



## DISTRIBUTION, THREATS AND CONSERVATION STATUS OF *HYPSELOBARBUS THOMASSI* (DAY, 1874), A POORLY KNOWN CYPRINID FISH OF THE WESTERN GHATS FRESHWATER ECOREGION

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**Abstract:** The Red Canarese Barb, *Hypseobarbus thomassi* (Day, 1874) is an endemic cyprinid fish of the rivers of the Western Ghats of India, which has been listed as 'Critically Endangered' in the IUCN Red List of Threatened Species. Like many of its congeners, *H. thomassi* is poorly known with very few verified records and voucher specimens in the past decades. Based on fresh materials collected from three west flowing rivers of Kerala, we provide information on its identity, distribution, phylogenetic position, threats and conservation. An updated conservation assessment of this species following the IUCN Red List criteria is also provided.

**Keywords:** Barb, freshwater fish, *Gonoproktopterus*, India, IUCN Red List.

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**Author Contribution:** AA, SP, CRR, AB & RR carried out the field work and collected the specimens; RR studied museum specimens; AA performed morphometry, ND carried out the extraction of DNA and related molecular laboratory work; SP carried out the phylogenetic analysis; AA, SP, ND, AB & RR wrote the manuscript.

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## INTRODUCTION

*Hypselobarbus thomassi* (Day, 1874) (Images 1 & 2) is a poorly known large cyprinid species endemic to the Western Ghats freshwater ecoregion in peninsular India (Devi & Ali 2011). Day (1874, p707) described *Barbus* (= *Hypselobarbus*) *thomassi* from South Canara as a large barb growing to more than 450mm in length. Subsequently, Day (1878, p 567; 1889, p 311) provided additional notes on this species. Historic literature (Day 1874, 1879, 1889) suggested that this species is restricted in distribution to the inland waters of the erstwhile South Canara, i.e., the area encompassing current day Dakshin Kannada District of Karnataka, and Kasargod District of Kerala.

Like many other species within this genus, *H. thomassi* has also been poorly represented in collections, and not many records are available in the primary literature. The first record of *H. thomassi* outside its type locality was most likely made by Jayaram et al. (1976) from the rivers of the Cardamom Hills, as previous ichthyological surveys in Travancore (e.g., Pillai 1929; John 1936) and the Anamalai Hills (Silas 1951) had not mentioned this species. Subsequent compilations and checklists (for

e.g., Talwar & Jhingran 1991; Menon 1999; Easa & Shaji 2003; Devi et al. 2005) provided the distribution range for *H. thomassi* as South Canara and Cardamom Hills. Later, many researchers added new records (although not supported by voucher specimens) of this species from various rivers in Kerala (see Table 1).

In the absence of recent records and contradictory claims made by researchers, the exact distribution range of *H. thomassi* remained uncertain. Abraham et al. (2011) indicated that only three species of *Hypselobarbus*, viz., *H. curmuca*, *H. kolus* and *H. kurali* are present in river Kallada, and suggested that the reports of *H. thomassi* from this river are not correct and is a case of misidentification (R. Abraham pers. comm. cited in Devi & Ali 2011). Hence, based on the assumption that *H. thomassi*, is restricted to an area of <10km<sup>2</sup> as two fragmented locations in the Nethravati and Kabini rivers, this species was listed as 'Critically Endangered/CR' in the IUCN Red List of Threatened Species (see Devi & Ali 2011). A recommendation for carrying out urgent surveys in the known areas of occurrence as well as validation of the identity of the southern Kerala populations was also made (Devi & Ali 2011).

Recently, Knight et al. (2013a) cleared the taxonomic



CRG-SAC.2013.45 - Vettilapara, Chalakudy, Kerala  
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**Image 1. Live specimens of *Hypselobarbus thomassi* from two sites in the Kerala region of Western Ghats.**

