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An inventory of endemic fish species in India with notes on state-wise distribution and conservation measures

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Abstract

Endemism refers to the species restricted to a geographical range. India is not an exception to the global perspective experiencing serious threats with regard to ecosystem instability and loss of fish diversity. A basic insight on the endemic fish species available in India and their status could be considered as a primary step to realize the present situation. This article emphasizes the endemic fish species recorded from India, their International Union for Conservation of Nature (IUCN) red list status and state-wise distribution that may be useful to adopt specific conservation strategy at the regional level.

Keywords: Indian endemic fish, state distribution, new fish species

1. Introduction

Fish constitutes almost half of the total number of vertebrates in the world ^[1]. Among the recorded fish species around the globe, about 11.7% are found in Indian waters ^[2] that has made India rich in biodiversity of the endemic fish species. Fish endemic to India refers to the fish species which are restricted to the geographical range of India and become unavailable in other such regions. Aquatic environment is experiencing serious threats with regard to ecosystem stability resulting loss of aquatic biodiversity ^[3]. The global extinction rate of fish has been alleged to be higher than it would have been naturally expected ^[4]. The key factors behind the loss of fish-diversity are habitat degradation and fragmentation, introduction of exotic alien species, water diversions, water pollution and global climate change ^[5]. Therefore, suitable conservatory measures are to be implemented to mitigate the impact of the pressures laid down by the environmental as well as anthropogenic stresses so that ichthyo-diversity of the endemic fish species in India may be protected. This article emphasizes the endemic fish species recorded from India, their IUCN red list status and state-wise distribution which may be useful to adopt specific conservation strategy at the regional level. This inventory also includes the IUCN not evaluated fish species which are recorded from India till 2015. A compilation of data on the endemic fish species from India along with their taxonomic status could be of importance to the academicians and researchers at the national level. Moreover, a concluding note on the conservation measures of these endemic fish species might suggest identifying the threatened endemic fish species and standardizing captive breeding protocol for their *in situ* conservation.

2. Indian endemic fishes, IUCN red list status and distribution

According to IUCN red list ^[6], species can be categorized as Extinct (EX), Extinct in the wild (EW), Critically Endangered (CR), Endangered (EN), Vulnerable (VU), Near Threatened (NT), Least Concern (LC) and Data Deficient (DD). About 295 numbers of endemic fish species exclusively found in India are recorded in IUCN ^[6], which are listed in table 1.

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Table 1: State wise distribution and list of Indian endemic fishes (excluding IUCN Not Evaluated Species)

IUCN red list status [#]	Order	FAMILY	SPECIES NAME
CR (13 species)	Cypriniformes (11 species)	Balitoridae	1. <i>Mesonoemacheilus herrei</i> TN 2. <i>Schistura papulifera</i> MEG
		Cyprinidae	1. <i>Barbodes wynaadensis</i> KAR,KER 2. <i>Horabiosa arunachalami</i> KER 3. <i>Hypselobarbus pulchellus</i> KAR 4. <i>Hypselobarbus thomassi</i> KAR 5. <i>Neolissochilus bovanicus</i> TN 6. <i>Parapsilorhynchus prateri</i> MAHR 7. <i>Pethia pookodensis</i> KER 8. <i>Puntius deccanensis</i> MAHR
		Psilorhynchidae	1. <i>Psilorhynchus tenura</i> KAR
	Siluriformes (2 species)	Bagridae	1. <i>Hemibagrus punctatus</i> KAR,KER,TN
		Sisoridae	1. <i>Glyptothorax kudremukhensis</i> KAR
EN (64 species)	Cypriniformes (48 species)	Balitoridae	1. <i>Homaloptera montana</i> KER,TN 2. <i>Homaloptera santhamparaiensis</i> KER 3. <i>Longischistura striata</i> KAR,KER,TN 4. <i>Nemacheilus petrubanarescui</i> KAR,KER 5. <i>Nemacheilus pulchellus</i> KER,TN 6. <i>Nemachilichthys shimogensis</i> KAR 7. <i>Schistura minutus</i> MAN 8. <i>Schistura nagodiensis</i> KAR 9. <i>Schistura reticulata</i> MAN 10. <i>Schistura sijuensis</i> MEG 11. <i>Schistura tigrinum</i> MAN 12. <i>Travancoria elongata</i> KER 13. <i>Travancoria jonesi</i> KER
		Cobitidae	1. <i>Botia striata</i> MAHR,KAR 2. <i>Lepidocephalichthys arunachalensis</i> ARP
		Cyprinidae	1. <i>Barilius canarensis</i> KAR 2. <i>Crossocheilus periyarensis</i> KER 3. <i>Dawkinsia arulius</i> KAR,KER,TN 4. <i>Dawkinsia exclamatio</i> KER 5. <i>Dawkinsia tambraparniei</i> TN 6. <i>Devario horai</i> ARP 7. <i>Devario neilgherriensis</i> KER,TN 8. <i>Eechathalakenda ophicephalus</i> KER 9. <i>Garra hughi</i> KER,TN 10. <i>Garra kalakadensis</i> TN 11. <i>Garra surendranathanii</i> KER 12. <i>Horabiosa joshuai</i> TN 13. <i>Hypselobarbus curmuca</i> KAR,KER,TN 14. <i>Hypselobarbus dubius</i> KAR,KER,TN 15. <i>Hypselobarbus micropogon</i> KER,TN 16. <i>Hypselobarbus mussullah</i> MAHR,KAR,KER,TN 17. <i>Hypselobarbus periyarensis</i> KER 18. <i>Labeo potail</i> MAHR,KAR,KER 19. <i>Lepidopygopsis typus</i> KER 20. <i>Osteochilus longidorsalis</i> KER 21. <i>Parapsilorhynchus elongatus</i> MAHR 22. <i>Pethia manipurensis</i> MAN 23. <i>Pethia sharmai</i> TN 24. <i>Puntius cauveriensis</i> KAR,KER 25. <i>Puntius crescentus</i> KAR 26. <i>Puntius fraseri</i> MAHR 27. <i>Sahyadria chalakkudiensis</i> KER 28. <i>Sahyadria denisonii</i> KAR,KER 29. <i>Schismatorhynchus nukta</i> MAHR,KAR,TN 30. <i>Thynnichthys sandkhol</i> MAHR,AP,KAR 31. <i>Tor kulkarnii</i> MAHR 32. <i>Tor malabaricus</i> KAR,KER,TN
	Psilorhynchidae	1. <i>Psilorhynchus microphthalmus</i> MAN	
	Perciformes (2 species)	Badidae	1. <i>Badis tuivaiei</i> MAN
		Cichlidae	1. <i>Etroplus canarensis</i> KAR
	Siluriformes (12 species)	Amblycipitidae	1. <i>Amblyceps arunchalensis</i> ARP
		Bagridae	1. <i>Batasio sharavatiensis</i> KAR 2. <i>Horabagrus nigricollaris</i> KER
		Schilbeidae	1. <i>Pseudeutropius mitchelli</i> KER 2. <i>Silonia childreni</i> MAHR,AP

