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Puntius nelsoni, Systomus chryseus and *S. rufus* (cypriniformes: cyprinidae), three new fish species from Kerala, India

Mathews Plamoottil

Abstract
Puntius nelsoni, a new species of the family cyprinidae, is distinguished from its congeners by the following combination of characters: body and fins yellowish; a narrow bluish green mark present on summit of occiput; a thin black band present outer to operculum; barbels short and never reach orbit; head wide and deep; snout shorter; vent located away from ventral fin origin; caudal peduncle long; scales between lateral line and dorsal fin 5 ½ and pre dorsal scales 9. *Systomus chryseus*, new species, differs from its relative species in having an unusually elongated body, golden to yellowish golden color on flanks, pectoral, pelvic and anal fins orange red; pectoral fin long and its tip reaches origin of ventral fin; lateral line scales 29-30 and pre dorsal scales 11. *Systomus rufus*, new species, differs from its congeners in having a deeper body; dorsal fin situated nearer to caudal fin base than snout tip and a little behind ventral origin; dorsal fin green and other fins red; 11-12 pre dorsal scales, 30 lateral line scales and 6½ scales between lateral line and dorsal fin base. The new species of fishes are described and compared with its related species.

Keywords: Taxonomy, New species, *Puntius parrah*, *Puntius viridis*, *Systomus sarana*.

1. Introduction
Puntius, *Systomus*, *Dawkinsia*, *Haludaria* and *Pethia* are the five lineages present within South Asian genus *Puntius.* The genus *Puntius* is characterized by the absence of rostral barbels, last unbranched dorsal fin ray smooth, dorsal fin with 3-4 simple and 8 branched rays, anal fin with 3 simple and 5 branched rays, lateral line complete with 22- 28 pored scales, presence of free uroneural, simple and acuminate gill rakers and presence of a post-epiphysial fontanelle [1].

Freshwater fish species of genus *Systomus* are the common fresh water fishes of India, found in most inland water bodies of the country. They are moderate sized fishes with many peculiar features. They possess four barbels, their last unbranched dorsal ray is osseous, strong, serrated and lateral line is complete.

The author could collect 4 specimens of genus *Puntius* and 7 specimens of genus *Systomus* from Manimala River, Kerala India; these cyprinid fishes bear features of the genera but carry enough characters to distinguish from their congeners; so they are described here as three new species *Puntius nelsoni, Systomus chryseus* and *S. rufus.*.

2. Materials and methods
Fishes were collected using cast nets and preserved in 10% formalin. Methods used are those of Jayaram[2] and measurements follow standard practices. Body depth and body width were measured both at dorsal-fin origin and anus, vertically from dorsal-fin origin to belly and from anus to dorsum respectively. In the meristic data of fin rays lower case Roman numerals (i, ii, iii etc) indicate simple, flexible and unbranched rays, Arabic numerals (1,2,3 etc) indicate branched rays.

Abbreviations- ZSI- Zoological Survey of India, Kolkata, West Bengal; ZSI/WGRC-

Zoological Survey of India, Western Ghats Regional Centre, Calicut; Kerala; CRG-SAC - Conservation Research Group, St Albert's College, Kochi; KUFOS..Kerala University for Fisheries and Ocean Studies, Cochin; UOK/AQB- University of Kerala, Aquatic biology and fisheries, Kariavattom, Thiruvananthapuram; PCMP- Personal Collections of Mathews Plamoottil; LLS- lateral line scales; DP- PL- distance between pectoral and pelvic fins; LCP- length of caudal peduncle, DCP- depth of caudal peduncle; WCP- width of caudal peduncle; DPL- A- distance between pelvic and anal fins; DVV- distance from ventral to vent; DAV- distance from anal to vent.

3. Results

3.1. *Puntius nelsoni*, sp. nov

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(Figures 1- 3 & Table 1)

Holotype: ZSI/WGRC/IR/2353, 91 mm SL, Kallumkal, Manimala River, Kerala, India, 9˚20'0''N, 76˚30'0''E, coll. Mathews Plamoottil, 21.08.2011.

Paratypes: ZSI/ WGRC/ IR/ 2354, 3 specimens, 81- 84 mm SL, Kallumkal, Manimala River, Kerala, India, 9˚20'0''N, 76˚30'0''E, coll. Mathews Plamoottil, 21.08.2011.

