

**DANIO RERIO (ACTINOPTERYGII: CYPRINIFORMES: CYPRINIDAE): A NEW RECORD FROM ANDAMAN ISLANDS, INDIA**

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**Abstract.** *Danio rerio* (Hamilton, 1822) is reported herewith for the first time from Andaman group of islands, which is a new addition to the freshwater fish fauna and also a significant insular record other than its known distribution range. The morphological description of *D. rerio* collected from North and Middle Andaman Island and the mainland, India topotypes are provided along with the molecular genetic comparison.

**Keywords:** zebrafish, archipelago, insular, freshwater fish, record

The Andaman and Nicobar Islands in the Bay of Bengal, stretching between 6°45'–13°45'N and 92°10'–94°15'E, consist of 572 islands. These islands are characterized by a rich diversity of flora and fauna with a high level of endemism (Rao et al. 2013). There has been only few records of freshwater fishes in the faunistic studies concerning those islands (Day 1870, 1876, 1878, Annandale and Hora 1925, Mukerji 1935, Herre 1939, 1940, 1941, Koumans 1940, Starmühlner 1976, Rao et. al 2000, Palavai and Davidar 2009, Devi 2010, Rajan and Sreeraj 2013, Rajan et al. 2013, Rajan and Sreeraj 2014a, 2014b, 2014c, Arun Kumar et al. 2016). An attempt to document the freshwater fishes was initiated by CIARI (Central Island Agricultural Research Institute), Port Blair during 2015, resulted in recording the occurrence of *Danio rerio* (Hamilton, 1822) from Middle and North Andaman. This paper describes this finding as a new record to the Andaman Islands.

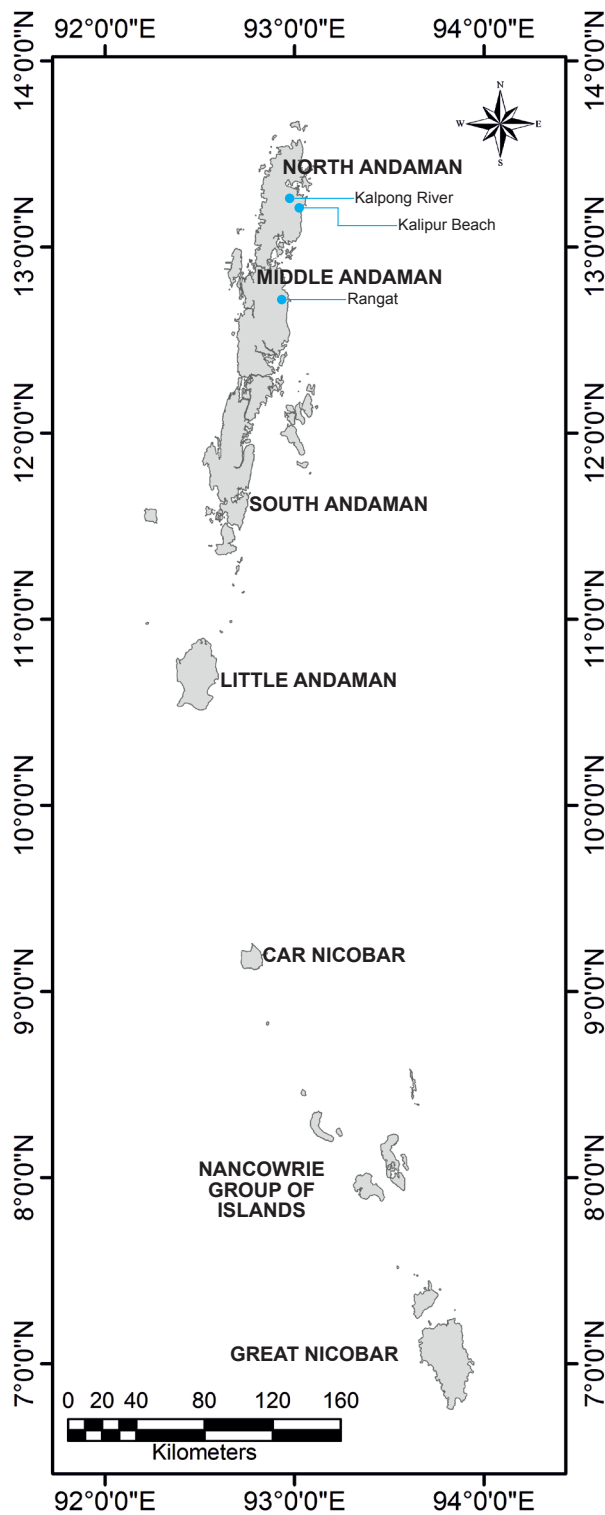
Four specimens of *Danio rerio*, three from the Kalpong River, one from a marsh near Kalipur beach, Diglipur, North Andaman and six specimens from Rangat, Middle Andaman were collected (Fig. 1). Specimens were preserved in 90% ethanol. All were compared with the topotypes collected from Kolkata, India by Soutrik Ghosh. Counts and measurements are based on Hubbs and Lagler (1964) and expressed in the percentage of standard length (SL) and head length (HL). Numbers in

