

## Reply to “Need for further research on the freshwater fish fauna of the Ashambu Hills landscape: a response to Abraham et al.”

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The response to the article and checklist (Abraham et al. 2011) by Raghavan (2011) is timely, and much appreciated. Such critical reading of manuscripts would not only help the authors to prepare the manuscripts with caution but aid fish taxonomists and researchers planning to work on similar topics. The critique has rightfully pointed out a few shortcomings that we overlooked. We are grateful to some of the constructive suggestions in the critical response, as this was a primary attempt to prepare a comprehensive database of fishes in the west-flowing drainages of the Ashambu Hills. We provide in this reply, a revised checklist for freshwater fishes in this region, based on some of the respondent’s suggestions.

We thank the respondent for pointing out some references we inadvertently overlooked (e.g. Kurup et al. 2004). We also missed some species from the list, largely due to taxonomic ambiguities or unavailability of obscure references (e.g. Jerdon 1849; Arnold 1911; Euphrasia et al. 2006) to us. Further, we had also decided to have strict criteria for including references that were published in journals or as theses (compiling

individual papers by authors from the theses). This was done because conference proceedings were often confusing for proper citation as their publication info was inadequate, leading to certain key omissions, as pointed. Finally, some references mentioned in the critique are rather new, (ongoing doctoral research cited in the response; Eschmeyer & Fricke 2011) and we would like to request the consideration that our manuscript was submitted before these publications, so some references may have been overlooked in the final version too.

Also, we would like to discuss the taxonomic status and occurrence of some species as it appears in our paper, with the following clarifications:

(i) The ‘missing’ species highlighted by the critique such as *Hypselobarbus thomassi*, *Tor khudree*, *Botia striata*, *Nemacheilus guentheri*, *Mystus sengtee*, *Glyptothorax lonah* and *Mystus gulio* are indeed species that were not included in the checklist, because of doubts about the taxonomic status of these species, and we did not describe in detail within the paper.

(ii) Also, many previous checklists that were consulted were seen to repeat earlier ones, apparently without extensive fieldwork, as remarked by the critique. Moreover, in our field sampling we did not find some species mentioned in earlier checklists, such as *Barilius gatensis*, which have been shown to be abundant in all the sampled rivers by past authors, hence the omission of some species in our paper.

(iii) The status of *Puntius melanampyx* has been ambiguous in literature and synonymized with *P. fasciatus* in earlier literature (Jayaram 1991, 2010). We add a new species *Puntius kannikattiensis* in our checklist. We sampled this species in Neyyar and Karamana rivers (reported from KMTR by Arunachalam & Johnson 2002).

(iv) With regard to our usage of the term, ‘range extension’, even though we have not explicitly used it on individual rivers, we have extended the ranges of some of the species, towards the south by a river or two. *Garra hughi*, as we mentioned in our paper, had been reported from the headwaters of the Vamanapuram River by Johnson & Arunachalam (2010). But, our study reports a population further south into the Neyyar River. And our goal is not to merely mention the novel southernmost range for the species, but to elaborate on



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the occurrence of the species in all drainages sampled, keeping in mind that such information would be of interest to any biogeographic work.

(v) *Puntius mahecola*, similarly, reported by Pethiyagoda & Kottelat (2005) to occur in Kallada, was only mentioned and indicated in the map to provide a wholesome representation of the species distribution in the sampled landscape. We have recorded it from all five sampled rivers (with the rivers Karamana and Neyyar being previously not reported), and hence a range extension for the species. It may be noted that the title of our paper is not ‘range extension into the Ashambu Hills’. We also agree that *Puntius mahecola* is not the synonym of *P. amphibius* and the taxonomic ambiguities remain to be resolved as to what actually represents the latter species, leaving scope for more comprehensive work, especially including the type localities.

(vi) Taxonomic ambiguities with regard to *Garra maclellandi* and *G. periyarensis* remain to be resolved and further research, incorporating molecular taxonomy, would help resolve these issues. At present

we believe the specimen we have is *G. maclellandi*. As our studies are ongoing, voucher specimens will be made available for scrutiny soon.

(vii) Additionally, further studies are warranted to record the population status of *Hypseleobarbus thomassi* in the Kallada River system. If, as the critique mentions, that studies are being currently undertaken for the same, then that should help resolve any taxonomic misunderstandings for the species in this region. Eschmeyer & Fong (2010) treat *Tor khudree malabaricus* as *T. malabaricus*; so the species we refer to is synonymous with *T. khudree*.