3.1.1. Diagnosis: *Puntius nelsoni* can be distinguished from its close congeners by the combination of following characters: maxillaries feeble, short and never reach orbit, nostrils inserted in the middle of orbit and snout tip, head deeper (89.3- 96.2 % HL), mouth gape wider (29.2- 31.0 % HL) and snout shorter (22.7- 28.8 % HL). Body and fins yellowish; a narrow light bluish green mark present on summit of occiput; outer to operculum numerous fine black dots present in the form of a thin band which of both sides join together at occiput. *Puntius nelsoni* can be distinguished from *P. dorsalis*, *P. sophore* and *P. stigma* in lacking (vs. having) any color spot on the base of dorsal fin; the new species further distinguished from *P. dorsalis*, *P. sophore*, *P. parrah*, *P. viridis* and *P. chola* in having a wider head. *Puntius nelsoni* differs from *P. madhusoodani* in having 5½ (vs. 4½) scales between lateral line and dorsal fin; it can be distinguished from *P. mahecola* in having 25- 26 lateral line scales (vs. 22) and 3½ scales (vs. 2½) between lateral line and ventral fin.

3.1.2. Description

General body shape and appearance is shown in Fig. 1 & 2. Morphometric data as in Table 1. Body elongate, laterally compressed; dorsal contour ascending, indented at nape, profile of back convex anterior to dorsal-fin origin, tapering gradually thereafter; ventral profile equally convex anterior to anal fin origin, curving gently up to caudal fin; head deep, 89.3- 96.2 % HL and wide , 68.2- 70.9 % HL; eyes, 26.8- 33.3 % HL, can be roughly seen from below ventral side; snout short, 22.7- 28.8 % HL; nostrils are inserted in the middle of orbit and snout tip and are covered by a thin flap originating from the anterior end; upper jaw a little longer and broader than lower jaw; tip of the former a little bulging; faint and indistinct transverse foldings present just behind it; it creates a slight depression in the snout between and forwards of eyes; barbels are one pair of small, feeble maxillaries and it never reach orbits or nostrils; mouth terminal, slightly upturned, fairly protruding and gape of it wide..

Dorsal fin originates just above the ventral fin origin, a little behind the pectoral tip and slightly nearer to snout than caudal base. Dorsal fin with three simple and 8 branched rays; first ray minute, osseous and seemingly absent; it is commonly fused to the second ray, which is delicate, osseous but softer than the first and form 1/3 of the third ray; second ray is also fused to the third ray; the latter is the longest one and is osseous, rigid, smooth and its tip filamentous; remaining rays of dorsal fin are branched and articulations of which are distinctly seen; last ray is similar to other rays and not branched to root. Dorsal base bears a row of 6- 8 scales. Outer margin of dorsal fin straight except the last ray which projects out. Dorsal fin longer than pectoral, pelvic and anal and its base also longer than all other fins. Pectoral fin inserted fairly in front of dorsal fin, tip never reaches ventral

Fig 1: Freshly collected specimen of *Puntius nelsoni*, Paratype, ZSI/WGRC 2354

Fig 2: *Puntius nelsoni*, Holotype, ZSI/ WGRC/ IR/ 2353;

Fig 3: Head region of *Puntius nelsoni*

origin and its upper surface nearly convex; it is longer than anal and shorter than dorsal and pelvic. Pectoral fin with one simple and 14- 15 branched rays. Ventral fin originates just below dorsal fin origin and fairly behind the pectoral tip; its tip never reach anal origin or vent and its outer margin is convex. Two auxiliary scales present on either side of the base of ventral, one above the other, the upper one soft and delicate, the lower one fleshier; these scales form only 1/5 of the length of ventral. Ventral fin with 9 rays; first and last rays are soft and unbranched. Ventral fin longer than pectoral and anal but shorter than dorsal. Anal fin originates behind the tip of last ray of dorsal, close to vent and considerably behind the ventral origin; its tip never reach caudal base; its distal margin slightly concave and its base with a row of 5 scales on either side. Anal fin with three simple and 5 branched rays; each branched ray is dichotomous from ¼ of the length from base, after next ¼ distance each of this again divides into distinct segments; last anal ray divided to root. Caudal fin, with 19 rays, moderately forked with equal, pointed lobes.