parenthesis after a count denotes the frequency of that count. DNA was extracted from one *D. rerio* specimen from North and two specimens from Middle Andaman using the standard protocol of Bruce et al. (1993). Partial mitochondrial gene 16S ribosomal RNA (16S) (Palumbi et al. 2002) was sequenced in ABI 3500 DNA analyser. The edited and trimmed sequences of *D. rerio* were submitted to the NCBI database (KY945239, KY945240, and KY242364). The homology of the generated sequence was analysed using the Basic Local Alignment Search Tool (BLAST) program in the National Centre for Biotechnology Information. Additional sequences of *Danio* spp. (AY788011, AY054970, AB741876, KT835295, KT624625-26, AY707452, and AY707455) were downloaded from the NCBI database to infer phylogenetic tree. All the specimens examined were deposited in the museum of the National Bureau of Fish Genetic Resources (NBFGR), Cochin (CH), Kerala, India and in the freshwater fish collection of the Central Island Agricultural Research Institute, Port Blair (CIARI/FF).

Family CYPRINIDAE  
*Danio* Hamilton, 1822  
*Danio rerio* (Hamilton, 1822)

**Materials examined.** *Danio rerio* (Figs.2A, 2B): NBFGR-CH-1180, 3, 19.23–22.24 mm SL, Kalpong River, Diglipur,

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**Fig. 1.** Map of the Andaman and Nicobar Islands showing the sampling sites

North Andaman, India (13°14.40'N, 92°58.39'E), 1 specimen, 29.96 mm SL, Kalipur Marsh, Diglipur, North Andaman, Praveenraj and Raymond Jani Angel, 26 Oct 2015 NBFGR-CH-1180, 1 specimen, 29.96 mm SL, Kalipur Marsh, near Kalipur beach, Diglipur, North Andaman, India, (13°13.52'N, 93°02.67'E), Praveenraj and Raymond Jani Angel, 26 Oct 2015. CIARI/FF-01, 6 specimens,

23.7–35.5 mm SL, Rangat, Middle Andaman, India (12°43.22'N, 92°53.11'E), Sailesh Kumar, 19 Apr 2016.

**Comparative material.** *Danio rerio* (Fig. 2C): NBFGR-CH-1179, 6 specimens, 18.7–21.1 mm SL, Alipurduar, Kolkata, India, Soutrik Ghosh, 15 Nov 2016.

**Description.** Body slender, laterally compressed, ventral portion more arched than dorsal. Head small and oval with small mouth, obliquely directed upward; lower jaw longer than upper jaw. Eyes moderate with circular pupil. Two pairs of barbels present, rostral pair longer than eye diameter and maxillary pair extending to pectoral fin base. Dorsal fin oval; anal fin marginally truncate; caudal fin forked and its anterior and posterior edge oval; pectoral fin sharp at anterior region; pelvic fin small; lateral line incomplete. Coloration: body pale olivaceous with four metallic-blue lines originating from head to caudal fin base and three golden lines running parallelly between blue lines. Caudal and anal fin barred with four blue stripes and interrupted by yellow stripes running parallel. Dorsal fin yellowish, bordered with faint blue to white stripe. Eyes silvery with melanophores scattered over it anteriorly. Comparative morphometric and meristic data of *D. rerio* specimens from the Middle and North Andaman and the mainland India, (topotypes) are provided in Table 1.

