JFLS | 2025 | Vol 7(1) | Pp 7-10

OPEN ACCESS

Journal of Fisheries and Life Sciences
International Peer-Reviewed Biannual Journal
www.fishlifesciencejournal.com

Research Article

Record of *Esomus danrica*, Hamilton 1822 (Cyprinidae) from Ritchie's Archipelago, Andaman Islands

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ISSN: 2456-6268

ARTICLE INFO
Received: 26 November 2024
Accepted: 18 August 2025
Available online: 08 September 2025

KEYWORDS
Cyprinid
South Andaman
Carp culture
Freshwater fish

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ABSTRACT

The study reports the occurrence of *Esomus danrica*, a cyprinid fish from Ritchie's Archipelago, Andaman Islands, for the first time. Biometrics and genetic data of the material of *E. danrica* from Ritchie's Archipelago, Andaman Islands, indicates that it likely originated from the mainland of India, possibly through the shipment of carp fingerlings. The present report serves as an addition to the existing list of introduced fish species and also alerts the local fish farmers to adopt biosecurity protocols in fish farming.

INTRODUCTION

Andaman and Nicobar Islands are bestowed with unique freshwater biodiversity with a high level of endemism. Comprehensive studies on the freshwater fish of the Andaman and Nicobar Islands are scanty and are limited to works done by Palavai & Davidar (2009) and Kiruba-Sankar et al. (2018). There are also reports of freshwater fish from unexplored parts of the Andaman and Nicobar groups by Praveenraj *et al.* (2017a, b, & c), *viz.*, *Danio rerio* from North Andaman, *Redigobius oyensi* from Car Nicobar Islands, and *Mugilogobius tigrinus* from South Andaman. Recently, *Sicyopterus garra*, a freshwater amphidromous goby, was also redescribed from the South Andaman Islands after a span of 95 years (Praveenraj *et al.,* 2022).

Ritchie's Archipelago is a cluster of smaller islands that lie some 25–30 kilometers east of Great Andaman, the main island group of the Andaman Islands. The archipelago consists of 4 larger islands, 7 smaller islands, and several islets, extending in a roughly north-south chain, parallel to the main Great Andaman group. Havelock Island, recently renamed as Swaraj Dweep in 2018, is an important tourist destination among the clusters of islands. Though a faunal survey on insects, amphibians, reptiles, and plants exists for Ritchie's Archipelago, there is a lack of study of freshwater fish from these islands. There are a few minor streams draining into creeks. A recent ichthyofaunal survey conducted at Saheed Dweep resulted in the collection of *Esomus danrica*, from a freshwater stream. The present work serves to report *E. danrica* for the first time from Havelock Island.

MATERIALS AND METHODS

Sampling was conducted during the year January 2023. Specimens were collected from a small fresh water stream at Saheed Dweep, Ritchie's Archipelago, Andaman Islands (Fig. 1). The specimens were photographed alive and fixed in 10% formalin, and subsequently transferred to 70% ethanol for identification. Counts and measurements are based on Hubbs and Lagler (1964) and expressed in the percentage of standard length (SL). The examined specimens were registered in the fisheries museum of the Central Island Agricultural Research institute under the accession number CIARI/FF-97.

GENETIC ANALYSIS

Total genomic DNA was isolated from the muscle tissue extracted from the left side of two specimens using

the DNeasy Blood & Tissue Kits™ (Qiagen, Germany) following the manufacturer's guidelines. The mitochondrial cytochrome c oxidase unit I (COI) partial gene (650 bp) was amplified using the PCR conditions and primers described in Ward *et al.* (2018). The resulting PCR products were purified and sequenced in forward and reverse directions using an ABI 3500 DNA analyser (Eurofins Pvt. Ltd., Bangalore). Sequence quality was assessed by examining the Phred score of each base using FinchTV software. The open reading frame of the sequence was confirmed using the NCBI ORF finder tool (https://www.ncbi.nlm.nih.gov/orffinder/). The final COI gene sequence obtained were submitted to NCBI GenBank under the accession numbers PQ326933-PQ326935 (n=3). Sequence alignment was performed using Clustal-W, integrated with MEGA XI (Tamura *et al.* 2021). Sequences were trimmed at the ends to ensure uniform length, and genetic distance values were estimated using MEGA XI.