		Siluridae	1. <i>Pterocryptis barakensis</i> MAN 2. <i>Pterocryptis wynaadensis</i> MAHR,KAR,KER,TN
		Sisoridae	1. <i>Glyptothorax anamalaiensis</i> KER,TN 2. <i>Glyptothorax davissinghi</i> KER 3. <i>Glyptothorax housei</i> KER,TN 4. <i>Glyptothorax madraspatanus</i> MAHR,KAR,KER 5. <i>Glyptothorax poonaensis</i> MAHR
	Synbranchiformes (2 species)	Chaudhuriidae	1. <i>Pillaia indica</i> WB,ASM*,MEG
		Synbranchidae	1. <i>Monopterus fossorius</i> KER
VU (64 species)	Beloniformes (1 species)	Hemiramphidae	1. <i>Hyporhamphus xanthopterus</i> KER
	Cypriniformes (49 species)	Balitoridae	1. <i>Aborichthys garoensis</i> ARP,MEG 2. <i>Aborichthys tikaderi</i> ARP 3. <i>Balitora mysorensis</i> KAR,KER 4. <i>Mesonoemacheilus pambarensis</i> KER 5. <i>Nemacheilus keralensis</i> KER 6. <i>Nemacheilus kodaguensis</i> KAR 7. <i>Nemacheilus menoni</i> KER 8. <i>Nemacheilus pavonaceus</i> ASM 9. <i>Nemacheilus periyarensis</i> KER 10. <i>Physoschistura elongata</i> MEG 11. <i>Schistura chindwinica</i> MAN 12. <i>Schistura inglisi</i> WB,SIK 13. <i>Schistura khugae</i> MAN 14. <i>Schistura nagaensis</i> MAN,NAG 15. <i>Schistura prashadi</i> MAN 16. <i>Schistura reticulofasciata</i> MEG 17. <i>Schistura sharavathiensis</i> KAR 18. <i>Schistura singhi</i> NAG
		Cyprinidae	1. <i>Barilius chatricensis</i> MAN 2. <i>Barilius dimorphicus</i> UTK 3. <i>Barilius ngawa</i> MAN 4. <i>Cirrhinus cirrhosus</i> WB,TN 5. <i>Danio jaintianensis</i> MEG 6. <i>Dawkinsia assimilis</i> KAR,KER,TN 7. <i>Dawkinsia rohani</i> TN 8. <i>Devario acuticephala</i> MAN,NAG 9. <i>Devario assamensis</i> ASM 10. <i>Devario fraseri</i> MAHR 11. <i>Devario naganensis</i> MAN,NAG 12. <i>Garra litanensis</i> MAN 13. <i>Garra manipurensis</i> MAN 14. <i>Garra menoni</i> KER 15. <i>Garra nambulica</i> MAN 16. <i>Garra paralissorhynchus</i> MAN 17. <i>Garra periyarensis</i> KER 18. <i>Horabiosia palaniensis</i> TN 19. <i>Hypselobarbus kolus</i> MAHR,KAR,KER,TN 20. <i>Laubuca fasciata</i> KER 21. <i>Parapsilorhynchus discophorus</i> MAHR 22. <i>Pethia ater</i> MAN 23. <i>Pethia khugae</i> MAN 24. <i>Pethia setnai</i> GO,KAR 25. <i>Pethia shalynius</i> MEG 26. <i>Pethia yuensis</i> MAN 27. <i>Puntius arenatus</i> KER,TN 28. <i>Puntius mudumalaiensis</i> TN 29. <i>Rasbora ornata</i> MAN 30. <i>Salmophasia belachi</i> KAR 31. <i>Salmophasia horai</i> PUN,MAHR,KAR
	Perciformes (2 species)	Channidae	1. <i>Channa diplogramme</i> KER,TN
		Osphronemidae	1. <i>Pseudosphromenus dayi</i> KER
	Siluriformes (9 species)	Sisoridae	Bagridae
			1. <i>Gagata itchkeea</i> MAHR,AP,KAR 2. <i>Glyptothorax saisii</i> JHA 3. <i>Glyptothorax trewavasae</i> MAHR,KAR 4. <i>Myersglanis jayarami</i> MAN 5. <i>Pseudecheneis sirenica</i> ARP 6. <i>Pseudecheneis ukhrulensis</i> MAN 7. <i>Sisor barakensis</i> MAN

