

**Research Article**

# First record of invasive croaking gourami, *Trichopsis vittata* (Cuvier 1831) in South-eastern Bangladesh

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**ABSTRACT****ARTICLE INFO**

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Introduction of invasive species is one of the major causes of native biodiversity loss as they can alter and degrade the habitat status; reduce food supplies, and poses threats to the environment. The croaking gourami *Trichopsis vittata* (Cuvier, 1831), a Southeast Asian freshwater teleost fish from Osphronemidae family, is generally known as an invasive alien species. Recently, a notable number of individuals of this species have been recorded from the southeastern Feni-Muhuri river system of Bangladesh during the study period from December 2017 to August 2018. Taxonomic identification was confirmed from the external appearance, morphometric measurements and meristic counts of the species. The body was laterally elongated with clearly visible stripes and black blotch above the pectoral fin base. Average total length, standard length, pre-dorsal length, pelvic fin base length, dorsal fin base length, anal-fin base length, and pectoral-fin base length were 5.3 cm, 3.64 cm, 2.36 cm, 2.17 cm, 1.95 cm, 1.5 cm, and 1.0 cm. The number of rays in the dorsal fin, anal fin, pectoral fin, pelvic fin, and caudal fin were 7-10, 31-34, 9-11, 5-8 and 14-17. The occurrence of *T. vittata* in this river indicates their rapid spreading across the country within a very short time. It is quite obvious that they must compete for niche space and food with native fish species and affect the native fish biodiversity. So, intensive research works along with counter survey are recommended to cross-check their spreading pattern, ecological sensitivity and impacts on native fish biodiversity for proper management and conservation.

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**INTRODUCTION**

Bangladesh is a South Asian country having precious water resources comprising of inland freshwater, brackish water, and marine waters enriched with aquatic biodiversity of about 800 fish species (Hussain and Mazid 2001). It is in the third position among the most suitable regions for fisheries and aquaculture in the world due to geographic position. Freshwater habitats of Bangladesh contain biodiversity of 260 indigenous fish and 24 freshwater prawn species. Such rich species diversity is attributed to the large area of flooded wetlands including beels, haors, baors, lakes, and the major river systems of the Padma, Meghna, and Jamuna (Hussain 2010). There are about 40-50 small indigenous species (SIS) are available in Bangladesh, having a maximum length of 25 cm (Shamsuzzaman *et al.* 2017). Besides these, about 150 exotic fish species have been introduced into the country over the last decades for aquaculture purposes, of which about 24 fish species are

found in the floodplains and tributaries of the Ganges Delta (Siddiqui *et al.*, 2007; IUCN, 2015). Recently, a notable number of individuals of an invasive croaking gourami, *Trichopsis vittata* (Cuvier, 1831) have been encountered from the southeastern Feni-Muhuri river system in Chittagong division during field survey of freshwater fish biodiversity in Bangladesh.

The croaking gourami *Trichopsis vittata* (Cuvier, 1831) is a Southeast Asian freshwater fish species from the perch group. They are native to waters in Southeast Asian countries including Thailand, Indonesia, Mekong basins, Vietnam (Robins 1992, Rainboth 1997, Baird *et al.* 1999, Kottelat 1985, 2013); the Ayeyarwady and the Yangon Rivers of Myanmar (Norén *et al.* 2017), the USA (Shafland 1996, Schofield and Pecora 2013, Schofield and Schulte 2016) and India (Talwar and Jhingran 1991, Vidthayanon 2012, Knight and Balasubramanian 2015). This species is

not fished commercially, occasionally sold as part of mixed catches in markets.

*T. vittata* was identified in Bangladesh for the first time in the Meghna and adjacent floodplain area (Hossain *et al.* 2012) and morphometries were studied by Islam *et al.* (2014) and Hossain (2014). After that, Noren *et al.* (2017) have identified this species from different habitats of Bangladesh, but detailed information of this species is not available. In addition, very limited works have been carried out on this species in Bangladesh for which most part of their life is still unrevealed to us. Therefore, this study aimed to investigate the biology, source of introduction, impacts on native fish biodiversity and spreading pattern of this croaking gourami to develop proper conservation strategy and implementation of a systematic approach.

