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SHORT COMMUNICATION

First record of *Rhynchorhamphus naga* Collette, 1976 (Beloniformes: Hemiramphidae) from Kerala, India, South Eastern Arabian Sea

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ABSTRACT

Species, under the genus *Rhynchorhamphus* (Family: Hemiramphidae), are widely distributed marine groups of fishes. Among four species described from India, only two species, i.e., *Rhynchorhamphus georgii* and *R. maabarica,* are reported along the Indian coast. However, during the present study, a specimen collected from the Western Indian Ocean, Chetty harbour, Kerala, the south-west coast of India, has been identified as *Rhynchorhamphus naga* (Collette, 1976), based on morphology and molecular characters. The species is characterized by D-14; A-14; Pec-9; Pev-6; GR-50 and a prolonged beak (171.82% HL). The species has been reported from Western Central Pacific and several other countries like Brunei Darussalam, Cambodia, Malaysia, Philippines, Singapore, Thailand and Vietnam considered to be endemic to that region. This finding reveals that the species has a wider distribution, as we recorded the species from Kerala, south-west coast of India along the Indian Ocean.

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Introduction

Rhynchorhamphus naga Collette, 1976, a minor epipelagic fish belonging to the family Hemiramphidae, is distributed widely in fresh, brackish and marine habitats. *R. naga* has been reported from the Gulf of Thailand and East Indies (Collette, 1976), Indonesia, Brunei Darussalam, Cambodia, Malaysia, Philippines (Cantor, 1849), Singapore, Thailand and Vietnam (Froese & Pauly, 2019) (Figure 1). The congeneric species *Rhynchorhamphus georgii* has a wide range of distribution in India (Varghese, 2005). Collette (1976) examined species of the genus *Rhynchorhamphus* in various museums and confirmed one from the Gulf of Thailand and the Java Sea as *Rhynchorhamphus naga* among two unrecognized species. The earlier literature on the distribution of species of the family

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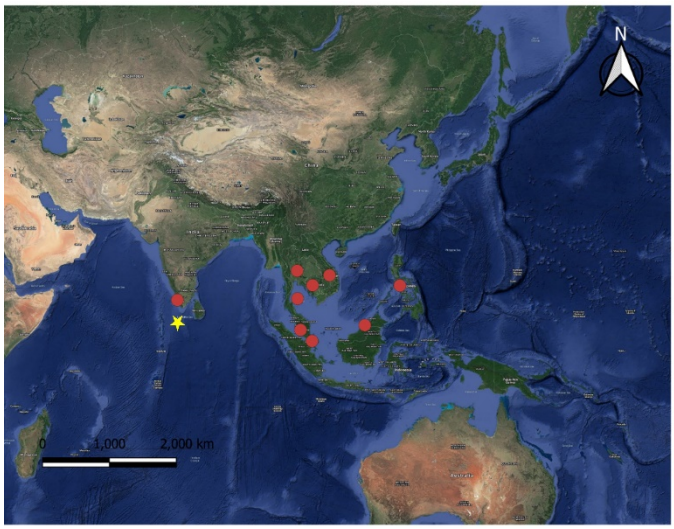

Figure 1. Distribution of *Rhynchorhamphus naga* Collette, 1976 in the World Ocean. The red circles indicate the records in different countries i.e., Brunei Darussalam, Cambodia, Malaysia, Philippines, Singapore, Thailand and Vietnam recently, from India Kerala - marked by yellow star).

Hemiramphidae has reported the distributional record of *R. georgii* (Figure 2) and *R. malabarica* from the Arabian Sea, especially in the south eastern region excluding *R. naga* (Varghese, 2005). However, a species collected from the the south eastern Arabian Sea region, Kerala, India did not match with the species distributed in the region. The identity of the species was confirmed by using standard identification keys (Collette, 1976), for morphomeristic traits and molecular tools (Ward et al., 2005) as *Rhynchorhamphus naga* (Figure 3) and thus, the present communication deals with the first record of *R. naga* from India.