	Synbranchiformes (1 species)	Synbranchidae	1. <i>Monopterus indicus</i> MAHR
	Syngnathiformes (1 species)	Syngnathidae	1. <i>Oostethus insularis</i> AN
	Tetraodontiformes (1 species)	Tetraodontidae	1. <i>Carinotetraodon travancoricus</i> KAR, KER
NT (12 species)	Cypriniformes (7 species)	Balitoridae	1. <i>Neonoemacheilus assamensis</i> ASM, MAN 2. <i>Schistura manipurensis</i> MAN, NAG
		Cobitidae	1. <i>Acantopsis multistigmatus</i> MAN
		Cyprinidae	1. <i>Barilius lairokensis</i> MAN 2. <i>Garra bicornuta</i> MAHR, KAR 3. <i>Garra rupecula</i> ARP, MAN, MEG 4. <i>Tor progeneius</i> UTK, ASM, MAN, MEG, NAG
	Perciformes (1 species)	Channidae	1. <i>Channa bleheri</i> ARP, ASM
	Siluriformes (3 species)	Bagridae	1. <i>Mystus malabaricus</i> MAHR, KAR, KER, TN
		Clariidae	1. <i>Clarias dussumieri</i> GO, KAR, KER, TN, PON
		Sisoridae	1. <i>Glyptothorax striatus</i> MEG
Synbranchiformes (1 species)	Chaudhuriidae	1. <i>Garo khajuriai</i> ASM, MEG	
LC (77 species)	Beloniformes (1 species)	Adrianichthyidae	1. <i>Oryzias setnai</i> GUJ, MAHR, KAR, KER
	Clupeiformes (1 species)	Clupeidae	1. <i>Dayella malabarica</i> KER
	Cypriniformes (53 species)	Balitoridae	1. <i>Aborichthys elongatus</i> WB, ARP 2. <i>Homaloptera manipurensis</i> MAN 3. <i>Homaloptera menoni</i> KER 4. <i>Homaloptera pillaii</i> KER 5. <i>Indoreonectes evezardi</i> MAHR, MP, KAR 6. <i>Mesonoemacheilus remadevii</i> KER 7. <i>Nemacheilus anguilla</i> MAHR, KAR, KER 8. <i>Nemacheilus denisoni</i> RAJ, MAHR, KAR, KER, TN 9. <i>Nemacheilus guentheri</i> KER 10. <i>Nemacheilus monilis</i> KER, TN 11. <i>Nemacheilus mooreh</i> MAHR, AP 12. <i>Nemacheilus nilgiriensis</i> KAR, KER, TN 13. <i>Nemacheilus rueppelli</i> MAHR 14. <i>Nemacheilus semiarmatus</i> KAR, KER, TN 15. <i>Nemacheilus triangularis</i> KAR, KER, TN 16. <i>Schistura dayi</i> CHA, MP, JHA, ODI 17. <i>Schistura tirapensis</i> ARP
			Cobitidae
		Cyprinidae	1. <i>Barbodes carnaticus</i> KAR, KER, TN 2. <i>Barilius bakeri</i> KAR, KER, TN 3. <i>Barilius gatensis</i> KAR, KER, TN 4. <i>Cirrhinus fulungee</i> MAHR, CHA, MP, AP, KAR 5. <i>Dawkinsia filamentosa</i> MAHR, GO, AP, KAR, KER, TN 6. <i>Esomus barbatus</i> KAR, TN 7. <i>Garra lissorhynchus</i> ARP, ASM, MAN, MEG, MIZ, NAG 8. <i>Garra maclellandi</i> KAR, KER, TN 9. <i>Garra mullya</i> GUJ, MAHR, GO, CHA, MP, JHA, ODI, WB, AP, KAR, KER, TN 10. <i>Garra naganensis</i> ARP, MAN, MEG, MIZ, NAG 11. <i>Garra stenorrhynchus</i> AP, KAR, KER, TN 12. <i>Haludaria fasciata</i> GO, AP, KAR, KER, TN 13. <i>Haludaria kannikattiensis</i> TN 14. <i>Hypselobarbus jerdoni</i> MAHR, KAR, KER, TN 15. <i>Hypselobarbus kurali</i> KAR, KER, TN 16. <i>Labeo kawrus</i> MAHR, KAR 17. <i>Labeo kontius</i> KAR, KER, TN 18. <i>Laubuca dadiburjori</i> GO, KAR, KER, TN 19. <i>Osteobrama bakeri</i> KAR, KER 20. <i>Osteobrama neilli</i> MAHR, AP, KAR, KER, TN 21. <i>Osteobrama vigorsii</i> MAHR, CHA, MP, ODI, AP, KAR 22. <i>Osteochilichthys brevidorsalis</i> KER, TN 23. <i>Osteochilichthys thomassi</i> AP, KAR, KER, TN 24. <i>Osteochilus nashii</i> MAHR, KAR, KER, TN 25. <i>Parapsilorhynchus tentaculatus</i> MAHR, CHA, MP, AP 26. <i>Pethia narayani</i> MAHR, GO, KAR 27. <i>Pethia punctata</i> KAR, KER, TN 28. <i>Puntius parrah</i> MAHR, KAR, KER, TN