Scales relatively large, rigid, containing concentric rings and are clearly countable due to presence of double layered outer margin. 25- 26 scales present along lateral line; 5 ½ scales between lateral line and dorsal fin and 3 ½ scales between lateral line and ventral fin; pre dorsal scales 9. Lateral line originates a little below the upper part of opercle, passes through lower half of the body and it is fairly distinct throughout.

3.1.3. Colouration: In life, body and fins yellowish; distal half of caudal fin dusky; dorsal side of head greenish yellow; a narrow light bluish green mark present on summit of occiput; a golden or reddish brown or scarlet mark occurs on operculum; outer to operculum numerous fine black dots in the form of a thin band which of both sides join together at occiput; a diffuse black blotch present on caudal base. Very fine dots scattered on scales and some parts of operculum; a black shade formed by the aggregation of black dots present in between most scales.

Formalin preserved specimens - Back and upper lateral sides brownish; lower lateral sides silvery; ventral side pale yellow. Dorsal fin and caudal fin pale darker; pectoral fin hyaline; ventral fin whitish yellow; anal hyaline with a dark shade on distal half. Caudal blotch became darker.

3.1.4. Etymology: The species is named after Dr. Nelson P. Abraham, Associate Professor, St. Thomas College, Kozhencherry, Kerala who has been a constant source of encouragement throughout the study.

3.1.5. Habitat: Kallumkal, the type locality of *Puntius nelsoni*, is the site of merging of Pamba River with Manimala River. This part of the river is blanketed by mud dominant sediments. Sand occurs as discrete patches within the mud dominant deposits. The depth and width of the channel at Kallumkal ranges from 1 to 10 and 30 to 85 m respectively. The reach has a bank height of 1 to 2 m from the general water level. Riparian vegetation moderate. The major flora includes *Bambusa bambos*, *B. vulgaris*, *Hibiscus tiliaceus* and *Ochreinauclea missionis*. *Cynodon dactylon* and *Cymbopogon flexuosus* are major grass species in this area. *Rasbora dandia*, *Osteobrama bakeri*, *Amblypharyngodon microlepis*, *Dawkinsia filamentosus*, *Haludaria fasciatus*, *Puntius parrah*, *P. viridis*, *Pethia ticto*, *Gonoproktopterus kurali*, *Catla catla*, *Labeo rohita*, *Labeo dussumieri*, *Cirrhina mrigala*, *Horabagrus brachysoma*, *Wallago attu* etc are some of the co-occurring fish species present in this region

3.1.6. Distribution: Currently known only from Manimala River, Kerala, India.

Table 1: Morphometric Characters of *Puntius nelsoni* (n= 4)

Measurement	Holotype	Range (HT included)	Mean	SD
Standard Length (mm)	91	81 - 91	86.5	7.2
Head length (mm)	24.0	19.0- 24.0	21.9	1.5
Percent of standard length				
Head length	26.4	25.7- 26.7	26.2	0.4
Head depth	24.2	23.8- 28.4	25.5	1.8
Head width	18.7	17.3-18.7	17.9	0.6
Body depth at dorsal origin	32.9	32.9- 33.7	33.3	0.3
Body depth at anal origin	23.6	23.0-25.9	25.1	1.2
Body width at dorsal origin	20.8	18.5- 21.4	20.2	1.2
Body width at anal origin	15.4	13.6- 15.7	14.8	0.9
Pre-dorsal length	50.6	50.0- 53.1	51.9	1.3
Post-dorsal length	53.3	53.0- 55.4	54.4	0.8
Pre-pectoral length	26.4	26.4- 27.9	27.3	0.6
Pre-pelvic length	49.5	49.4- 51.8	50.7	1.1
Pre-anal length	75.8	73.8- 81.8	76.4	3.3
Length of dorsal fin	21.9	21. 8- 23.5	22.9	0.7
Length of pectoral fin	17.5	17.3- 18.4	17.7	0.5
Length of pelvic fin	18.7	18.5- 19.4	18.8	0.4
Length of anal fin	17.58	16.1- 17.6	16.7	0.6
Length of base of dorsal fin	19.8	19.0- 21.8	20.7	0.9
Length of base of anal	10.9	9.5- 10.9	9.9	0.6
Length of caudal peduncle	18.7	17.7- 20.0	18.9	0.9
Depth of caudal peduncle	14.3	13.1-14.4	13.8	0.5
Width of caudal peduncle	7.7	7.4- 7.7	7.6	0.2
Distance from anal to vent	3.1	2.4- 3.1	2.7	0.3
Distance from ventral to vent	25.8	23.8- 27.2	25.3	1.3
Percent of head length				
Head depth	91.7	89.3- 96.2	92.8	2.8
Head width	70.8	68.2- 70.9	68.5	1.5
Eye diameter	33.3	26.8- 33.3	28.9	2.6
Inter orbital width	41.7	41.0- 43.3	41.8	1.3
Inter narial width	27.1	26.8- 28.8	27.7	2.1
Snout length	25.0	22.7- 28.8	25.8	2.8
Width of gape of mouth	29.2	29.2- 31.0	29.9	0.7
Length of maxillary barbels	12.5	12.4- 14.4	13.7	0.8