Material and Methods

The fishes were caught by traditional ring seines (mesh size 8-10 mm), locally known as 'choodavala' from a depth of (7-8 m) in December 2018 in Chetty Fishing Harbour (9°37'25.4814" N, 76°17'44.7246" E), Kerala, India. Specimens were identified using a standard key (Collette, 1976), photographed and morphological traits were studied in fresh conditions. The COI gene (655bp) from the mitochondrial region was amplified by using targeted Primers such as FISH F2, FISH R2 (Ward et al., 2005). The thermal conditions for amplifying the COI region were set as an initial denaturation for 3 min at 94°C, followed by 35 cycles of 30 s at 94°C for denaturation, 30 s at 54°C for annealing, 60 s at 72°C for extension, with a final extension at 72°C for 10 min. The amplicons were purified and sequenced in both directions using PCR primers. The consensus sequences were blasted (BLASTN) against NCBI, and deposited in NCBI, Gene Bank (Accession Number *R. naga*-MN855100) (Figure 4).

Results

The collected specimen of hemiramphid was identified as *R. naga* (Collette, 1976) based on morphological and molecular characters (Table 1). Body slender (267.65 mm SL) with a prominent beak (171.82% of HL) but comparatively shorter than *R. georgii*. Nasal pectoral length 59.34% of HL. The upper jaw length (25.18% of HL) with prominent scales. Pre dorsal length is 51.62% of the standard length. Rays on dorsal fin 14; anal fin 14; pectoral fin 9; pelvic fin 6; gill rakers on first gill

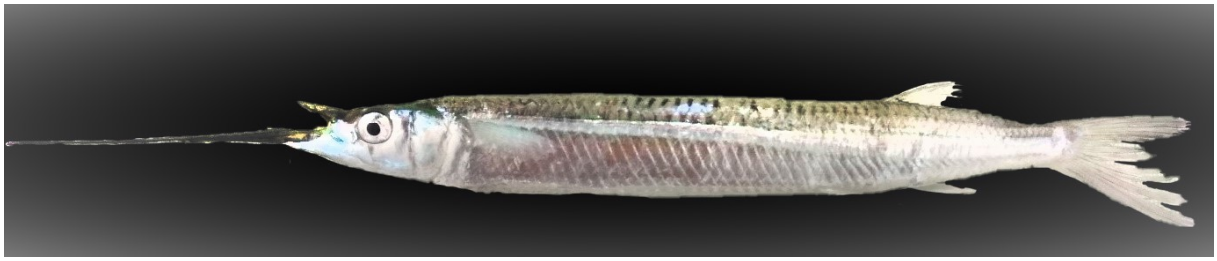

Figure 2. *Rhnchorhamphus georgii*

Figure 3. *Rhynchorhamphus naga*

Table 1. Morphometric and meristic parameters of species of genus *Rhynchorhamphus*, expressed as a percentage of standard length and head length

Parameters	**SPECIES**				
	R. naga		***R. georgii***		***R. malabarica***
Author	Present (n=1)	Collette, 1976	Present (n=15)	Collette, 1976	Collette, 1976
Characters (% of HL)					
ED	20.15%		17.49%-23.95%		
SNL	43.75%		42.61-51.64%		
BL	171.82% (1.71)	1.52-3.29 (mean x= 2.08)	134.05%-181.78%	1.23-2.64 (x's 1.48-1.75)	1.23-2.64 (x's 1.48-1.75)
UPJL	25.19%		24.97%-32.06%		
IOD	23.65%		24.11%-32.09%		
IND	12.38%		12.63%-18.85%		
NPL	59.35%		59.60%-71.83%		
Characters (% of SL)					
PDL/SL	55.06%%		53.18%-69.99%		
PAL/SL	59.23%		56.52%-71.71%		
PPvL/SL	10.38%		27.86-63.99%		
PPeL/SL	18.36%		16.85%-23.10%		
DFBL/SL	10.95%		10.48%-14.40%		
AFBL/SL	8.42%		7.30%-10.74%		
PEBL/SL	1.79%		1.78%-2.97%		
DFL/SL	6.39%		6.09%-8.57%		
AFL/SL	5.41%		4.52%-6.75%		
PeFL/SL	8.06%		8.50%-11.0%		
BD/SL	7.05%		7.86%-9.88%		
BW/SL	5.58%		4.90%-6.73%		
DAD/SL	7.02%		7.57%-9.06%		
CPL/SL	5.54%		3.06%-4.67%		
CPW/SL	3.28%		3.35%-6.77%		
Meristic characters					
Dorsal fin rays	14	14 or 15	14-16		
Anal fin rays	14	14 or 15	13-15		
Pectoral fin rays	9	10-12	9-11		
Pelvic fin rays	6		5-6		
Gill raker	50	47-59 (x 52.4)	45-58		
Pre dorsal scale	42	37-43 (Usually 40)	41-45		