			29. <i>Puntius sahyadriensis</i> MAHR,KAR 30. <i>Rasbora labiosa</i> GUJ,MAHR,KAR 31. <i>Rohtee ogilbii</i> MAHR,AP,KAR 32. <i>Salmophasia boopis</i> MAHR,GO,KAR,KER,TN 33. <i>Salmophasia untrahi</i> MAHR,CHA,ODI,AP,KAR,TN 34. <i>Salmophasia novacula</i> MAHR,KAR,TN	
	Perciformes (5 species)	Ambassidae	1. <i>Parambassis dayi</i> KAR,KER 2. <i>Parambassis thomassi</i> GO,KAR,KER	
		Badidae	1. <i>Badis blosyrus</i> WB,ASM	
		Gobiidae	1. <i>Sicyopterus griseus</i> KAR,KER,TN	
		Nandidae	1. <i>Pristolepis marginata</i> GUJ,MAHR,KAR,KER,TN	
	Siluriformes (16 species)	Bagridae	1. <i>Batasio fasciolatus</i> WB,ARP 2. <i>Hemibagrus maydelli</i> MAHR,AP,KAR 3. <i>Mystus montanus</i> KAR,KER,TN 4. <i>Mystus oculatus</i> KER,TN 5. <i>Mystus seengtee</i> MAHR,GO,AP,KAR,KER,TN 6. <i>Rita chrysea</i> CHA,MP,ODI 7. <i>Rita gogra</i> MAHR,CHA,MP,AP,KAR 8. <i>Rita kuturnee</i> MAHR,CHA,AP,KAR	
			Siluridae	1. <i>Ompok malabaricus</i> MAHR,GO,AP,KAR,KER
			Sisoridae	1. <i>Glyptothorax annandalei</i> MAHR,KAR,KER,TN 2. <i>Glyptothorax chindwinica</i> MAN 3. <i>Glyptothorax garhwali</i> UTK 4. <i>Glyptothorax granulus</i> MAN 5. <i>Glyptothorax lonah</i> MAHR,MP,ODI,KAR 6. <i>Glyptothorax ventrolineatus</i> MAN 7. <i>Hara horai</i> WB,ARP,ASM
	Synbranchiformes (1 species)			Mastacembelidae
	DD (65 species)	Beloniformes (1 species)		Hemiramphidae
Cypriniformes (21 species)		Balitoridae	1. <i>Nemacheilus doonensis</i> UP 2. <i>Nemacheilus stigmofasciatus</i> KAR	
		Cobitidae	1. <i>Pangio apoda</i> WB	
		Cyprinidae	1. <i>Barilius evezardi</i> MAHR,KAR 2. <i>Barilius radiolatus</i> MP 3. <i>Betadevario ramachandrani</i> KAR 4. <i>Danionella priapus</i> WB 5. <i>Devario manipurensis</i> MAN 6. <i>Haludaria melanampyx</i> KAR,KER 7. <i>Hypselobarbus dobsoni</i> AP,KAR,KER,TN 8. <i>Hypselobarbus lithopidos</i> KER 9. <i>Neolissochilus dukai</i> UP,ASM 10. <i>Neolissochilus spinulosus</i> SIK 11. <i>Opsarius cocsa</i> BI,WB,TN 12. <i>Oreochthys crenuchoides</i> WB 13. <i>Puntius ambassis</i> AP,TN 14. <i>Puntius mahecola</i> KER 15. <i>Schizothorax kumaonensis</i> UP 16. <i>Tor barakae</i> MAN	
			Psilorhynchidae	1. <i>Psilorhynchus amplicephalus</i> ASM 2. <i>Psilorhynchus arunachalensis</i> ARP
Perciformes (7 species)			Badidae	1. <i>Badis assamensis</i> ARP,ASM 2. <i>Badis kanabos</i> ASM 3. <i>Badis dibruensis</i> ASM 4. <i>Dario dario</i> WB,ASM
			Channidae	1. <i>Channa aurantimaculata</i> ASM
			Gobiidae	1. <i>Bathygobius ostreicola</i> ODI,AP
			Nandidae	1. <i>Nandus andrewi</i> WB
Siluriformes (31 species)		Amblycipitidae	1. <i>Amblyceps tenuispinis</i> UP 2. <i>Amblyceps torrentis</i> MAN 3. <i>Amblyceps tuberculatum</i> MAN	
	Bagridae	1. <i>Batasio merianiensis</i> ARP*,ASM 2. <i>Batasio spilurus</i> ASM		
	Clariidae	1. <i>Horaglanis alikunhii</i> KER 2. <i>Horaglanis krishnai</i> KER		
	Erethistidae	1. <i>Conta pectinata</i> ASM,MEG 2. <i>Erethistoides montana</i> WB,ASM,TRI 3. <i>Erethistoides senkhiensis</i> ARP 4. <i>Erethistoides sicula</i> WB		

			5. <i>Hara koladynensis</i> MIZ 6. <i>Pseudolaguvia austrina</i> KER 7. <i>Pseudolaguvia ferruginea</i> WB 8. <i>Pseudolaguvia ferula</i> WB 9. <i>Pseudolaguvia flavida</i> WB 10. <i>Pseudolaguvia foveolata</i> WB 11. <i>Pseudolaguvia virgulata</i> MIZ
		Heteropneustidae	1. <i>Heteropneustes longipectoralis</i> TN
		Schilbeidae	1. <i>Clupisoma bastari</i> CHA 2. <i>Eutropiichthys goongwaree</i> MAHR,AP 3. <i>Neotropius khavalchor</i> MAHR,AP,KAR 4. <i>Proeutropiichthys buchanani</i> ***
		Siluridae	1. <i>Ompok goae</i> GO 2. <i>Pterocryptis indicus</i> ARP
		Sisoridae	1. <i>Exostoma barakensis</i> MAN 2. <i>Glyptothorax brevipinnis</i> UTK,MP**** 3. <i>Glyptothorax chintuipuiensis</i> MIZ 4. <i>Glyptothorax malabarensis</i> KER 5. <i>Pseudecheneis suppaetula</i> HP 6. <i>Sisor torosus</i> BI,DEL
	Synbranchiformes (4 species)	Synbranchidae	1. <i>Monopterus digressus</i> KER 2. <i>Monopterus eapeni</i> KER 3. <i>Monopterus hodgarti</i> ARP 4. <i>Monopterus roseni</i> KER
	Tetraodontiformes (1 species)	Tetraodontidae	1. <i>Carinotetraodon imitator</i> KAR,KER