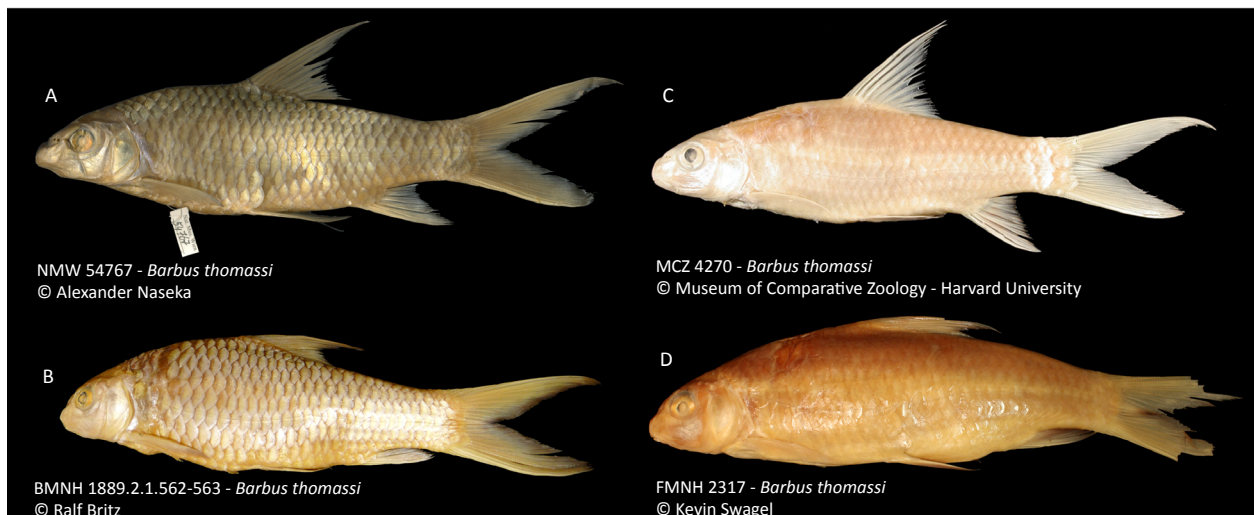


Image 2. Syntypes and/or Day's specimens of *Hypselobarbus thomassi*

Table 1. Previous records of *Hypselobarbus thomassi* from the Western Ghats

| Location/River                          | Reference  |
|---|--|
| South Canara <sup>1</sup>               | Day (1874, 1878, 1889)                             |
| Cardamom Hills                          | Jayaram et al. (1976)                              |
| Kabini River (Wayanad)                  | Easa & Shaji (2003)                                |
| Periyar River (Malayatoor, Pooyamkutty) | Thomas (2004)                                      |
| Periyar River                           | Thomas et al. (2002); Beevi & Ramachandran (2009)  |
| Chalakudy River                         | Kurup et al. (2004); Beevi & Ramachandran (2009)   |
| Kallada River (Kulathupuzha)            | Kurup et al. (2004)                                |
| Tunga River (Sringeri and Hariharapura) | Ahmad & Venkateshwarlu (2012); Ahmad et al. (2013) |
| Kempu Hole River                        | Knight et al. (2013a)                              |
| Mula-Mutha River                        | Wagh & Ghate (2003)                                |

<sup>1</sup>Currently Dakshin Kannada and Udupi District of Karnataka and Kasargod District of Kerala

ambiguity surrounding the identity of *H. thomassi* after making fresh collections from its type locality. They also examined a single specimen of the species from the Athirapilly waterfalls in Chalakudy River, Kerala, and suggested that they are conspecific with the populations found in South Canara, its type locality; and that the claims made by Devi & Ali (2011) on the taxonomic distinctiveness of the Kerala population needs to be substantiated.

Based on specimens collected from the Chalakudy, Periyar and Kallada rivers as well as re-examining materials that formed the basis of the study of Abraham et al. (2010), we provide additional information on the current distribution range of *H. thomassi* in the

Western Ghats freshwater ecoregion. Based on the updated information on distribution and threats, we then propose an updated Red List assessment for this endemic species.

## MATERIALS AND METHODS

### Materials examined

*Hypselobarbus thomassi*, CRG-SAC.2013.41, 13.vi.2013, 1 ex., 106.4mm SL, Vettilapara, 10.287°N & 76.498°E, Chalakudy River, Kerala, India, coll. R. Raghavan & A. Ali; *Hypselobarbus thomassi*, CRG-SAC.2013.72, 05.iv.2013, 1 ex., 138.31mm SL, Rosemalai, 8.910°N & 77.164°E, Kallada river, Kerala, India, coll. Renjith Kumar; *Hypselobarbus thomassi*, DABFUK F 15, 20.vi.2010, 1 ex., 83mm SL, Thenmala, 8.874°N & 77.195°E, Kallada River, Kerala, India, coll. A. Bijukumar; *Hypselobarbus thomassi*, CRG-SAC.2004.201, 04.iii.2004, 1 ex., 127.07mm SL, Pooyamkutty, 10.169°N & 76.793°E, Periyar River, Kerala, India, coll. R. Raghavan et al.

### Photographs and X-ray

*Barbus thomassi*, F. Day, MCZ 4270, 1 ex, South Canara, India; *Barbus thomassi*, F. Day, FMNH 2317, 1 ex, South Canara, India; *Barbus thomassi*, F. Day, NMW 54767, 1 ex, South Canara, India (also radiograph - see Image 3); *Barbus thomassi*, F. Day, BMNH 1889.2.1.562, 1 ex, South Canara, India.

### Museum abbreviations

BMNH: Natural History Museum, London; CRG-SAC: Conservation Research Group, St. Albert's College, Kochi;



Image 3. Radiograph of a syntype of *Hypselobarbus thomassi* [Courtesy: Alexander Naseka]

DABFUK: Department of Aquatic Biology and Fisheries University of Kerala, Trivandrum; FMNH: Field Museum, Chicago; MCZ: Museum of Comparative Zoology, Harvard; NMW: Natural History Museum, Vienna.

#### Taxonomy

We use the generic name *Hypselobarbus* instead of *Gonoproktopterus* following Arunachalam et al. (2012), Yang et al. (2012), and Knight et al. (2013a,b,c).

#### Morphometric data collection

Counts and measurements follow Pethiyagoda et al. (2012) and Knight et al. (2013a). Measurements were taken using a digital calliper to the nearest 0.1mm. Subunits of body are presented as percent of standard length (SL) and subunits of head are provided as percent of head length (HL) (see Table 2).