Note: (Standard length or Sl; Snout length SNL; Eye Diameter ED; Upper jaw length UJL; Beak length BL; Inter orbital Depth IOD; Inter Nasal Depth IND; Nasal Pectoral length NPL; Head length HL; Pre dorsal length PDL; Pre Anal length PAL; Pre pelvic length PPvL; Pre pectoral length PPeL; Dorsal fin length DFL; Dorsal fin Base length DFBL; Anal fin Length AFL; Anal fin Base length AFBL Pectoral fin Length PeFL; Body Depth BD; Body Width BW; Dorsal Anal Distance DAD; Caudal peduncle Length CPL; Caudal peduncle Width CPW)

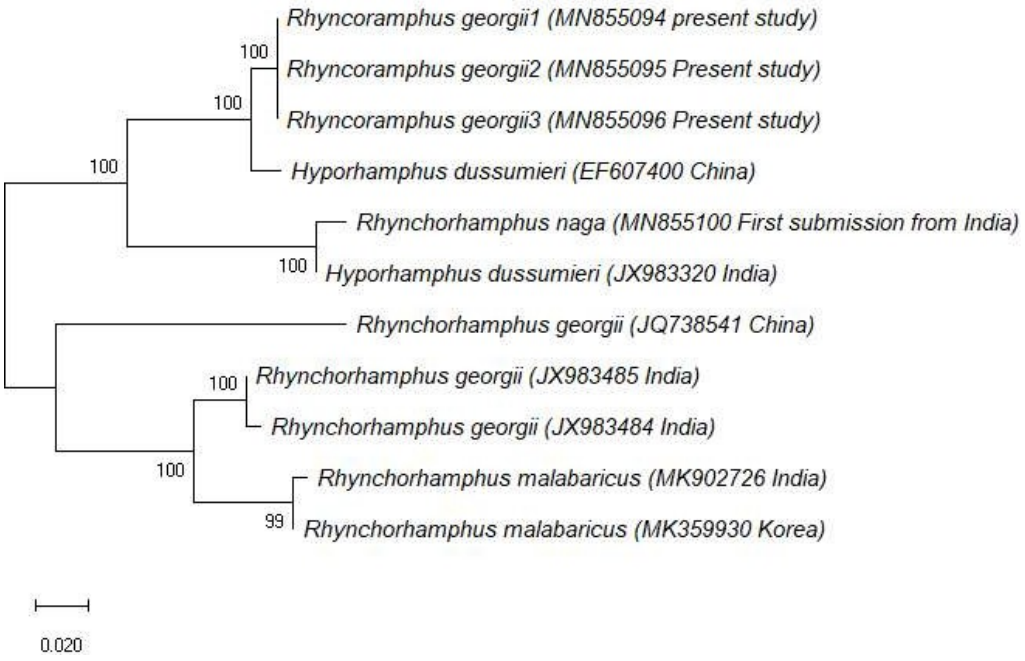

Figure 4. Maximum likelihood phylogenetic tree of *R. naga* based on DNA sequences of the mitochondrial COI gene