IUCN red list status: CR-Critically Endangered, EN-Endangered, VU-Vulnerable, NT-Near Threatened, LC-Least Concern, DD-Data Deficient.

*Distribution in West Bengal and Assam is newly reported by Arunachalam, *et. al.* [7] and Pathak, *et. al.* [8] respectively; **Distribution in Arunachal Pradesh is recently reported by Tamang and Sinha [9]; *** The exact distribution of this species is unknown, although it is likely to be found in the Indus and Ganges river drainages in India [6]; **** Distribution not reported in IUCN [6] however it is reported by Jayaram [10] and Pandey, *et. al.* [11]

Northern India: HAR-Haryana, HP-Himachal Pradesh, JK-Jammu & Kashmir, PUN-Punjab, UTK-Uttarakhand, UP-Uttar Pradesh; Western India: RAJ-Rajasthan, GUJ- Gujarat, MAHR-Maharashtra, GO-Goa; Central India: CHA-Chhattisgarh, MP-Madhya Pradesh; Eastern India: BI-Bihar, JHA-Jharkhand, ODI-Odisha, WB-West Bengal; North-Eastern India: ARP-Arunachal Pradesh, ASM-Assam, MAN-Manipur, MEG-Meghalaya, MIZ-Mizoram, NAG-Nagaland, SIK-Sikkim, TRI-Tripura; Southern India: AP-Andhra Pradesh (including Telangana, as separate data for Telangana till not available in IUCN for the enlisted fishes), KAR-Karnataka, KER-Kerala, TN-Tamil Nadu; Union territories: AN-Andaman and Nicobar Islands, CHN-Chandigarh, DN-Dadra and Nagar Haveli, DD-Daman and Diu, LAK-Lakshadweep, DEL-National Capital Territory of Delhi, PON-Pondicherry.

These large numbers of fish species occurring in India listed in table 1 are in threat as about 48% of them belong to the threatened category considering the numbers of CR, EN and VU species presented in the table 1. Among the states and union territories of India, Kerala might be considered as the richest state concerning the endemic fish species, while the Southern India zone is the richest in fish endemism considering the six geographic zones of India (Fig. 1). In addition to this exhaustive list of fish species evaluated by the IUCN, there are many other fish species reported from India that has either recently been identified or not yet been

assessed by IUCN [6] (listed in Table 2, up to 2015). There is meagerly any doubt that many of these IUCN not evaluated fish species might also be endemic to India. India is one of the megabiodiversity countries in the world that occupied the 9th position in terms of freshwater megabiodiversity [12]. It seems to be paradoxical to note that though a great deal of attention had been paid to classify the worlds' top 25 biodiversity hotspots, vertebrate group were considered excluding fish [13]. This is mostly because of the poorly available data indicating the need to evaluate the regional fish biodiversity with a holistic approach.