**Molecular characterization.** All the *Danio rerio* sequences generated under the accession number KY945239, KY945240 (Middle Andaman) and KY242364 (North Andaman) matched 99%–100% identity with existing 16S rRNA sequences of *D. rerio* (GenBank: KT624624, KT624625, KT624626). Maximum Likelihood method based on the Kimura 2-parameter model (Kimura 1980), was conducted using MEGA (Molecular Evolutionary Genetics Analysis) version 7 (Kumar et al. 2016), to provide a phylogenetic tree representing patterning of divergences (Fig. 3)

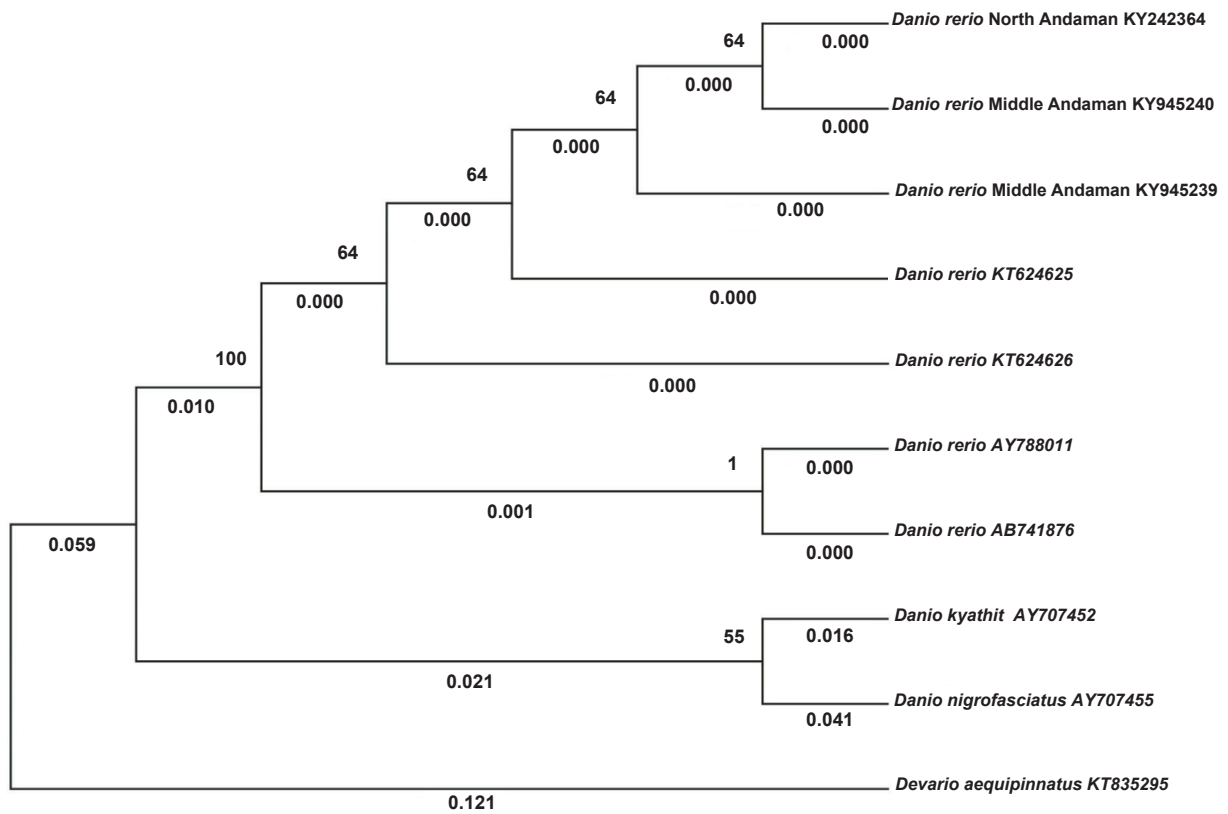
**Distribution.** *Danio rerio* has a wide distribution from northern Myanmar, Nepal, Bangladesh, Ganges and Brahmaputra rivers basins in north-eastern India and southern India (Barman 1991, Talwar and Jhingran 1991, Spence et al. 2006)