The maximum likelihood (ML) phylogenetic tree was constructed using the COI dataset comprising 14 sequences, including 3 sequences generated in the present study. The best fit nucleotide substitution model was selected from 24 models, based on the one with the lowest BIC scores (Bayesian Information Criterion), which described the best substitution pattern (Nei and Kumar 2000). jModelTest (Posada, 2008) suggested the best fit nucleotide substitution model to be the Tamura-Nei model (TN93) with gamma distribution and assumption that a certain fraction of sites are evolutionarily invariable (I) [(GI), AICc=12239.659, lnL= –5999.435, (I)=0.56, (+G) =1.16]. The phylogenetic tree was constructed based on the maximum likelihood fits in MEGA XI (Kumar *et al.* 2018), and its reliability was estimated using bootstrap values run for 1,000 iterations.

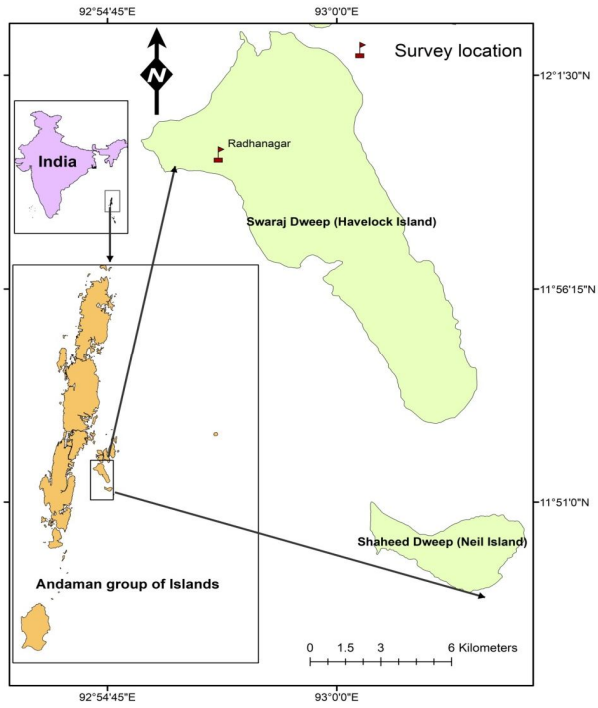

Fig. 1. Sampling location at Saheed Dweep, Andaman group of Islands

RESULTS AND DISCUSSION

MATERIALS EXAMINED

Esomus danrica (Figs. 2A, 2B), CIARI/FF-97, 3 ex., 35.6–39.4 mm SL, Radha Nagar, Havelock Island, Ritchie's Archipelago, (Lat 11.992604, Long 92.955130), Coll. R.S. Naveen, 22.1.2023.

DESCRIPTION

Body slender, laterally compressed, elongated, pectoral fin reaching beyond pelvic fin origin, dorsal fin slightly entire to anal fin origin, rostral barbell reaching half the length of eye diameter. Dorsal fin anterior to anal fin. Pectoral fin when adpressed reaching beyond pelvic fin origin. Adpressed pelvic fin almost touching anal fin origin. Dorsal fin rays ii, $6^{1/2}$, its margin almost straight, anal fin rays ii, $5^{1/2}$ its margin convex, caudal fin deeply forked, lobes pointed, caudal fin rays 10+9 (3) ; pectoral fin rays i, 9; pelvic fin rays i, 6 (3). Lateral line scales 30 (3), transverse scales 7 (3), predorsal scales 15 (1), 16 (2), circumpeduncular scales 6 (1), 7(2), preplevic scales 14 (3). Anal fin with 1 scale row towards the base.

COLOURATION OF THE LIVE

Body with a black broad band extending from beyond the eye to the base of caudal fin. Colour above black band silverish-golden, below black band silverfish (Fig. 2). Pectoral fin translucently yellowish; dorsal, anal, pelvic and caudal fin pale yellow. Colouration in 70% ethanol: Overall body colour grey, band on the body black, all fins translucent. Operculum silvery (Fig. 3)

HABITAT AND ECOLOGICAL NOTES

The habitat at the collection site was a small freshwater stream with cemented embankments passing through a hotel. The stream didn't have any aquatic vegetation (Fig. 4).

GENETIC ANALYSIS

The NCBI BLAST analysis suggested the co1 sequences of *Esomus danrica* generated in this study has 100% similarity with the sequences of *Esomus danrica* (KJ936754-56; OL638204; OR148072-73), from the mainland of India, furthering suggesting that the specimens from Ritchie's Archipelago must be a possible introduction. This result is also further supported by the Maximum likelihood tree based on co1 sequences (Fig. 5).