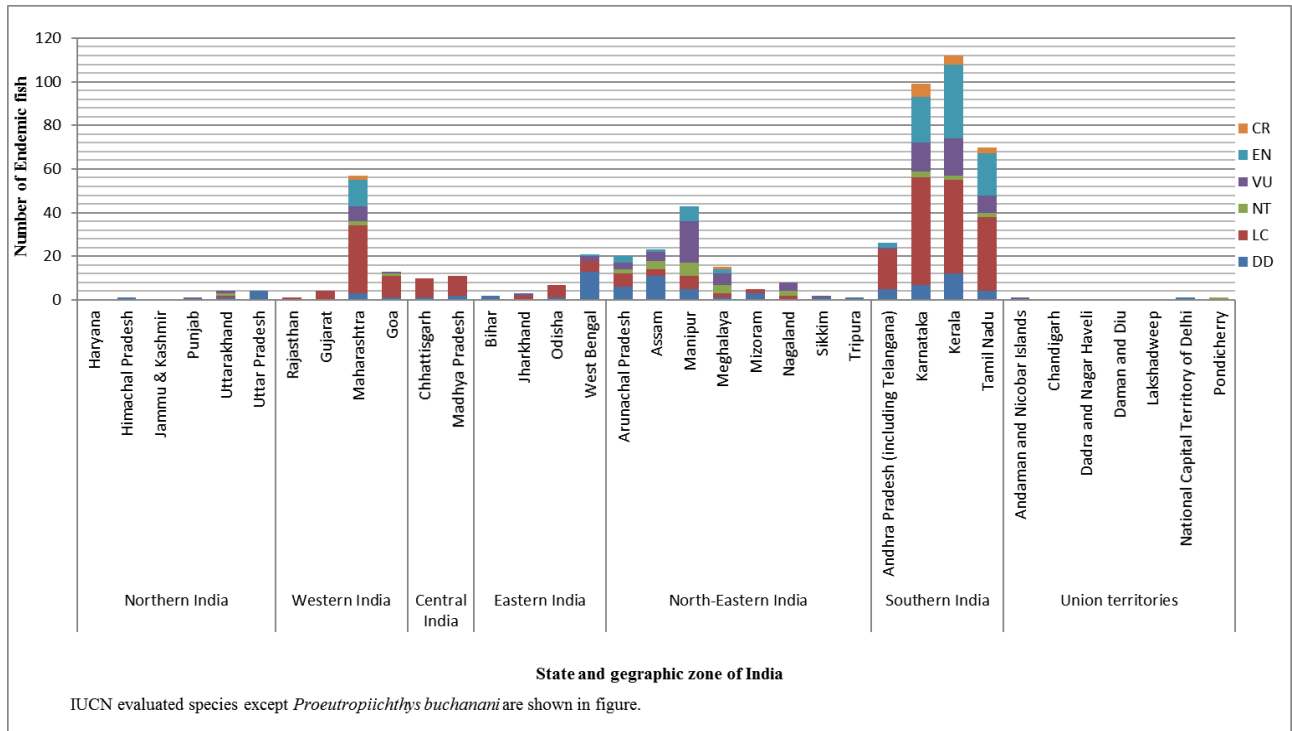


Fig 1: State and geographical zone wise endemism of Indian endemic fishes.

Table 2: List of IUCN Not Evaluated (NE) fish species recorded from India (up to 2015)

Order	Family	SPECIES NAME
Clupeiformes (1 species)	Engraulidae	1. <i>Setipinna brevifilis</i> * [14]
	Balitoridae	1. <i>Acanthocobitis pavonacea</i> ASM [15] 2. <i>Balitora jalpalli</i> KER [14] 3. <i>Balitora laticauda</i> MAHR [14] 4. <i>Bhavania arunachalensis</i> ARP [15] 5. <i>Homaloptera silasi</i> KER [14] 6. <i>Schistura aizawlensis</i> MIZ [16]
Cypriniformes (82 species)	Cobitidae	1. <i>Pangio ammophila</i> KAR [14] 2. <i>Pangio longipinnis</i> MAN [15]
	Cyprinidae	1. <i>Barilius ardens</i> KAR, KER [17] 2. <i>Barilius profundus</i> MIZ [18] 3. <i>Chela macrolepis</i> TN [14] 4. <i>Dawkinsia rubrotinctus</i> KAR, KER, TN [14] 5. <i>Devario deruptotalea</i> MAN [14] 6. <i>Esomus manipurensis</i> MAN [15] 7. <i>Garra alticaputus</i> ARP [14] 8. <i>Garra arupi</i> ARP [14] 9. <i>Garra chakpiensis</i> MAN [19] 10. <i>Garra cornigera</i> MAN [20] 11. <i>Garra dampensis</i> MIZ [14] 12. <i>Garra kalpangi</i> ARP [14] 13. <i>Garra kimini</i> ARP [14] 14. <i>Garra magnidiscus</i> ARP [14] 15. <i>Garra minimus</i> ARP [14] 16. <i>Garra nigricauda</i> ARP [14] 17. <i>Garra palanuvica</i> KER [14] 18. <i>Garra ukhrulensis</i> MAN [19] 19. <i>Garra namyensis</i> MAN [14] 20. <i>Garra trilobata</i> MAN [20] 21. <i>Labeo rajasthanicus</i> RAJ [15] 22. <i>Labeo udaipurensis</i> RAJ [15] 23. <i>Laubuka lateens</i> KAR, TN [21] 24. <i>Laubuka trevori</i> KAR, TN [21] 25. <i>Pethia aurea</i> WB [14] 26. <i>Pethia striata</i> KAR [22] 27. <i>Pethia expletiformis</i> MIZ [14] 28. <i>Pethia longicauda</i> MAHR [14] 29. <i>Pethia rutila</i> MIZ [14] 30. <i>Puntius dolichopterus</i> KER [23] 31. <i>Puntius khohi</i> UTK [15]