**Remarks.** *Danio rerio* was described as “*Cyprinus rerio*” from the Kosi River, a tributary of the Ganges River in Bengal, India, and was placed under the genus “*Danio*” as a division of “*Cyprinus*” (Hamilton 1822). After the proposal of the genus “*Brachydanio*” by Weber and de Beaufort (1916), the smaller species with seven branched dorsal rays and incomplete or absent lateral line were placed under *Brachydanio* (including *D. rerio*) and the larger bodied forms under *Danio* (see Chu 1981). Chu (1981) synonymised *Brachydanio* with *Danio* because of overlapping characters. Subsequently, Barman (1991) lumped all ‘*Danio*, *Brachydanio* and *Devario*’ in a single genus “*Danio*”. After a thorough phylogenetic and morphological analysis by Fang (2003), the genus *Danio* and *Devario* were found to be distinct, and the genus *Brachydanio* was also synonymised with *Danio*, and the name *D. rerio* came into usage.

The occurrence of *D. rerio* from the Andaman Islands is an interesting geographic record from the insular



**Fig. 2.** *Danio rerio* CIARI/FF-01, 33.78 mm SL, gravid female, Rangat, Middle Andaman (preserved) (A); NBFGR-CH-1180, 22.4 mm SL, Kalpong River, Diglipur, North Andaman (preserved) (B); NBFGR-CH-1179, 24.7 mm SL, Alipurduar, Kolkata (freshly preserved) (C); photo credit: J. Praveenraj



**Fig. 3.** Maximum likelihood phylogenetic tree of *Danio* spp. inferred from DNA sequences of Ribosomal 16SRNA gene; *Devario aequipinnatus* (McClelland, 1839) is used as out-group

**Table 1**  
Morphometric and meristic characters of *Danio rerio* from Andaman Islands and topotypes

Character	North Andaman <i>n</i> = 4		Middle Andaman <i>n</i> = 6		Topotype <i>n</i> = 6	
	Range	Mean ± SD	Range	Mean ± SD	Range	Mean ± SD
Standard length [mm]	19.23–29.96		23.7–35.5		18.7–21.1	
In percent SL						
Body depth	22.2–29.3	25.8 ± 3.6	22.0–25.3	23.6 ± 1.4	22.4–24.7	23.6 ± 0.8
Head length	24.1–28.9	26.1 ± 2.0	21.6–24.3	22.8 ± 1.1	23.5–26.6	25.3 ± 1.0
Head depth	15.1–20.4	17.9 ± 2.2	17.0–21.8	20.0 ± 1.8	17.2–19.9	18.0 ± 0.9
Pre-dorsal length	54.4–63.1	59.3 ± 3.6	56.9–63.5	61.2 ± 2.4	55.5–59.5	57.4 ± 1.6
Dorsal fin base length	10.4–14.7	12.2 ± 1.8	8.60–10.6	9.6 ± 0.6	12.4–13.4	12.9 ± 0.4
Anal fin base length	20.6–22.8	21.8 ± 0.9	15.9–25.7	19.4 ± 3.5	19.4–23.2	21.4 ± 1.4
Caudal peduncle depth	11.7–12.7	12.2 ± 0.4	10.3–12.0	11.2 ± 0.6	11.4–12.3	11.8 ± 0.3
Caudal peduncle length	14.2–21.4	17.3 ± 3.2	13.3–21.7	17.6 ± 2.9	14.3–20.9	17.1 ± 2.1
Pectoral fin length	19.6–22.5	20.7 ± 1.3	18.0–20.7	19.3 ± 0.9	18.2–25.8	23.8 ± 2.7
Pelvic fin length	12.4–15.5	14.0 ± 1.4	10.2–13.4	11.4 ± 1.2	11.8–15.7	14.0 ± 1.3
			<b>In percent HL</b>			
Snout length	20.1–23.3	21.5 ± 1.3	19.3–26.8	22.7 ± 2.5	16.6–28.8	21.8 ± 4.4
Eye orbit diameter	28.6–32.9	30.4 ± 1.9	29.1–37.5	33.0 ± 3.2	33.5–40.6	36.9 ± 2.9
Inter orbital width	22.0–27.4	24.3 ± 2.3	22.9–27.1	24.9 ± 1.7	26.1–33.1	29.1 ± 2.9
Post orbital head length	43.8–52.4	47.7 ± 4.1	44.9–56.3	50.5 ± 4.5	39.2–49.5	46.1 ± 4.4
Head depth	62.7–71.6	68.7 ± 4.1	72.7–93.0	87.9 ± 7.7	66.7–75.5	71.5 ± 3.2
Upper jaw length	17.3–26.6	21.8 ± 3.9	21.5–28.2	25.0 ± 2.3	21.6–30.4	25.2 ± 3.4
			<b>Meristics</b>			
Dorsal fin	ii/7 (4)		ii/7 (6)		ii/7 (6)	
Pelvic fin	i/6 (4)		i/6 (4)		i/6 (4)	
Pectoral fin	i/12 (4)		i/12 (6)		i/12 (6)	
Anal fin	ii/12 (4)		ii/12 (5), ii/11 <sup>1/2</sup> (1)		ii/12 (4), ii/11 <sup>1/2</sup> (2)	
Caudal fin	i/16 <i>i</i> (4)		i/16 <i>i</i> (4), i/15 <i>i</i> (1), i/14 <i>i</i> (1)		i/16 <i>i</i> (4), i/15 <i>i</i> (1), i/14 <i>i</i> (1)	
Lateral scales	27 + 2 (4)		27 + 2 (3), 27 + 1 (1), 26 + 1 (2)		27 + 2 (4), 27 + 1 (2)	
Predorsal scales	15 (4)		15 (6)		14 (6)	