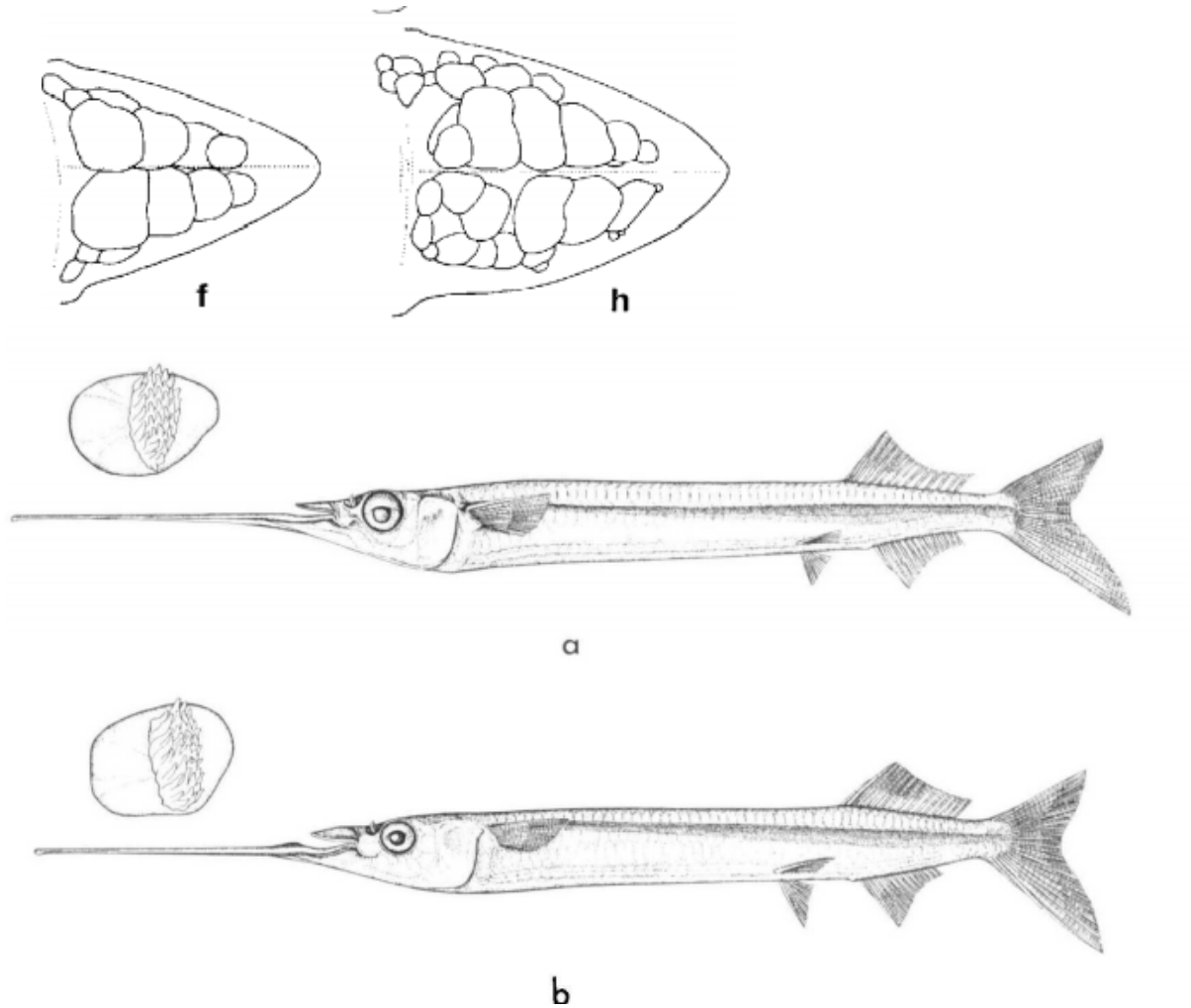

Fig. 5. The most peculiar distinguishing features of *Rhynchorhamphus naga* (Collette, 1972) (f, a) & *R. georgii* (Collette, 1972) (h, b)

arch 50, predorsal scales 42. Body with prominent silvery stripe, passing from behind the opercular region to the origin of the caudal fin. Caudal fin slightly forked. Both the jaws with adense, minute and conical teeth; the tongue and vomer are toothless. Body scales large, thin, cycloid and deciduous. In fresh condition, abdomen appears bluish, beak yellowish blue, a prominent lateral stripe passing through the lateral side of the body and slightly broadened towards the caudal region; lower lobe of caudal fin bluish while upper lobe yellowish blue, and blue marking on anal fin and below the abdomen.