## MATERIALS AND METHODS

The inland open water bodies of Bangladesh are rich sources of different types of fishes from the ancient time. There are about 700 actively flowing rivers in Bangladesh across the country having 260 freshwater fish and other commercially important aquatic organisms. The Feni River is a transboundary river originated from the hill ranges of south Tripura in India (23°20'N & 91°47'E) and entered Bangladesh through Sabroom town. This river is used to form the demarcation line between Chittagong, Noakhali and Tripura State of India. The Muhuri river also known as Little Feni, originated from Noakhali District joins the Feni river near its mouth at Char Kalidas point (22°54'37.5"N & 91°30'02.4"E). *Trichopsis vittata* was first collected from the highly polluted industrial area on 14 December 2017 at 11:40 am. Different types of fishing gear including Dip nets, seine nets, and traps were used in sampling of the fish. Few other individuals were collected from the adjacent water areas on the day. Again in May 2018 and August 2018, *T. vittata* was recorded from the Feni-Muhuri River system during a subsequent thorough investigation. There was total of eight sampling station where nominal distance between two stations was 1.5 km. GPS Coordinates of the sampling sites are 22°56'03.2"N 91°32'15.4"E, 22°55'36.7"N 91°31'56.7"E, 22°55'08.9"N 91°31'38.7"E, 22°54'42.8"N 91°31'21.1"E, 22°54'21.7"N 91°30'54.3"E, 22°54'03.4"N 91°30'25.7"E, 22°54'00.3"N 91°29'53.0"E and 22°54'36.8"N 91°30'01.2"E.

Collected fish samples were immediately preserved in 10% formaldehyde for taxonomic study. After that, the fish samples were transferred into 30%, 50% and 70% subsequent solutions of ethanol for long-time preservation following the preservation method stated by Talwar and Jingran (1991) and Sterba (1962). Morphometric and meristic characteristics including Total Length (TL), Standard Length (SL), Forked Length (FL), Head Length (HL), Peduncle Length (PL), Peduncle Depth (PD), Pectoral Fin Length (P<sub>1</sub>FL), Pelvic Fin Length (P<sub>2</sub>FL), Pelvic Fin Base Length (P<sub>2</sub>FB), Scale Above Lateral Line (SALL), rays in dorsal fin, anal fin, pectoral fin, pelvic fin, and caudal fin and others were studied using standard methodology used by Murdy and Shibukawa (2001).

## RESULTS AND DISCUSSION

Total of eighteen individuals was collected from the Feni-Muhuri river system during the study period. The body shape of the collected samples was laterally elongated and

the dorsal fin originates far behind the base of the pectoral fin. Body-color was pale brown with clearly visible stripes and black spots on the fins on both sides of the body. The iris of the eye was bright blue. Multi-branched fin rays present in the anal fin with six to eight spines. Pelvic fin contains 1 spine followed by a filament and 4 branched rays. The dorsal fin contains two to four spines. Anal fin with a few elongated filament-like rays, extending back almost to the tip of caudal fin; and black blotches above the pectoral-fin base. About 13 transverse scale rows present in the body and lateral line is absent (Fig. 1). It is an insectivorous fish, naturally capable of producing a croaking noise or audible sound using their pectoral fins (Ladich *et al.* 1992, Bischof 1996, Ladich 2007). Vocalization often starts on the first day after hatching which changes with increasing the age of hatchlings and development of sound-producing structure (Henglmüller 1999, Liengpornpan *et al.* 2006, 2007). This species is typically regarded as a negative biological indicator and has been recorded from different countries as an introduced fish species.



**Fig. 1:** Photograph of *Trichopsis vittata*, collected from the Feni-Muhuri River system on 14 December 2017 at 11:40 am

Average total length, standard length, pre-dorsal length, pre-orbital length, post-orbital length, and inter-orbital lengths were 5.3 cm, 3.64 cm, 2.36 cm, 0.36 cm, 0.67 cm and 0.42 cm respectively. The pelvic fin base length, dorsal fin base length, anal-fin base length, and pectoral-fin base length were 2.17 cm, 1.95 cm, 1.5 cm, and 1.0 cm respectively. Meristic characteristics are the discrete, serially repeated, and countable characteristics. Meristic counts for dorsal fin rays of *T. vittata* ranged from 7 to 10, anal fin rays were found to be ranged from 31 to 34, pectoral fins ranged from 9 to 11, pelvic fins ranged from 5 to 8 and caudal fin rays ranged from 14 to 17. It has been found that the number of rays were the same among the specimens collected from the different water bodies. The dorsal fin rays, pectoral fin rays, pelvic fin rays, and the caudal fin rays were similar as described by Rainboth (1997), Utayopas (2001), and Hossain (2012). Reed (1967) and other researchers reported that the fin rays of same species do not differ much from each other.