		32. <i>Puntius melanostigma</i> KER,TN ^[15] 33. <i>Puntius morehensis</i> MAN ^[15] 34. <i>Puntius muzaffarpurensis</i> BI ^[15] 35. <i>Puntius nangalensis</i> HP,PUN,TN ^[15] 36. <i>Puntius nelsoni</i> KER ^[24] 37. <i>Puntius nigronotus</i> KER ^[25] 38. <i>Puntius viridis</i> KER ^[14] 39. <i>Salmophasia orissaensis</i> ODI ^[15] 40. <i>Schizothorax huegelii</i> JK ^[15] 41. <i>Systemus chryseus</i> KER ^[24] 42. <i>Systemus rufus</i> KER ^[24]
	Nemacheilidae	1. <i>Nemacheilus carletoni</i> HP ^[14] 2. <i>Nemacheilus drassensis</i> JK ^[15] 3. <i>Nemacheilus gangeticus</i> UP ^[15] 4. <i>Nemacheilus guttatus</i> ASM ^[14] 5. <i>Nemacheilus kaimurensis</i> UP ^[15] 6. <i>Nemacheilus shehensis</i> JK ^[15] 7. <i>Paraschistura montana</i> HP ^[15] 8. <i>Physoschistura chindwinensis</i> MAN ^[14] 9. <i>Physoschistura dikrongensis</i> ARP ^[14] 10. <i>Physoschistura tigrinum</i> MAN ^[14] 11. <i>Schistura altipedunculatus</i> KAR ^[15] 12. <i>Schistura fasciata</i> MAN ^[14] 13. <i>Schistura himachalensis</i> HP ^[15] 14. <i>Schistura koladynensis</i> MIZ ^[26] 15. <i>Schistura liyaiensis</i> MAN ^[27] 16. <i>Schistura maculosa</i> MIZ ^[14] 17. <i>Schistura mizoramensis</i> MIZ ^[28] 18. <i>Schistura nebishwari</i> MIZ ^[29] 19. <i>Schistura obliquofascia</i> UTK ^[14] 20. <i>Schistura paucireticulata</i> MIZ ^[14] 21. <i>Schistura phamhringi</i> MAN ^[14] 22. <i>Schistura porocephala</i> MIZ ^[14] 23. <i>Schistura rendahli</i> ** ^[15] 24. <i>Schistura scyphovecteta</i> MIZ ^[29] 25. <i>Schistura andrewi</i> MIZ ^[30] 26. <i>Triplophysa shehensis</i> JK ^[15] 27. <i>Triplophysa marmorata</i> JK ^[15]
	Psilorhynchidae	1. <i>Psilorhynchus chakpiensi</i> MAN ^[14] 2. <i>Psilorhynchus kaladanensis</i> MIZ ^[31] 3. <i>Psilorhynchus khopai</i> MIZ ^[14] 4. <i>Psilorhynchus maculatus</i> MAN ^[14] 5. <i>Psilorhynchus ngathanu</i> MAN ^[14] 6. <i>Psilorhynchus hamiltoni</i> WB ^[14]
Cyprinodontiformes (1 species)	Aplocheilidae	1. <i>Aplocheilus kirchmayeri</i> GO ^[15]
Perciformes (22 species)	Ambassidae	1. <i>Parambassis bistigmata</i> ARP,MEG ^[14] 2. <i>Parambassis serrata</i> MIZ ^[32] 3. <i>Parambassis waikhomi</i> MAN ^[14]
	Badidae	1. <i>Badis andrewraoi</i> WB ^[14] 2. <i>Badis autumnum</i> WB ^[14] 3. <i>Badis kyanos</i> WB ^[14] 4. <i>Badis singenensis</i> ARP ^[14] 5. <i>Badis soraya</i> WB ^[14] 6. <i>Badis britzi</i> KAR ^[33] 7. <i>Badis laspiophilus</i> WB ^[14] 8. <i>Badis triocellus</i> ARP,ASM,MEG ^[14] 9. <i>Dario kaja</i> MEG ^[14] 10. <i>Dario urops</i> KAR,KER ^[14] 11. <i>Dario huli</i> KAR ^[34]
	Channidae	1. <i>Channa andrao</i> WB ^[14]
	Eleotridae	1. <i>Eleotris andamensis</i> AN ^[15]
	Gobiidae	1. <i>Acentrogobius griseus</i> AP,TN ^[15] 2. <i>Callogobius seshaiyai</i> TN ^[15] 3. <i>Yongeichthys tuticorinensis</i> TN ^[15]
	Pristolepididae	1. <i>Pristolepis pentacantha</i> KER ^[35]
	Pristolepididae	1. <i>Pristolepis rubripinnis</i> KER ^[14]
	Sciaenidae	1. <i>Johnius gangeticus</i> UP,*** ^[15]
	Siluriformes (45 species)	Amblycipitidae
Bagridae		1. <i>Batasio convexirostrum</i> MIZ ^[14] 2. <i>Batasio flavus</i> KER ^[36]

		<ol style="list-style-type: none"> 3. <i>Horabagrus melanosoma</i> KER^[14] 4. <i>Mystus canarensis</i> KAR^[15] 5. <i>Mystus heoki</i> KER^[14] 6. <i>Mystus indicus</i> KER^[14] 7. <i>Mystus keralai</i> KER^[37] 8. <i>Mystus menoni</i> KER^[14] 9. <i>Mystus ngasep</i> MAN^[14]
	Clariidae	<ol style="list-style-type: none"> 1. <i>Clarias dayi</i> KER, TN^[15] 2. <i>Horaglanis abdulkalami</i> KER^[14]
	Kryptoglanidae	<ol style="list-style-type: none"> 1. <i>Kryptoglanis shajii</i> KER^[14]
	Olyridae	<ol style="list-style-type: none"> 1. <i>Olyra astrifera</i> KER^[14] 2. <i>Olyra saginata</i> MIZ^[14]
	Schilbeidae	<ol style="list-style-type: none"> 1. <i>Eutropiichthys cetosus</i> MIZ^[14]
	Siluridae	<ol style="list-style-type: none"> 1. <i>Ompok karunkodu</i> TN^[14]
	Sisoridae	<ol style="list-style-type: none"> 1. <i>Creteuchiloglanis arunachalensis</i> ARP^[38] 2. <i>Creteuchiloglanis payjab</i> ARP^[39] 3. <i>Exostoma sawmteai</i> MIZ^[40] 4. <i>Exostoma tenuicaudata</i> ARP^[41] 5. <i>Glyptothorax ater</i> MIZ^[14] 6. <i>Glyptothorax caudimaculatus</i> MIZ^[14] 7. <i>Glyptothorax churamanii</i> MIZ^[42] 8. <i>Glyptothorax clavatus</i> MAN^[14] 9. <i>Glyptothorax dikrongensis</i> ARP^[14] 10. <i>Glyptothorax elankadensis</i> KER^[43] 11. <i>Glyptothorax jayarami</i> MIZ^[14] 12. <i>Glyptothorax maceratus</i> MIZ^[14] 13. <i>Glyptothorax mibangi</i> ARP^[44] 14. <i>Glyptothorax nelsoni</i> BI^[15] 15. <i>Glyptothorax pantherinus</i> ARP^[14] 16. <i>Glyptothorax radiolus</i> WB^[14] 17. <i>Glyptothorax scrobiculus</i> MIZ^[45] 18. <i>Glyptothorax senapatiensis</i> MAN^[46] 19. <i>Glyptothorax sykesi</i> ****^[15] 20. <i>Glyptothorax verrucosus</i> MIZ^[47] 21. <i>Oreoglanis majusculus</i> ARP^[14] 22. <i>Oreoglanis pangenensis</i> ARP^[48] 23. <i>Pseudecheneis koladynae</i> MIZ^[14] 24. <i>Pseudolaguvia lapillicola</i> KAR^[49] 25. <i>Pseudolaguvia nubile</i> MIZ^[14] 26. <i>Pseudolaguvia viriosa</i> ARP^[14] 27. <i>Pseudolaguvia jiyaensis</i> ARP^[14] 28. <i>Pseudolaguvia magna</i> ARP^[14]
Synbranchiformes (4 species)	Mastacembelidae	<ol style="list-style-type: none"> 1. <i>Macrognathus albus</i> KER^[14] 2. <i>Macrognathus fasciatus</i> KER^[14] 3. <i>Macrognathus malabaricus</i> KER^[15]
	Synbranchidae	<ol style="list-style-type: none"> 1. <i>Monopterus ichthyophoides</i> MIZ^[14]