*n* = number of specimens, SD = standard deviation, SL = fish standard length, HL = head length; Numbers in parenthesis after a count denote the frequency of that count.

freshwaters. Recently the distributional record of *D. rerio* from peninsular India has been reported (Whiteley et al. 2011), and the natural history of various populations from peninsular India, northern part, eastern and north-eastern parts of India were studied (Arunachalam et al. 2013). Hence the distributional records are from the Cauvery River basin, the Krishna River basin, and the Sharavati River basin from peninsular India, tributaries of the Ganges River basin, the Mahanadi River basin and tributaries of the Brahmaputra River basin. In the presently reported study, no significant variations in the meristic and morphometric characters between *D. rerio* specimens from the Andaman Islands, the topotypes, and the data from Day (1876, 1878) and Barman (1991) were observed. Overall, the morphological and molecular data confirmed the taxon identity. However, the new distributional record of *D. rerio* from the Andaman Islands is surprisingly far from its supposed native range, which suggests an accidental introduction through freshwater aquaculture. It is reported that alien fish introductions at the Andaman and Nicobar Islands are believed to be done during the British rule (Rajan and Sreeraj 2014c). History on carp introduction in the Andaman Islands is known from the records of Annandale and Hora (1925) and Mukerji (1935). Five species of air-breathing fishes are well established in the native waters; three species of Gangetic carps, one species of barb, and four species of exotic carps are being cultured in ponds (Sen 1975, Mohanraj et al. 1999, Palavai and Davidar 2009, Rajan and Sreeraj 2013, Rajan and Sreeraj 2014c). However, there are no reports of introduced carps from native waters. North and Middle Andaman islands have a numerous population of local Bengali settlers, involved in aquaculture of Gangetic and exotic Chinese carps. To a large extent, carp spawns are bought from mainland Kolkata and there is an ample chance of weed-fishes introduction, coming along with it as a contaminant. Hence, the presently reported findings of *D. rerio* from the Andaman Islands may probably be a result of a deliberate release or escape from fish farms. *Danio rerio* is generally omnivorous, and their natural diet consists of zooplankton, insect, and phytoplankton, filamentous algae, invertebrate eggs, arachnids and detritus (McClure et al. 2006, Spence et al. 2007). The establishment of *D. rerio* population in the natural waters of Middle and North Andaman may pose a serious ecological threat in the form of competition for food and space with the native fishes. Comprehensive studies might impart more knowledge on their behaviour and feeding ecology in the insular freshwaters of Andaman Islands.

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