Introduction of invasive species is one of the major causes of native biodiversity loss as they can alter and degrade the habitat status; reduce food supplies, and poses threats to the environment (Hettinger 2001, Innal and Erk'akan 2006). According to Siddiqui *et al.* (2007) and IUCN (2015), there are about 24 exotic fish species found in the floodplains and tributaries of the Ganges Delta. Exotic fish species have been introduced in Bangladesh either due

to aquarium release or deliberate aquaculture attempts and bio-control efforts. *T. vittata* is a newer addition to the list.

In the sampling sites, this species was found in a very lower density than the other fishes at different times of the year. However, the overall count of this species is sufficient to prove their strong biology and adaptability in disturbed ecology. This is the very first record of *T. vittata* in southeastern regions of Bangladesh. Yeasmin *et al.* (2017) recorded total of 65 freshwater fish species belonging to 11 orders and 29 families from the Feni-Muhuri river system with two gourami species from the Osphronemidae family, striped gourami (*Trichogaster fasciatus*; Bloch and Schneider, 1801) and red gourami (*Trichogaster lalius*; Hamilton, 1822). Previously this species was recorded from the Meghna River and the Old Brahmaputra River (Hossain *et al.* 2012, Islam *et al.* 2014) and the Baikka beel, a freshwater wetland ecosystem in the northeastern Bangladesh (Akash and Hossain, 2018). This species was found in higher abundance from highly polluted water body with severely lower dissolved oxygen level. This finding is similar to Ng *et al.* (2018) and Li *et al.* (2019) where they recorded *T. vittata* from heavily disturbed freshwater ecology with lower pH and dissolved oxygen level. Li *et al.* (2019) recorded *T. vittata* from the freshwater river streams containing 3.52 mg/L dissolved oxygen. Islam *et al.* (2018) reported on heavy metal pollution in the Feni river estuary with higher rate of pollution in the upward stations. In our study, the presence of *T. vittata* was always associated with nearly stagnant, freshwater habitats marked with zero salinity and rich in submerged and floating vegetation which is similar to the previous findings (Norén *et al.* 2017).

It is still unknown exactly either *T. vittata* is found in Bangladesh waters as a true survivor or newly introduced. There is an assumption that this species was illegally released in the waters of Bangladesh but there is no evidence of that. Besides this, there is strong controversy among the scientists regarding their way of introduction. Norén *et al.* (2017), who identified *Trichopsis vittata* from Bangladesh and Myanmar with scientific documentation for the first time, mentioned it most likely an aquarium escape but another school (Akash and Hossain 2018) disagreed to this opinion and opined that their (*T. vittata*) establishment in Bangladesh is owing to deliberate aquaculture attempts, acting as an invasion vector. The sampling locations in the southeastern Feni-Muhuri rivers system is far away from the main town and have no direct connection with the river system. So there is no possibility of introducing *T. vittata* in this region from aquarium escape. In addition, the local aquarium fish traders and fish farmers are not familiar with this invasive fish species. Findings from this study strongly disagreed to the previous opinions regarding their source of introduction in this region.

## CONCLUSION

Introduction of invasive species is one of the major causes of native biodiversity loss and threats to the environment (De Iongh and Van Zon 1993). *T. vittata* is a non-native fish species has been recorded from several water bodies in Bangladesh including the Meghna River, Buriganga River, Feni River and Muhuri River. But still unknown either it was introduced accidentally from aquarium escape or intentionally for aquaculture purpose.

This fish is spreading very quickly across the country over the years with a north-eastwardly colonization pattern which will definitely affect the native fish biodiversity. However, the impact of this species on other indigenous fish species is currently unknown. The absence of data does not equate to lack of effects. It is quite obvious that they must compete for niche space and food with native species. Currently, there are no other techniques available for eradication of *T. vittata* except dewatering and using pesticides which cause a great deal of collateral damage to native species. Further research works will undoubtedly enhance our understanding of their geographic ranges, behavioral interactions, and impacts on native biodiversity. Therefore, studying biology and interspecies interactions of *T. vittata* across its nonnative range in Bangladesh has become an urgent issue.