#### DNA isolation and molecular phylogeny

Muscle tissue was harvested from a fresh specimen each collected from two different river systems, Chalakudy and Kallada in Kerala (CRG-SAC.2013.42, CRG-SAC.2013.72.1) and was preserved in absolute ethanol. The tissue was digested at 60°C for two hours using the STE buffer (0.1M NaCl, 0.05 M Tris-HCl, 0.01M EDTA, 1%SDS) with 15µl Proteinase K (20mg/ml) per 500ml of STE buffer. DNA was extracted using conventional phenol-chloroform method and re-suspended in nuclease free water. Polymerase chain reaction was performed to amplify mitochondrial cytochrome oxidase subunit I (cox1) gene, using the forward primer Fish R1 (5'- TCAACCAACCACAAAGACATTGGCAC-3') and reverse primer Fish R1 (5'- TAGACTTCTGGGTGGCCAAAGAATCA-3') (Ward et al. 2005). PCR reaction was performed in a 25µl reaction volume containing 5µl of template DNA (~200ng), 2.5µl of 10X reaction buffer (100 mM Tris pH

9.0, 500 mM KCl, 15mM MgCl<sub>2</sub>, 0.1% Gelatin), 2µl of 25mM MgCl<sub>2</sub>, 1µl of 10mM dNTPs, 1µl of each primer, 1µl Taq polymerase (1U/µl) and 12.5µl nuclease free water. The thermal profile was 10 mins at 95°C, and 35 cycles of 1 min at 94°C, 1 min at 54°C and 2 mins at 72°C, followed by extension of 10 mins at 72°C. Amplified DNA fragments were purified using the 'Promega Wizard Gel and PCR clean up' system and sequenced. The purified PCR products were sequenced using ABI prism 3730 sequencer (Applied Biosystems, USA) and Big dye terminator sequencing kit (ABI Prism, USA).

BLAST tool (Altschul et al. 1990) was used to analyze the integrity of the sequence. The sequences were submitted to NCBI GenBank (accession numbers pending). We retrieved additional sequences for other related species from NCBI GeneBank database (<http://www.ncbi.nlm.nih.gov/>). GenBank accession numbers for the sequences used for the analysis are provided in Table 3 and Fig. 1. Sequences were aligned using MUSCLE (Edgar 2004). A Maximum Likelihood (ML) phylogeny was built in PHYML ver 3.0 (Guindon et al. 2010) using the dataset after finding out the best fit nucleotide substitution model using MrAIC (Nylander 2004).

#### RESULTS AND DISCUSSION

Values of morphometric characters of the specimens that we collected (Table 2) are within the general range as observed in the putative topotypes studied by Knight et al. (2013a). Whatever minor variations that were observed were due to the reason that closely related large growing cypriniform fishes, often tend to have an allometric growth pattern (Mina et al. 1996; Patimar & Farzi 2011), resulting in discrepancy in morphometric

**Table 2. Morphometric characters and meristics of *Hypselobarbus thomassi* collected from three river systems of Kerala**

|                               | CRG.SAC.2013.41<br>Vettilapara,<br>Chalaky River | CRG.SAC.2004.201<br>Pooyamkutti,<br>Periyar River | CRG.SAC.2013.72<br>Rosemalai, Kallada<br>River | DABFUK F15<br>Tenmala, Kallada<br>River |
|-------------------------------|--|---|--|---|
| <b>Morphometric Character</b> |  |   |  |   |
| Standard Length (SL) in mm    | 106.4  | 127.1   | 138.3  | 83.1                                    |
| % SL                          |  |   |  |   |
| Head Length                   | 25.6   | 25.4  | 25.92  | 26.5                                    |
| Pre dorsal length             | 48.0   | 50.5  | 50.62  | 47.0                                    |
| Pre pelvic length             | 53.5   | 51.8  | 54.5   | 50.6                                    |
| Caudal peduncle length        | 21.1   | 22.1  | 21.0   | 19.8                                    |
| Body depth                    | 29.1   | 31.8  | 31.4   | 28.9                                    |
| Dorsal fin height             | 35.7   | 27.5  | 27.6   | 26.1                                    |
| Dorsal fin base               | 15.1   | 15.5  | 14.4   | 15.7                                    |
| Pectoral fin length           | 17.2   | 19.9  | 21.5   | 17.2                                    |
| Pelvic fin length             | 17.8   | 19.4  | 19.8   | 16.2                                    |
| Anal fin base                 | 7.6  | 7.2   | 6.8  | 6.5                                     |
| Dorsal hypural distance       | 54.3   | 55.4  | 54.3   | 57.8                                    |
| <b>% Head Length (HL)</b>     |  |   |  |   |
| Snout length                  | 41.2   | 40.8  | 37.4   | 33.4                                    |
| Head depth                    | 75.3   | 71.1  | 71.4   | 72.7                                    |
| Eye diameter                  | 30.2   | 29.6  | 29.0   | 27.3                                    |
| Maxillary barbel length       | 22.0   | 24.8  | 23.8   | 22.2                                    |
| Rostral barbel length         | 13.6   | 14.9  | 15.6   | 15.9                                    |
| Internarial width             | 19.9   | 20.3  | 19.5   | 22.7                                    |
| Interorbital width            | 36.0   | 35.9  | 33.7   | 34.1                                    |
| <b>Meristics</b>              |  |   |  |   |
| Dorsal                        | iv 9   | iv 9  | iv 9   | iv 9                                    |
| Pectoral                      | i 15   | i 15  | i 15   | i 15                                    |
| Ventral                       | i 9  | i 9   | i 9  | i 9                                     |
| Anal                          | iii 5  | iii 5   | iii 5  | iii 5                                   |
| Caudal                        | 1+9+8+1  | 1+9+8+1   | 1+9+8+1  | 1+9+8+1                                 |
| Lateral line scales           | 34+1   | 33+1  | 33+1   | 33+1                                    |
| Lateral transverse Scales     | ½-5-1-3  | ½-5-1-3   | ½-6-1-3  | ½-6-1-3                                 |
| Pre Dorsal Scales             | 11   | 11  | 11   | 11                                      |

