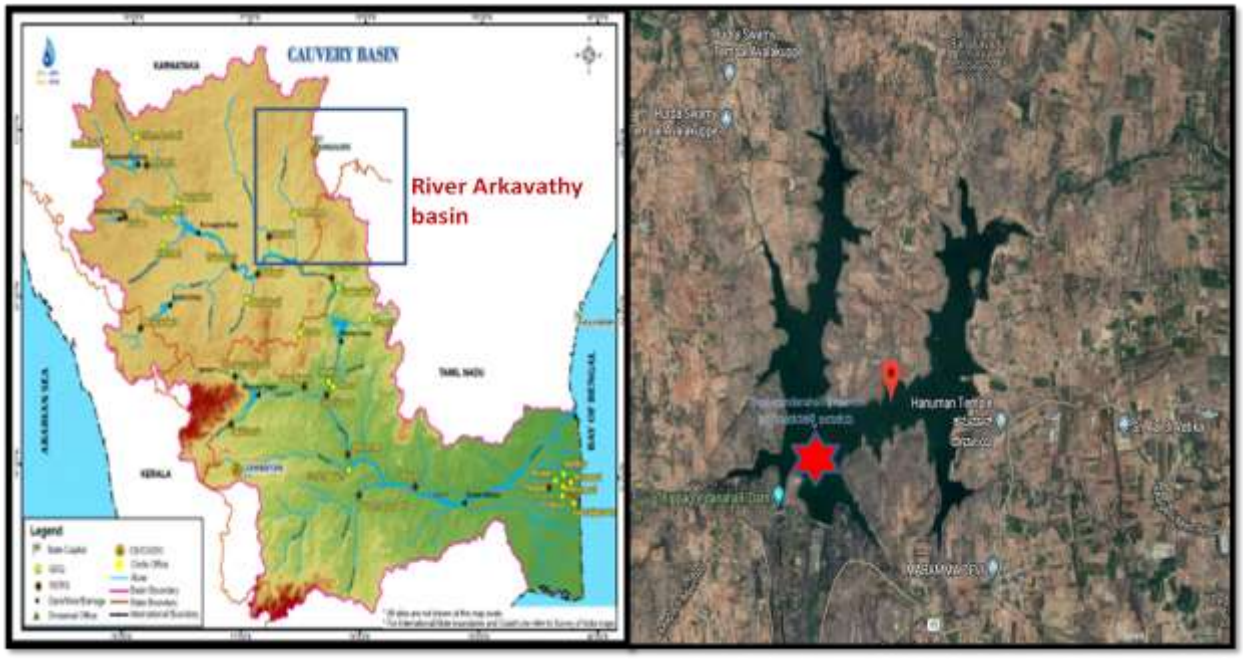

Fig.2 Male and Female specimens of *Trichogaster lalius*

It used to make bubble nest under macrophytes. *T. lalius* is an exotic to Cauvery river system but it is our native fish to north east region of India. Invasive species are considered as one of the major causes of devastation of native fish biodiversity in freshwater ecosystem. Invasive species program from US forest service formed few criteria for invasive species (USDA, 2016). *T. lalius* may not be an invasive species, because of its small size, calm nature and wide range of feeding habits. This species is not harming environment or other native fishes[4]. Further studies are required to understand the habitat and behavior of this fish.

T. lalius has a good ornamental value and Thippagondanahalli reservoir is a habitat suitable for this fish species. Awareness on collection and marketing of this fish can improve the livelihood of fishermen. At the same time good management practices and population study of *T. lalius* is also important to identify the parent population and for their conservation.

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