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## DISCLOSURE STATEMENT

The authors declare that there exist no conflicts of interest regarding the publication of this article. The funding bodies had no role in the study design, data collection, data analysis, data interpretation or decision to publish the findings.

## REFERENCE

- Akash M. and M.A. Hossain. 2018. A Southeast Asian species in the Ganges Delta: on spreading extent of non-native croaking gourami *Trichopsis vittata* (Cuvier, 1831) in Bangladesh. *Bioinvasion Record*, 7: 447-450.
- Ahmed, Z. U., Begum, Z. T., Hassan, M. A., Khondker, M., Kabir, S. M. H., Ahmad, M. A. T. A., ... & Haque, E. U. 2008. Encyclopedia of flora and fauna of Bangladesh, Volume 23, *Asiatic Society of Bangladesh, Dhaka, Dhaka, Bangladesh*, 300 pp.
- Baird I.G., Inthaphaisy V., P. Kisouvannalath, Phylavanh B., and Mounsouphom B. 1999. The fishes of southern Lao. *Vientiane (Lao) Ministry of Agriculture and Forestry*.
- Bischof C. 1996. Diversity in agonistic behavior of croaking gouramis (*Trichopsis vittata*, *T. schalleri*, and *T. pumila*; Anabantoidei) and the paradise fish (Macropodus opercularis; Anabantoidei). *Aggressive Behavior: Official Journal of the International Society for Research on Aggression*, 22: 447-455.
- Coad B. W. and A. Abdoli. 1993. Exotic fish species in the fresh waters of Iran. *Zoology in the Middle East*, 9: 65-80.
- De Iongh, H. H. and J. C. J. Van Zon. 1993. Assessment of impact of the introduction of exotic fish species in north-east Thailand. *Aquaculture and Fisheries Management*, 24: 279-289.