proportions (also see Ali et al. 2013).

### Description

Body elongate, laterally compressed, dorsal profile convex with the pre dorsal contour ascending up to dorsal fin origin then descending gently towards caudal peduncle. Ventral profile also convex anteriorly up to pelvic fin origin, almost flat up to anal fin base, then slanting sharply to the caudal base.

Head laterally compressed, eyes positioned somewhat superiorly, visible from dorsal and ventral

aspects. Nares placed very close to the antero-superior rim of the orbit. An elevated flap is present at the middle of the nares. Mouth sub-terminal, reaching to vertical at middle of nostrils, U shaped in ventral aspect with interrupted labial fold. Two pairs of thin barbels; the rostral pair shorter than the maxillary one. Rostral barbels, when adpressed reach the base of maxillary barbels and a point in vertical from the posterior extremity of the nostrils.

Dorsal fin origin above 10<sup>th</sup> scale of the lateral line and is slightly in advance of pelvic fin origin; sharply

Table 3. Details of *cox1* sequences of *Hypselobarbus* species used for the phylogenetic analyses presented in Fig 1.

| Genbank Accession Number | Species  | Location                                   | Remarks                        |
|--------------------------|--|--|--------------------------------|
| HM010710                 | <i>Hypselobarbus jerdoni</i> <sup>1</sup>            | No location information                    |                                |
| HM010712                 | ' <i>Hypselobarbus lithopidos</i> '                  | India; Shimoga Fish Farm                   | Misidentification <sup>2</sup> |
| KF955537                 | <i>Hypselobarbus lithopidos</i>                      | India; Chandragiri                         | Topotype                       |
| F955538                  | <i>Hypselobarbus lithopidos</i>                      | India; Chandragiri                         | Topotype                       |
| KF955536                 | <i>Hypselobarbus thomassi</i>                        | India; Vettilapara; Chalakudy              |                                |
| KF955539                 | <i>Hypselobarbus thomassi</i>                        | India; Rosemalai, Kallada                  |                                |
| HM010715                 | ' <i>Hypselobarbus lithopidos</i> '                  | India; Rusewalai (= Rosemalai ?) fish farm | Misidentification <sup>2</sup> |
| KC445465                 | <i>Hypselobarbus periyarensis</i>                    | No location information                    |                                |
| KF113559                 | <i>Hypselobarbus periyarensis</i>                    | India; Periyar Tiger Reserve               | Topotype                       |
| HM010717                 | <i>Hypselobarbus periyarensis</i>                    | No location information                    |                                |
| HM010708                 | <i>Hypselobarbus</i> cf. <i>curmuca</i> <sup>3</sup> | No location information                    |                                |
| HM010709                 | <i>Hypselobarbus dubius</i>                          | No location information                    |                                |
| HM010718                 | <i>Hypselobarbus micropogon</i>                      | No location information                    |                                |
| KC445464                 | <i>Hypselobarbus micropogon</i>                      | No location information                    |                                |
| HM010711                 | <i>Hypselobarbus</i> cf. <i>curmuca</i> <sup>4</sup> | No location information                    |                                |
| HM010716                 | <i>Hypselobarbus canarensis</i> <sup>5</sup>         | No location information                    |                                |
| HM010719                 | <i>Hypselobarbus canarensis</i> <sup>5</sup>         | No location information                    |                                |
| KC445463                 | <i>Hypselobarbus canarensis</i> <sup>5</sup>         | No location information                    |                                |

<sup>1</sup> as *Puntius jerdoni* in Genbank; <sup>2</sup> Please see discussion in this paper and also Ali et al. (2013) and Knight et al. (2013); <sup>3</sup> Knight et al. (2013c) cleared the taxonomic identity and established a neotype for *H. curmuca*. Since the sequence HM010708 has no information on the location of collection of the specimen, we tentatively treat it as *Hypselobarbus* cf. *curmuca*; <sup>4</sup> Genbank records state that HM010711 represent a sequence for *H. kolus*. However, Knight et al. (2013c) has considered *H. kolus* as a synonym of *H. curmuca*. Therefore we tentatively treat the sequence as belonging to *Hypselobarbus* cf. *curmuca*; <sup>5</sup> Genbank records state that HM010716, HM010719 and KC445463 represent sequences for *H. kurali*. However, Knight et al. (2013c) synonymised *H. kurali* with *H. canarensis*.