Though there are very minute differences among the species of the genus, the species can be differentiated based on the lowest number of gill rakers (41), a narrow as well as shorter upper jaw and a broad prominent silvery stripe along the body, and slightly triangular shaped head.

Table 2 Comparison of morph-meristic characters of *R. naga* reported by authors from different geographical areas

Morphometric Traits	**Authors**	
	Present (n=1)	**Collette (1976)**
Characters in proportion to HL		
LJL/HL	1.71	1.52-3.29
IOD/OD	1.17	0.84-1.21
Meristic Characters		
DFR	14	14
AFR	14	15
PEFR	10	10-12
PVFR	6	-
PDS	42	37-43
GR (1st Gill arch)	50	47-59
GR (2nd Gill arch)	41	40-53

Note: HL-Head Length, LJL-Lower jaw Length, IOD-Inter Orbital Distance, IOD-Inter Orbital Distance, OD-Orbit Diameter)

Discussion

The Indo-Pacific region is considered to be a distributional hub, particularly for the genus *Rhynchorhamphus* (Collette, 1976). Collette (1976) has described *R. naga* from the Gulf of Thailand and the East Indies. There is no reported evidence of a distributional record of *Rhynchorhamphus naga* from the Indian Ocean region. Further, the overlapping of morpho-metric characters among the species under the genus *Rhynchorhamphus* creates ambiguity. There are very minute differences among the species of the genus (closely resembles *R. georgii*), but the species can be differentiated based on the lowest number of gill rakers and narrower as well as shorter upper jaw (compared to *R.georgii*) and a broad prominent silvery stripe along the body, slightly triangular shaped head. Thus, even if the species was distributed in the region, it was not correctly identified and reported earlier. The incorrect species identification based on morphological characters that has been deposited in public sequence databases such as GenBank leads to further taxonomic complications, thus there is a necessity for taxonomic verification of deposited sequence data based on taxonomic characters of voucher specimens (Silpa et al., 2021). However, the identity of *R. naga* was confirmed with the barcoding along with the original description. The species has been confirmed through NCBI-BLAST. Further, though the species has shown genetical similarity with *Hyporhamphus dussumieri*, there is a clear distinction between the genera *Rhynchorhamphus* and *Hyporhamphus,* especially the presence of fimbriae with nasal papilla in *Rhynchorhamphus* (Figure 5). Comparison of the morpho-meristic observations (Table 2), recorded during the present and earlier study (Collette, 1976) shows close similarity in the character of the species. Among the species under the genus *Rhynchorhamphus*, *Rhynchorhamphus naga* consists of fewest number of gills rakers. The proportion of IOD/OD 1.17 and LJL/HL 1.71 were found to be in the range of earlier studies. The standard length of the specimen was recorded to be 285.48 mm, comparatively higher than the earlier observation (62-177 mm). This variation may be due to a change in temperature which is considered to be an extrinsic factor for influential growth (Denechaud et al., 2020). The present report confirms the extension of the distribution range of *R.naga* from the Gulf of Thailand and East Indies to Kerala, the south-west coast of India, South eastern Arabian Sea. The east and west coast of Gulf of Thailand has been influenced by Pacific Ocean, the South China Sea, the Indian Ocean, the Andaman Sea, respectively. There is a possibility of migration of fish from the Gulf of Thailand to India through the Straits of Malacca due to surface water current (Kimura et al., 2009; Satapoomin, 2011; Klangunurak et al., 2012). Climatic variability associated with the change has been reported as a responsible factor for the distributional pattern of fishes (Rijnsdorp et al., 2009; Vivekanandan, 2011; Mohanty et al., 2017; Campana et al., 2020).

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Compliance With Ethical Standards

Authors' Contributions

AB & AKJ: Designed the study.
AB & JTM: Collection of the specimens.
AB: Wrote the first draft of the manuscript.
AB, JTM & APK: Performed and managed statistical analyses.
All authors read and approved the final manuscript.

Conflict of Interest

The authors declare that there is no conflict of interest.

Ethical Approval

For this type of study, formal consent is not required.

Data Availability

The specimens were stored in the museum repository CIFE, Mumbai.

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