- Henglmüller S.M. and F. Ladich. 1999. Development of agonistic behaviour and vocalization in croaking gouramis. *Journal of Fish Biology*, 54: 380-395.
- Hussain M.G. 2010. Freshwater fishes of Bangladesh: Fisheries, biodiversity and habitat. *Aquatic Ecosystem Health & Management*, 13: 85–93.
- Hossain M.A., Wahab M.A. and Belton B. 2012. The checklist of the riverine fishes of Bangladesh. *The world Fish Center, Bangladesh and South Asia Office*, Dhaka. 2012.
- Hossain M.A. 2014. Habitat and fish diversity: Bangladesh perspective. In Recent advances in fisheries of Bangladesh. *Bangladesh Fisheries Research Forum, Dhaka 2014* (pp. 1-26).
- Hussain M.G. and M.A. Mazid. 2001. Genetic improvement and conservation of carp species in Bangladesh. Bangladesh Fisheries Research Institute and International Center for Living Aquatic Resources Management, 73 pp.
- Hettinger N. 2001. Exotic species, naturalisation, and biological nativism. *Environmental Values*, 10: 193-224.
- Islam M.S., Hossain M.B., Matin A. and Sarker M.S.I. 2018. Assessment of heavy metal pollution, distribution and source apportionment in the sediment from Feni River estuary, Bangladesh. *Chemosphere*, 202: 25-32.
- Islam M.S., Hossain M.A., Islam M.S., Akand M.K. and Utsa S.S. 2014. Morphometric, meristic and landmark-based analysis of a rare croaking gourami, *Trichopsis vittata*. *Bangladesh Journal of Fisheries*, 1:8.
- IUCN Bangladesh. 2015. Red List of Bangladesh, Volume 5, Freshwater Fishes. IUCN, International Union for Conservation of Nature. Bangladesh Country Office, Dhaka. 2015, xvi+360 pp.
- Innal, D. and F. Erk'akan. 2006. Effects of exotic and translocated fish species in the inland waters of Turkey. *Reviews in Fish Biology and Fisheries*, 16: 39-50.
- Knight J.M. and S. Balasubramanian. 2015. On a record of two alien fish species (Teleostei: Osphronemidae) from the natural waters of Chennai, Tamil Nadu, India. *Journal of Threatened Taxa*, 7: 7044-7046.
- Kottelat M. 1985. Fresh-water fishes of Kampuchea. *Hydrobiologia* 121: 249-79.
- Kottelat M. 2013. The fishes of the inland waters of Southeast Asia: a catalogue and core bibliography of the fishes known to occur in freshwaters, mangroves and estuaries. *Raffles Bulletin of Zoology*, 27: 1–663.
- Ladich F., Brittinger W. and Kratochvil H. 1992. Significance of agonistic vocalization in the croaking gourami (*Trichopsis vittatus*, Teleostei). *Ethology*, 90:307-314.
- Ladich F. 2007. Females whisper briefly during sex: context-and sex-specific differences in sounds made by croaking gouramis. *Animal Behaviour*, 73: 379-387.
- Liengpornpan S., Jaroensutasinee M. and Jaroensutasinee K. 2007. Biology of croaking gourami *Trichopsis vittata*: the fish that croaks. *Thaksin University Journal*, 10: 72-83.
- Liengpornpan S., Jaroensutasinee M. and Jaroensutasinee K. 2006. Mating habits and nesting habitats of the croaking gourami *Trichopsis vittata*. *Acta Zoologica Sinica*, 52: 846-853.
- Li T., Loh Y.X., Lim W., Nyanasengeran M., Low B.W., Ta, H.H., Yeo D.C. and Cai Y. 2019. The fish fauna of Bukit Timah Nature Reserve, Singapore. *Garden's Bulletin Singapore*, 71: 557-753.
- Murdy E.O., and K. Shibukawa. 2001. A revision of the gobiid fish genus *Odontamblyopus* (Gobiidae: Amblyopinae). *Ichthyological Research*, 48: 31-43.
- NG C.K., OOI P.A., WONG W.L. and KHOO G. 2018. Ichthyofauna checklist (Chordata: Actinopterygii) for indicating water quality in Kampar River catchment, Malaysia. *Biodiversitas*, 19: 2252-2274.
- Norén M., Kullander S., Rahman M.M. and Mollah A.R. 2017. First records of Croaking Gourami, *Trichopsis vittata* (Cuvier, 1831) (Teleostei: Osphronemidae), from Myanmar and Bangladesh. *Check List*, 13:81.
- Robins C.R. 1992. Common and scientific names of fishes from the United States and Canada. *American Fisheries Society (USA) Special Publication*, 20:183p.
- Rainboth W.J. 1997. Fishes of the Cambodian Mekong. FAO species identification field guide for fishery purpose. *Fish of the Cambodian Mekong, Rome*. 303p.
- Reed W. 1967. Fish and fisheries of Northern Nigeria. Ministry of Agriculture, Northern Nigeria.
- Ruiz G.M., Carlton J.T., Grosholz E.D. and Hines A. H. 1997. Global invasions of marine and estuarine habitats by non-indigenous species: mechanisms, extent, and consequences. *American Zoologist*, 37: 621-632.
- Shamsuzzaman M.M., Islam M.M., Tania N.J., M.A. Al-Mamun, P.P. Barman and Xu X. 2017. Fisheries resources of Bangladesh: Present status and future direction. *Aquaculture and Fisheries*, 2:145-156.
- Schofield P.J. and Pecora D.J. 2013. Croaking gourami, *Trichopsis vittata* (Cuvier, 1831), in Florida, USA. *BioInvasions Records*, 2: 247-51.
- Schofield P.J. and Schulte J.M. 2016. Small but tough: What can ecophysiology of croaking gourami *Trichopsis vittata* (Cuvier, 1831) tell us about invasiveness of non-native fishes in Florida? *NeoBiota*, 28:51.
- Shafland P.L. 1996. Exotic fishes of Florida—1994. *Reviews in Fisheries Science*, 4: 101-22.
- Sterba G. 1962. Freshwater fishes of the world. Vista Books, London. 878 p.
- Talwar P.K. and A.G. Jhingran 1991. Inland fisheries of India and adjacent countries. Vol. I & II, 1-158.
- UtaYoPas P. 2001. Fluctuating Asymmetry in Fishes Inhabiting Polluted and Unpolluted Bodies of Water in Thailand. *Journal of Science & Technology Asia*, 6:10-20.
- Vidthayanon C. 2012. *Trichopsis vittata*. The IUCN Red List of Threatened Species, 2012.
- Yeasmin S., G.A. Latifa, and G. W. Chowdhury. 2017. Diversity of ichthyofauna of Feni and Muhuri rivers, Feni, Bangladesh. *Bangladesh Journal of Zoology*, 45: 47-60.