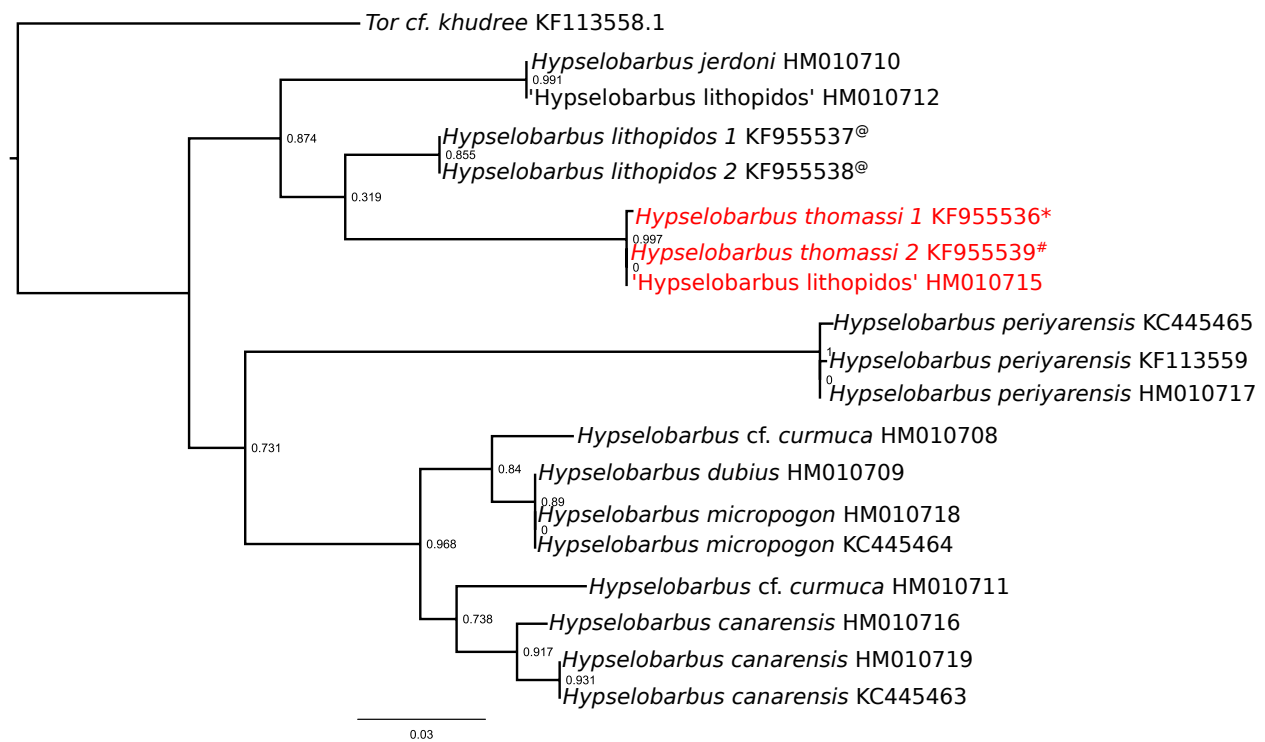


Figure 1. Maximum Likelihood tree using *cox1* gene showing the phylogenetic position of *Hypselobarbus thomassi* in relation to its congeners. @## Sequenced for the present study, \* Chalakkudy River, # Kallada River; the sequences within inverted commas (') are misidentifications in Arunchalam et al. (2012).

pointed at apex with a concave distal margin. Posterior margins of pectoral and pelvic fins convex, curved not reaching to vertical from insertion of pelvic fin and anal fin respectively. Anal fin with a concave distal margin; caudal fin deeply forked; both the lobes with pointed tips, upper lobe slightly longer than the lower one.

Dorsal fin with four simple and nine branched rays, the last one branched to the base. Last unbranched dorsal fin ray longest followed by the first branched ray. Pectoral fin with one simple and 15 branched rays. Pelvic fin with one simple and nine branched rays. Anal fin with three simple and five branched rays, last one branched to the base. Caudal fin with 9+8 branched rays and 3-4 procumbent rays above and below the principal fin rays of each lobe.

Lateral line complete with 33–34 pored scales, plus one unperforated scale at the base of the caudal fin. Eleven predorsal scales (excluding the notched one at fin origin) and 14 circumpeduncular scales ( $\frac{1}{2}$ -3-1-2- $\frac{1}{2}$  scale in transverse line). Transverse scale count between dorsal fin origin and pelvic fin origin  $\frac{1}{2}$ +5+1+3 and  $3\frac{1}{2}$  scales between lateral line and anal fin. There exist 21 pre ventral scales and 30 pre anal scales. Dorsal base sheathed with 9–10 scales where as the anal fin with 5–6 scales. One scale row between the urogenital opening and anal fin origin. The two axillary scales present at the pelvic fin base exceed a bit beyond the posterior insertion of the fin.