Finally, we would like to reiterate that the primary intention and scope of our paper was to present a checklist of fish species occurring in the west-flowing rivers of the Ashambu Hills of Kerala and not provide a comprehensive taxonomic treatment as such. We would also like to mention here that some taxonomic limitations of the study arise from the minimally invasive sampling approaches we preferred to use, whereby we did not make excessive ‘collections’ of every sampled species. We did make specimen

**Table 1. An annotated, revised checklist of freshwater fish species known from the Ashambu Hills landscape. This checklist is derived from previous literature (see above) and updated by species sampled during our study (species for which preferred habitat, elevation range and occurrence are mentioned).**

Genus	Species Author	Threats	Preferred Habitat	Elevation Range	Occurrence in Rivers
<b>Ambassidae</b>					
<i>Chanda</i>	<i>nama</i> Hamilton	HL	Ru	m	KLD
<i>Parambassis</i>	<i>dayi</i> * Bleeker	HL			
<i>Parambassis</i>	<i>thomassi</i> * (Day)	HL, DY, IN	Ru	m	KLD, VAM, KAR, NEY
<i>Pseudambassis</i>	<i>ranga</i> (Hamilton-Buchanan)	HL	Ru	m	KLD, KAR, NEY
<b>Anabantidae</b>					
<i>Anabas</i>	<i>testudineus</i> Bloch	HL, IN, DY			
<b>Anguillidae</b>					
<i>Anguilla</i>	<i>bengalensis</i> Gray	HL	Ru, PI	l,m,h	KLD, ITK, VAM, KAR, NEY
<i>Anguilla</i>	<i>bicolor</i> McClelland	HL			
<b>Aplocheilidae</b>					
<i>Aplocheilus</i>	<i>lineatus</i> (Valenciennes)	HL	PI	l,m	KLD, ITK, VAM, KAR, NEY
<i>Aplocheilus</i>	<i>blockii</i> (Arnold)	HL	PI	m	NEY
<b>Bagridae</b>					
<i>Batasio</i>	<i>travancorica</i> * Hora & Law	HL, DY			
<i>Horabagrus</i>	<i>brachysoma</i> * (Gunther)	HL, DY	PI	l,m	KLD, KAR, NEY
<i>Mystus</i>	<i>armatus</i> Day	HL			
<i>Mystus</i>	<i>bleekeri</i> (Day)	HL	PI	m, h	NEY
<i>Mystus</i>	<i>gulio</i> (Hamilton)				