*Ganges system, from at least Delhi to Calcutta; **Known from a single specimen from Nadur Madhmeswar, southern India; ***Ganga river, including its Hooghly estuary in India; ****Peninsular India. Northern India: HAR-Haryana, HP-Himachal Pradesh, JK-Jammu & Kashmir, PUN-Punjab, UTK-Uttarakhand, UP-Uttar Pradesh; Western India: RAJ-Rajasthan, GUJ-Gujarat, MAHR-Maharashtra, GO-Goa; Central India: CHA-Chhattisgarh, MP-Madhya Pradesh; Eastern India: BI-Bihar, JHA-Jharkhand, ODI-Odisha, WB-West Bengal; North-Eastern India: ARP-Arunachal Pradesh, ASM-Assam, MAN-Manipur, MEG-Meghalaya, MIZ-Mizoram, NAG-Nagaland, SIK-Sikkim, TRI-Tripura; Southern India: AP-Andhra Pradesh (including Telangana), KAR-Karnataka, KER-Kerala, TN-Tamil Nadu; Union territories: AN- Andaman and Nicobar Islands, CHN-Chandigarh, DN-Dadra and Nagar Haveli, DD-Daman and Diu, LAK-Lakshadweep, DEL-National Capital Territory of Delhi, PON-Pondicherry.

3. Need for conservation: Present status and future perspectives

It is needless to mention that at present a large number of fish species are facing serious threat. Further studies would be required to map the threats in detail, together with their short term and long term impacts on the ichthyo-diversity. Major reasons behind this situation might include pollution, discharging industrial effluents, discharged pesticides, use of biological resources, over fishing, deforestation, habitat loss, habitat degradation, habitat alteration, natural system modifications, invasive alien species^[50], over fishing for aquarium trade^[51], and climate change. All these factors either directly or indirectly harm the fish diversity. Residential and commercial developments including tourism

and recreational areas are also affecting many endemic fish species^[50].

Since long killing fish in inland water by poisoning or by explosion is punishable offence according to the Indian Fisheries Act (1897). The act also empowered the state governments to ban fishing in selected inland waters and during some season by notification as needed. As for example, Kerala government has stopped fishing of *Sahyadria denisonii* in their breeding season and use of some destructive fishing gears, as this fish is being overexploited for ornamental fish trade^[52]. But there are many other endemic fish species which facing threats of extinction and till date they are not facilitated by the Indian Wildlife Protection Act. Captive breeding protocols for some endemic fishes have

been standardized (viz. *Dawkinsia exclamatio* ^[53], *Dawkinsia filamentosa* ^[53], *Dawkinsia tambraparniei* ^[54], *Garra mullya* ^[53], *Haludaria fasciata* ^[53], *Horabagrus brachysoma* ^[55], *Hypseobarbus curmuca* ^[56], *Laubuca fasciata* ^[53], *Nemacheilus semiarmatus* ^[53], *Nemacheilus triangularis* ^[53], *Pethia pookodensis* ^[53], *Pristolepis marginata* ^[53], *Puntius melanostigma* ^[53] and *Sahyadria denisonii* ^[57]), however, standardization of captive breeding for most of the endemic fishes, especially threatened species is yet to be done.

Exhaustive surveys, stock assessment, habit and habitat study is needed to know the exact status of the threatened endemic fishes as suggested by Ali *et. al.* ^[58] for *Hemibagrus punctatus* (CR), that this species should be listed as vulnerable species due to its wider distribution found in recent surveys. *Hypseobarbus lithopidos*, a data deficient species has no further information regarding its occurrence since 1941 through extensive surveys made around its type locality and therefore, it was assumed to be extinct ^[6]. Even though, further study is needed for the confirmation. The proper distribution of some species viz., *Glyptothorax sykesi*, *Proeutropiichthys buehanani*, *Schistura rendahli* is also not known authentically. *Labeo nigrescens*, a IUCN not evaluated species presently considered as synonym of *Labeo calbasu* ^[15], may be a valid species endemic to Karnataka and Kerala ^[59,60]. Further surveys is also required regarding distribution and population trend of 'IUCN Not Evaluated fish species' recorded from India to adopt specific conservation strategy for this wide array of freshwater fishes. Thus, this brief discussion could be drawn together to give a message that it is the crucial time to focus on the native endemic fish species, otherwise endemism would have been a great history for us in near future.

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