### Colouration

Dorsal side of the body and the flanks above the lateral line are greenish grey in colour and the flanks below lateral line and the ventral side are bright silvery in colouration. Body devoid of any distinct markings. All the fins orange-red in colour at their proximal ends and with a greyish tinge at the distal ends. Head, scales and rostral barbels with many minute scattered chromatophores but is absent on the maxillary barbels (when viewed under microscope).

### Squamation

Observations from the present study as well as those carried out earlier on the genus *Hypselobarbus* have revealed that these large barbs have a wide range in their lateral line scale counts (for e.g., 31–36 in *H. thomassi*; 37–39 in *H. lithopidos*) (Day 1874; Ali et al. 2013; Knight et al. 2013a).

### Distribution

*Hypselobarbus thomassi* is endemic to the Western Ghats of India (Dahanukar & Raghavan 2013). It is

currently known as fragmented populations from several small west flowing rivers in the Western Ghats freshwater ecoregion, viz., Kempuhole (Karnataka State) (Knight et al. 2013a), Chalakudy, Periyar and Kallada (Kerala State) (Image 4). There are at least 26 west flowing and two east flowing river systems between Kempuhole and Chalakudy, and six west flowing and one east flowing river systems between Periyar and Kallada (see River Research Center 2013 for a list of rivers in Kerala). However, comprehensive ichthyological surveys carried out during the last decade and a half (Kurup et al. 2004; River Research Center 2013 and references therein) have failed to record *H. thomassi* from any of these rivers. Although local knowledge of fishers in Chandragiri River reveal that the species is sometimes caught, there are no voucher specimens to confirm this. Nevertheless, the location of the Chandragiri basin in the larger South Canara landscape (the type locality of the species) may actually mean that the species could be present in the river. The records of *H. thomassi* from two east flowing river systems, Kabini River of Cauvery River system (Easa & Shaji 2003), and Tunga-Bhadra (Ahmad & Venkateshwarlu 2012; Ahmad et al. 2013) and Mula-Mutha Rivers of Krishna River system (Wagh & Ghate 2003), are difficult to verify as there are no voucher specimens. It is also essential to note that the record of this species from Mula-Mutha River by Wagh & Ghate (2003), based on the collections made during 1992–1995, is likely to be wrong because the species was neither recorded during previous (Fraser 1942; Suter 1944; Tonapi & Mulherkar 1963), nor later (Kharat et al. 2001) studies.

Until reliable records backed up by voucher specimens are available from the east flowing rivers (Cauvery and Krishna), we consider *H. thomassi* to be restricted to the west flowing rivers of the Western Ghats. We therefore exclude the records of the species from east flowing drainages in the distribution map (Image 4).

### Population status

Currently there is very little information on the population status of *H. thomassi* from its native range. Menon (2004) mentioned that an extensive search in South Canara, the type locality *H. thomassi*, resulted in the collection of only one specimen. Local knowledge of fishers in the Chalakudy and Periyar rivers reveal that the fish is not common and is rarely caught. Extensive surveys in the Kasargod District of Kerala State (erstwhile South Canara - type locality) including Chandragiri (Biju 2005) as well as neighbouring basins of Uppala and