Genus	Species Author	Threats	Preferred Habitat	Elevation Range	Occurrence in Rivers
<i>Mystus</i>	<i>keletius</i> (Valenciennes)	HL			
<i>Mystus</i>	<i>malabaricus</i> * (Jerdon)	HL, DY	PI	m, h	KLD, ITK, VAM, KAR, NEY
<i>Mystus</i>	<i>montanus</i> Jerdon	HL			
<i>Mystus</i>	<i>oculatus</i> Valenciennes	HL	Ru, PI	m	NEY
<i>Mystus</i>	<i>sengtee</i> Hamilton-Buchanan	HL			
<i>Mystus</i>	<i>vittatus</i> Bloch	HL			
<b>Balitoridae</b>					
<i>Bhavana</i>	<i>australis</i> * Jerdon	HL	Ra	h	KLD
<i>Travancoria</i>	<i>jonesi</i> * Hora	HL	Ra, Ri	h	KLD, VAM
<i>Nemacheilus</i>	<i>denisoni</i> * Day	HL			
<i>Nemacheilus</i>	<i>pulchellus</i> * Day	HL			
<i>Nemacheilus</i>	<i>guentheri</i> * Day	HL			
<i>Nemacheilus</i>	<i>triangularis</i> * Day	HL	Ra, Ru, Ri	m,h	KLD, VAM, KAR, NEY
<i>Pangio</i>	<i>goensis</i> * Tilak	HL			
<i>Lepidocephalichthys</i>	<i>thermalis</i> (Valenciennes)	HL	Ra, Ru, Ri	m,h	KLD
<i>Xenotodon</i>	<i>cancilla</i> Hamilton-Buchanan	HL, DY	Ru, PI	l,m	KLD, ITK, VAM, KAR, NEY
<b>Channidae</b>					
<i>Channa</i>	<i>gachua</i> Bloch & Schneider	HL, DY, IN	Ru, PI	l,m	VAM
<i>Channa</i>	<i>marulius</i> Hamilton-Buchanan	HL, DY, IN	Ru, PI	l,m	VAM, KLD
<i>Channa</i>	<i>striata</i> (Bloch)	HL, DY	Ru, PI	l,m	KLD, ITK, VAM, KAR, NEY
<i>Channa</i>	<i>diplogramma</i> * ^ (Day)	HL, DY, OF	Ru, PI	m	KLD
<b>Cichlidae</b>					
<i>Etroplus</i>	<i>maculatus</i> (Bloch)	HL, DY	Ru, PI	l,m	KLD, ITK, VAM, KAR, NEY
<i>Etroplus</i>	<i>suratensis</i> (Bloch)	HL, DY	Ru, PI	l	KLD, ITK, VAM, KAR, NEY
<i>Oreochromis</i>	<i>mossambicus</i> (Peters)	-	Ru, PI	l,m	NEY, KLD
<b>Clariidae</b>					
<i>Clarias</i>	<i>dussumieri</i> * Valenciennes	HL, OF, IN	PI	m	KLD, NEY
<i>Heteropneustes</i>	<i>fossilis</i> Bloch	HL, DY	PI	l,m	NEY
<b>Clupeidae</b>					
<i>Dayella</i>	<i>malabarica</i> * (Day)	HL	Ru	m	KLD
<b>Cyprinidae</b>					
<i>Laubuca</i>	<i>dadyburjori</i> * Menon	HL			
<i>Salmophasia</i>	<i>boopis</i> * Day	HL, DY			
<i>Salmophasia</i>	<i>balookee</i> (Sykes)	HL, DY	Ru	m	NEY
<i>Esomus</i>	<i>danricus</i> Hamilton-Buchanan				
<i>Esomus</i>	<i>thermoicos</i> Valenciennes				
<i>Devario</i>	<i>aequipinnatus</i> (McClelland)	HL	Ru, PI	l,m,h	KLD, ITK, VAM, KAR, NEY
<i>Devario</i>	<i>malabaricus</i> * (Jerdon)	HL	Ru, PI	l,m,h	KLD, ITK, VAM, KAR, NEY
<i>Rasbora</i>	<i>daniconius</i> (Hamilton)	HL	Ru, PI	l,m,h	KLD, ITK, VAM, KAR, NEY
<i>Amblypharyngodon</i>	<i>melettinus</i> (Valenciennes)	HL, DY	Ru	l,m	NEY
<i>Amblypharyngodon</i>	<i>microlepis</i> (Bleeker)	HL			
<i>Barilius</i>	<i>bakeri</i> * Day	HL, EX	Ra, Ru	m, h	KLD, ITK, VAM, KAR, NEY
<i>Barilius</i>	<i>bendelisis</i> Hamilton-Buchanan	HL			
<i>Barilius</i>	<i>gatensis</i> * Valenciennes	HL			
<i>Cyprinus</i>	<i>carpio</i> Linnaeus	-	PI	m	KLD, NEY
<i>Ctenopharyngodon</i>	<i>idella</i> Valenciennes	-			