DISCUSSION

Esomus danrica was originally described from the Ganges, India by Hamilton (1822) as *Cyprinus danricus.* Day (1870) reported *Nuria danrica* (now *Esomus danrica*) from the Nicobars. Day (1870) mentions that "variety *Nuria malabarica* Day plate Exvlv, Fig. 7, is a form found along the coasts of India, Burma and the Nicobars. It is distinguished by the entire absence of the lateral-line, but is otherwise exactly similar to the type". Day in page no. XIV also mentions that "I have examined some freshwater-fishes (*Nuria*) from the Nicobars, from whence they were brought

by Mr. Ball, and find them identical with the species existing in India and Burma". Our field trips at Nicobar Islands did not yield any specimens of *E. danrica*. Further, a search for the specimens at British and Australian museum did not yield any specimens of *E. danrica* from the Nicobars. The reports of *E. danrica* by Day (1870) remain unknown. However, there is a report of *Esomus* sp. by Kumar *et al.* (2016), which is an *Esomus danrica*. Our meristics, morphometry and genetic analysis demonstrate that there is no any significant difference between specimens from Andaman Islands and mainland, India. Kiruba-Sankar *et al.* (2018) also reported *E. danrica* from South Andaman, which was from a small ditch adjacent to aquaculture ponds. We believe that the occurrence of *E. danrica* at Ritchie's Archipelago is possibly due to accidental release from the carp ponds, which is a major aquaculture activity there. *Esomus danrica* is a common inhabitant of carp ponds in the mainland, India. In Andaman Islands majority of the carp seeds are brought from Kolkata, India, hence, the species might have come as a contaminant in the carp seeds. The alien fish species of Andaman & Nicobar Islands has been well documented by Rajan & Sreeraj (2013 and 2014), and Kiruba-Sankar *et al.* (2017). These studies show that the freshwater bodies of A & N islands have potentially invasive fish species which may cause damage to the native aquatic life forms. The present report serves as an addition to the existing introduced fish species and also alerts the local fish farmers to adopt biosecurity protocols in fish farming.

Table 1. Morphometric characters of *Esomus danrica* from Ritchie's Archipelago, Andaman Islands

Morphometric characters	**Range (*n*=3)**	**Mean ± SD**
Standard length (mm)	35.6–39.4	
In percent of standard length		
Head length	25.2–25.8	25.5±0.2
Snout length	6.5–7.5	7.0±0.3
Orbit diameter	7.5–8.0	7.8±0.2
Interorbital width	5.8–7.4	6.6±0.5
Head depth	15.4–16.2	15.8±0.2
Body width	9.6–11.6	10.7±0.6
Body depth	19.1–21.6	20.2±0.8
Predorsal length	64.7–65.4	65.2±0.2
Prepelvic length	50.5–52.4	51.7±0.6
Preanal length	70.9–72.3	71.9±0.5
Caudal-peduncle depth	10.1–11.4	10.8±0.4
Caudal-peduncle length	17.7–20.6	19.4±0.3
Dorsal-fin length	18.1–19.9	19.3±0.6
Anal-fin length	16.6–21.3	18.3±1.5
Pectoral-fin length	27.1–35.2	30.8±2.4
Pelvic fin length	13.2–18.2	15.8±1.5
Rostral barbel	7.7–8.5	8.2±0.3
Maxillary barbel	43.8–47.5	45.4±1.1

Fig. 2. *Esomus danrica*, CIARI/FF-97, 39.4 mm SL, colouration in life

Fig. 3. *Esomus danrica*, CIARI/FF-97, 39.4 mm SL, colouration in preservative

Fig. 4. Habitat at Saheed Dweep, Ritchie's Archipelago, Andaman Islands

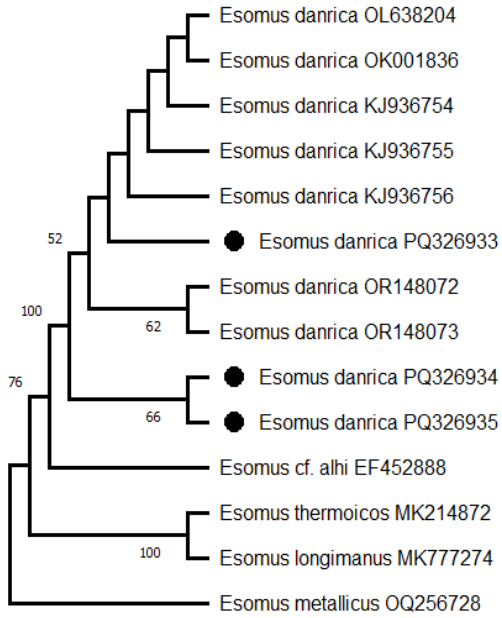

Fig. 5. Maximum likelihood tree for *Esomus danrica* (black circle), collected from Ritchie's Archipelago, Andaman Islands. Black circle indicates sequence generated in this study

ACKNOWLEDGEMENT

The authors wish to extend their heartfelt thanks to the Director of ICAR-CIARI for the invaluable facilities and support that contributed to the successful completion of this work.

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