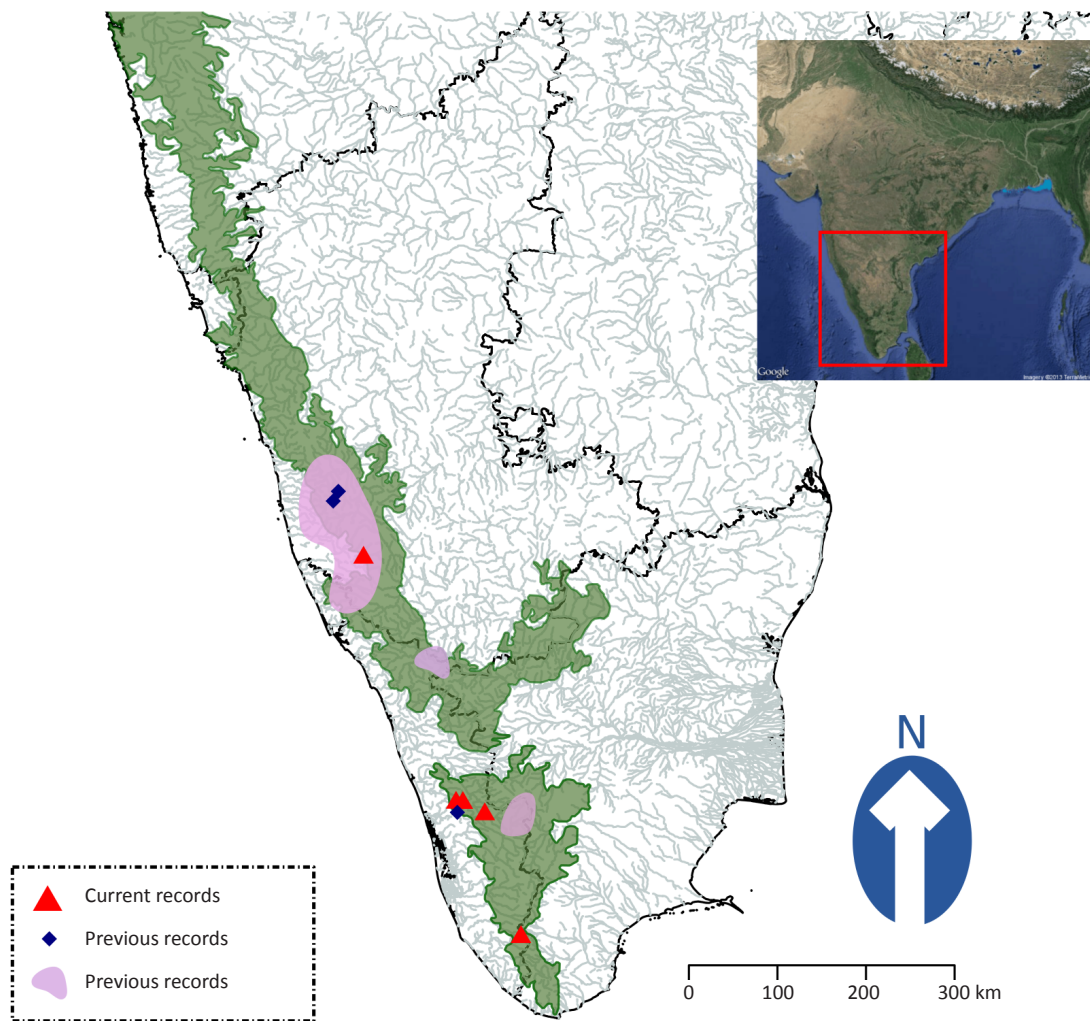


Image 4. Map showing the distribution range of *Hypselobarbus thomassi* in the Western Ghats region [the pink shades denote occurrence records of the species where information on the exact location is unavailable]

Manjeshwaram (Biju et al. 1999 a,b) did not yield any specimens of *H. thomassi*. Although, Ramachandra et al. (2012) suggested that *H. thomassi* is extirpated from several west flowing rivers of Karnataka including Kali, Bedti, Aghanashini, Sharavati and Nethravati, Knight et al. (2013a) collected several specimens from Nethravati indicating that the fish is still extant.

#### Habitat and Ecology

*Hypselobarbus thomassi* inhabits pool-riffle, run and glide habitats in fast to moderately flowing streams shaded with a fine amount of riparian vegetation. It favours clear, well oxygenated water flowing gently over substrates that are extensively encountered in these microhabitats such as boulders, bedrocks and sand. The adults of the species always dwell in moderately deep pools, whilst the juveniles are seen in the shallow areas

associated with the pool-riffle and run habitats. The habitats of *H. thomassi* in the three river systems of Kerala are shown in Images 5–7.

#### Phylogenetic position

A genetic distance of 0.1% was observed between the *cox1* sequence of *H. thomassi*, from the Chalakkudy River and Kallada River. Interestingly, the sequence generated from the specimen collected from Kallada River (Fig. 1) demonstrates the uniqueness with a sequence from the GenBank (HM010715) which was deposited as *H. lithopidos* (from Rosemalai - also in the Kallada River system) (see Arunachalam et al. 2012). These three sequences formed a monophyletic group (Fig. 1) which was sister to the topotypic sequences of *H. lithopidos* collected for the present study. The average genetic distance between the sequence of topotypic





Image 5. Habitat of *Hypselobarbus thomassi* at Vettilapara in Chalakudy River. Image taken on 18 February 2004.



Image 6. Habitat of *Hypselobarbus thomassi* at Pooyamkutty in Periyar River. Image taken on 09 January 2008.



Image 7. Habitat of *Hypselobarbus thomassi* at Thenmala in Kallada River. Image taken on 04 March 2004.

*H. lithopidos*, collected from South Canara, and the *H. thomassi* sequences were 4.85%. This confirms that the sequence HM010715, collected from Rosemalai, is in fact *H. thomassi* and not *H. lithopidos* as argued by Arunachalam et al. (2012). Our phylogenetic analysis and additional observations made in two recent papers (Ali et al. 2013; Knight et al. 2013a) demonstrates that Arunachalam et al. (2012) provides an inaccurate picture of the phylogenetic relationship of the genus *Hypselobarbus*.

### Threats and conservation

To the best of our knowledge, there is no targeted fishery of *H. thomassi* as a food fish anywhere in its distribution range. However, they are caught along with other species of *Hypselobarbus* as well as Mahseer (*Tor* sp.) in the Kallada River in Kerala. Unmanaged aquarium trade (see Raghavan et al. 2013) is a concern as local

fishers acknowledge the fact that juvenile *H. thomassi* are sometimes caught as by-catch during aquarium fish collections for its congener, *H. jerdoni* in the rivers of Dakshin Kannada and Kasargod districts of Kerala (=erstwhile South Canara). Destructive fishing practices especially dynamiting is a major threat to the species in the streams around Pooyamkutty in Periyar River, as well as in Umayar, Rosemalai and Katalapara regions of Kallada river. Poisoning and electric fishing are prevalent in the Sullia region of Dakshin Kannada, especially when the water levels are low (see Ali et al. 2013).