Genus	Species Author	Threats	Preferred Habitat	Elevation Range	Occurrence in Rivers
<i>Labeo</i>	<i>dussumieri</i> + Valenciennes	HL, EX			
<i>Labeo</i>	<i>rohita</i> Hamilton-Buchanan	HL			
<i>Labeo</i>	<i>calbasu</i> Hamilton-Buchanan	HL			
<i>Tor</i>	<i>malabaricus</i> + (Jerdon)	HL, OF, DY, EX	PI	m, h	KLD, VAM, KAR, NEY
<i>Catla</i>	<i>catla</i> Valenciennes	-			
<i>Cirrhinus</i>	<i>mrigala</i> Hamilton-Buchanan	-			
<i>Garra</i>	<i>mccllellandi</i> +, RE (Jerdon)	HL, DY, EX	Ra, Ru	h	NEY
<i>Garra</i>	<i>mullya</i> (Sykes)	HL, DY, EX	Ra, Ru, PI, Ri	l, m, h	KLD, ITK, VAM, KAR, NEY
<i>Garra</i>	<i>hughi</i> +, RE Silas	HL	Ra, Ru, PI, Ri	h	KLD, VAM, NEY
<i>Garra</i>	<i>surendranathanii</i> + Shaji, Arun & Easa	HL			
<i>Horabiossa</i>	<i>joshuai</i> + Silas	HL, EX			
<i>Hypselobarbus</i>	<i>curmuca</i> + (Hamilton)	HL, OF, DY, EX, IN	Ru, PI	m, h	KLD, ITK, VAM, KAR, NEY
<i>Hypselobarbus</i>	<i>jerdoni</i> + RE (Day)	HL, EX, DY	Ru, PI	m	KLD
<i>Hypselobarbus</i>	<i>kolus</i> + (Sykes)	HL, DY	Ru, PI	m	KLD
<i>Hypselobarbus</i>	<i>kurali</i> + Menon & Rema Devi	HL, DY	Ru, PI	m	KLD
<i>Hypselobarbus</i>	<i>thomassi</i>				
<i>Osteobrama</i>	<i>bakeri</i> + Day	HL, DY, IN	Ru, PI	m	KLD
<i>Puntius</i>	<i>arulius</i> Jerdon	HL			
<i>Puntius</i>	<i>bimaculatus</i> (Bleeker)	HL, DY, IN			
<i>Barbodes</i>	<i>carnaticus</i> + (Jerdon)	HL			
<i>Puntius</i>	<i>chola</i> Hamilton-Buchanan	HL, DY, IN			
<i>Puntius</i>	<i>conchonius</i> Hamilton-Buchanan	HL, DY, IN			
<i>Puntius</i>	<i>denisonii</i> + Day	HL, DY, OF			
<i>Puntius</i>	<i>dorsalis</i> (Jerdon)	HL, DY	Ru, PI	m, h	KLD, ITK, VAM, NEY
<i>Puntius</i>	<i>exclamatio</i> +, ASH Pethiyagoda & Kottelat	HL, EX, DY	Ru, PI	m	KLD
<i>Puntius</i>	<i>fasciatus</i> + (Jerdon)	HL, DY	Ru, PI, Ri	m, h	KLD, VAM, KAR, NEY
<i>Puntius</i>	<i>filamentosus</i> (Valenciennes)	HL, DY, IN	Ru, PI	m	KLD, ITK, VAM, KAR, NEY
<i>Puntius</i>	<i>kannikattiensis</i> + (Arunachalam & Johnson, 2002)	HL, DY	Ru, PI, Ri	h	NEY, KAR
<i>Puntius</i>	<i>sp. nov.</i> +, #, ASH	HL	Ru, PI	m	ITK
<i>Puntius</i>	<i>mahecola</i> +, RE (Valenciennes)	HL, IN	Ru, PI	m	ITK, NEY
<i>Puntius</i>	<i>parrah</i> Day	HL	Ru, PI	m	KAR
<i>Puntius</i>	<i>sarana subnasutus</i> + Valenciennes	HL, OF, IN, DY	Ru, PI	l, m	KLD, ITK, NEY
<i>Puntius</i>	<i>tambraparniei</i> + Silas	HL			
<i>Puntius</i>	<i>ticto</i> Hamilton-Buchanan	HL, EX, DY, IN	Ru, PI, Ri	m	KLD, ITK, KAR, NEY
<i>Puntius</i>	<i>vittatus</i> Day	HL			
<b>Gobiidae</b>					
<i>Sicyopterus</i>	<i>griseus</i> Day	HL	Ru	l, m	KAR
<i>Awaous</i>	<i>gutum</i> Hamilton-Buchanan	HL	Ru	l, m	KAR
<i>Glossogobius</i>	<i>giuris</i> Hamilton-Buchanan	HL, DY, IN	Ru	l, m	KLD, ITK, VAM, KAR
<b>Hemiramphidae</b>					
<i>Hyporamphus</i>	<i>limbatus</i> Valenciennes	HL	Ru, PI	l	KLD
<b>Mastacembelidae</b>					
<i>Mastacembelus</i>	<i>armatus</i> (Lacepede)	HL, OF, DY, IN	Ru, PI, Ri	l, m, h	KLD, NEY

Genus	Species Author	Threats	Preferred Habitat	Elevation Range	Occurrence in Rivers
<i>Macrognaathus</i>	<i>guentheri</i> (Day)	HL, DY			
<b>Nandidae</b>					
<i>Pristolepis</i>	<i>marginata</i> <sup>†</sup> Jerdon	HL, DY	Ru, PI	l, m	KLD, NEY
<b>Notopteridae</b>					
<i>Notopterus</i>	<i>notopterus</i> Pallas	HL			
<b>Osphronemidae</b>					
<i>Pseudosphronemus</i>	<i>cupanus</i> (Cuvier)	HL, DY			
<b>Siluridae</b>					
<i>Ompok</i>	<i>bimaculatus</i> (Bloch)	HL, DY	Ru, PI	m, h	NEY
<i>Ompok</i>	<i>malabaricus</i> <sup>†</sup> (Valenciennes)	HL, DY, EX	Ru, PI	m, h	NEY, KLD
<i>Wallago</i>	<i>attu</i> Bloch & Schneider	HL, DY, OF			
<b>Sisoridae</b>					
<i>Glyptothorax</i>	<i>annandalei</i> Hora	HL			
<i>Glyptothorax</i>	<i>lonah</i> Sikes	HL			
<i>Glyptothorax</i>	<i>madraspatanus</i> <sup>†</sup> Day	HL			
<b>Synbranchidae</b>					
<i>Monopterus</i>	<i>fossorius</i> Nair	HL, OF, DY			
<b>Syngnathidae</b>					
<i>Microphis</i>	<i>cunocalus</i> Hamilton-Buchanan	HL			
<b>Tetraodontidae</b>					
<i>Carinotetraodon</i>	<i>travancoricus</i> <sup>†</sup> Hora & Nair	HL, OF			KLD

**Key:** Author names in brackets indicate redescrptions. **Threats:** HL - Habitat Loss; DY - Dynamite Fishing; OF - Overfishing; EX - Exotic species; IN - Industrial Pollution. **Preferred Habitat:** Ru - Run; Ri - Riffle; Ra - Rapid; PI - Pool. **Elevation range:** l - low; m - mid; h - high. <sup>#</sup> - Abraham et al. 2010; In Preparation; so still not a valid species. <sup>RE</sup> - Range extension to the Ashambu Hills Landscape; <sup>†</sup> - Taxonomy following new molecular study showing that the Indian species of Giant Snakehead; previously *C. micropeltes* should be treated as a distinct species *C. diplogramma* (Adamson et al. 2010). Endemism: <sup>†</sup> - Western Ghats; <sup>ASH</sup> - Ashambu Hills. **Occurrence in Rivers:** KLD - Kallada; ITK - Ithikkara; VAM - Vamanapuram; KAR - Karamana; NEY - Neyyar. PA - Protected Area; NPA - Non-Protected Area.

collections where we thought it necessary, but avoided wanton collections on account of the threats faced by rare fishes even within Protected Areas. One of our important endeavours in this study has been to actively on taxonomic issues, avoid excessive collection for merely taxonomic work, especially from within conservations reserves and sanctuaries where many endemics occur (Abraham & Kelkar, in Press) and also from unprotected areas. Many current and previous studies (e.g. Baby et. al. 2010) have employed the use of electro-fishing methods in critical aquatic habitats within conservation landscapes. We believe that there are and have to be more sensible ways, (although, of course, much more tedious and time-consuming) for collection of fish species. Experienced fish taxonomists (such as Shri C. P. Shaji; pers.comm.) have observed mass mortality of several non-target aquatic species and life forms like amphibian tadpoles, juveniles fishes, crustaceans and macro-invertebrates,

immediately following episodes of electro-fishing by 'scientific sampling' (Nielsen 1998).

We do not deny the importance of the respondent's suggestions. At the same time, we would like to stress the importance of minimally invasive ways for highly threatened taxa such as freshwater fishes and amphibians. We believe that the time's need is to go beyond mere stamp-collecting and check-listing, through inculcating certain conservation sensitivities in field research, and we are glad to have done that. We thank the respondent's thoughtful and in-depth comments on our article. Our revised checklist (Table 1) may be referred as an erratum to the original paper (Abraham et al. 2011). We also sincerely hope that this discussion would be useful for authors working on freshwater fishes in the region.

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