Currently, *H. thomassi* has been listed as 'Critically Endangered' (Devi & Ali 2011) in the IUCN Red List of Threatened Species based on limited distribution information available during the assessment. Additional information on distribution, threats and taxonomic clarifications (Knight et al. 2013a; this paper) have led to a scenario where the conservation status of the species needs to be re-assessed. The proposed Red List Status of the species has been provided in Appendix 1.

### CONCLUSIONS

In spite of research that began more than two hundred years ago, our knowledge on the diversity and distribution of freshwater fishes of Western Ghats is far from complete. Studies such as those reported in the present paper, as well as others (for e.g., Katwate et al. 2012; Ali et al. 2013; Emmanuel et al. 2013; Knight et al. 2013a,b,c;) are addressing this gap in knowledge on species distribution, widely termed as the 'Wallacean shortfall' thereby facilitating the development and implementation of conservation policies and action in this exceptional region of freshwater biodiversity.

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**APPENDIX 1****PROPOSED RED LIST STATUS FOR *HYPSELOBARBUS THOMASSI*****CURRENT STATUS:** Critically Endangered B2ab(iii)**PROPOSED STATUS:** Endangered B2ab(iii)**Taxonomy**SCIENTIFIC NAME: *Hypselobarbus thomassi*

SPECIES AUTHORITY: Day (1874)

COMMON NAMES: Red Mahseer, Red Canarese Barb, Nilgiri Shark, Kempu Peruval (Kannada), Chemban Kooral (Malayalam)

SYNONYMS: *Barbus thomassi*, *Puntius thomassi*, *Gonoproktopterus thomassi*

**TAXONOMIC NOTES:** *Hypselobarbus thomassi* was described by Day (1874) from the inland waters of erstwhile South Canara, India. There is considerable taxonomic ambiguity on the genus *Hypselobarbus*. Species currently placed within this genus have been placed in *Barbus* (Day 1874), *Puntius* (Jayaram 1981), *Gonoproktopterus* (Jayaram 2010; Pethiyagoda et al. 2012) and *Hypselobarbus* (Arunachalam et al. 2012; Yang et al. 2012; Ali et al. 2013; Knight et al. 2013a,b,c). The most recent paper (Knight et al. 2013c) has cleared the generic status of *Hypselobarbus*, which we follow.

**Assessment Information**

RED LIST CATEGORY AND CRITERIA: Endangered B2ab(iii)

**JUSTIFICATION:** *Hypselobarbus thomassi* is assessed as Endangered because of its severely fragmented and restricted distribution to four west flowing river systems of the Western Ghats, with an estimated area of occupancy (AOO) of less than 100km<sup>2</sup> (approximately 20km stretch in each river with an average width of 250m) based on the distribution of the species in the middle reaches (60–400 m altitude) of the known hydrobasins. There is also a continuing decline in the quality of the habitats throughout its range due to pollution, dams and destructive fishing practices.

**Geographic range**

**RANGE DESCRIPTION:** Endemic to the Western Ghats freshwater ecoregion, where they are currently known from four west flowing river systems, Kempuhole (Karnataka State), Chalakudy, Periyar and Kallada (Kerala State) (present study; Knight et al. 2013a), and probably the Chandragiri River system (Kerala/Karnataka). The estimated (approximate) current extent of occurrence (EEO) is less than 5,000km<sup>2</sup> and current (approximate) area of occupancy (AOO) no more than 500km<sup>2</sup>.

COUNTRIES: India (states of Karnataka and Kerala)

RANGE MAP: see Image 4

**Habitat and Ecology**

**HABITAT AND ECOLOGY:** Known to inhabit pool-riffle, run and glide habitats in fast to moderately flowing streams. The fish is known to attain sizes up to 100cm (Menon 1999), although average sizes are in the range of 60cm and 4kg (see Knight et al. 2013a).

SYSTEMS: Freshwater

**Threats**

**MAJOR THREATS:** Destructive fishing practices including dynamiting and poisoning are the major threats in its distribution range. Habitat alteration through sand mining, construction of dams and other barrages, pollution and unmanaged collections (especially of juveniles) for the aquarium pet trade pose additional risks to local populations.

**Population**

**POPULATION:** No information on the population status. Local knowledge of fishers in its distribution range indicate that the fish is rare compared to its congeners.

POPULATION TREND: Decreasing

**Conservation**

**CONSERVATION ACTION:** No conservation actions are also currently in place. Except for the populations inside the Shenduruney Wildlife Sanctuary in Kerala, much of the range of this species is outside protected areas. The project on 'Lost fishes of the Western Ghats' is involved in research, education and awareness on poorly known species of the region including *H. thomassi*. Increased survey efforts are needed in other river systems of southern Karnataka and northern Kerala (in around the type locality: South Canara) to confirm whether undiscovered populations exist. Education and awareness programs need to be carried out in close cooperation with the Fisheries Department as well as local self governments (Panchayath) in its range. There is also a need to confirm the exact identity of the specimens from the east flowing drainages of Krishna and Cauvery, currently recorded as *H. thomassi*.