3.1.7. Discussion

Puntius dorsalis (Jerdon), *P. parrah* Day, *P. madhusoodani* Kumar *et al*, *P. viridis* Plamoottil & Abraham, *P. chola* (Hamilton) and *P. sophore* (Hamilton) are the congeners of *Puntius nelsoni*. Of these first four were originally described from inland water bodies of South India.

Fig 4: *Puntius dorsalis*, ZSI/FF 2730, Madras, coll. Francis Day;

Fig 5: *Puntius parrah*, ZSI FF 4934, Irinjalakuda.

In *Puntius dorsalis* (Jerdon[3]) (Fig. 4) a black spot present at the base of dorsal fin (vs. absent in the new species), have a long and pointed snout 31.8- 37.1% HL (vs. snout short, 22.7- 28.8 % HL), head width lesser (42.4- 58.3 % HL vs. 68.2- 70.9), height of head lesser (head depth at occiput 63.6-78.9 % HL vs. 89.3- 96.2) and scales between lateral line and ventral fin 2½ (vs. 3½). *Puntius parrah* Day[4], (Fig. 5) described from Karuvannoor River of Kerala, shows distinct differences to the present species. In *P. parrah*, maxillary barbels are longer, 15.0- 17.6 % HL and reach anterior border of eyes (vs. maxillaries shorter, 12.4- 14.4 % HL and never reach orbit in *P. nelsoni*), dorsal fin and caudal fin are dusky (vs. green to yellowish green), a dark bluish line present along mid lateral line, which is more distinct in preserved state (vs. dark bluish line absent in fresh or preserved condition), upper edge of dorsal fin concave (vs. upper edge of dorsal fin straight except the last ray), head width lesser (60.0- 68.0 % HL vs. 68.2- 70.9), 8 pre dorsal scales (vs. 9), width of gape of mouth equal to inter narial distance (vs. greater than INW) and branched rays of anal fin not dichotomous (vs. each branched ray of anal is dichotomous from ¼ of the length from base, after next ¼ distance each of this again divides into distinct segments).

The new species differ from *P. chola* (Hamilton- Buchanan) [5] (Fig. 7) of Gangetic plains in a number of characters. In *P. chola* head width lesser (42.9- 63.7 % HL vs. 68.2- 70.9 in *P. nelsoni*), width of gape of mouth shorter (19.1- 23.8 % HL vs. 29.2- 30.9), a slight ridge present along the middle of lower jaw (vs. absent), first two dorsal rays are very thick (vs. moderate), dorsal fin is variegated with dots collected in the form of various spots and a black spot present on gill covers (vs. absent), upper margin of dorsal fin concave (vs. straight), dorsal fin base shorter (63.4- 73.8 % HL vs. 75.0- 81.8), pectoral and ventral fin are equal in length (vs. ventral fin longer than pectoral fin) and pre dorsal scales 10- 12 (vs. 9).

Fig 6: *Puntius madhusoodani* Paratype, CRG-SAC 457;

Fig 7: *Puntius chola*, ZSI/FF 2203, Assam, coll. S.L. Hora

The present species can be easily distinguished from *Puntius madhusoodani* Kumar *et al* [6] (Fig. 6) described from Manimala River recently. In *P. madhusoodani*, head longer (27.1- 29.5% SL vs. 25.7- 26.7 in *P. nelsoni*), head depth lesser (20.7- 23.1 % SL vs. 23.8- 28.4), snout longer (28.6- 30.0 % HL vs. 22.7-28.8), barbels elongated (4.4 % SL vs. 3.5), dorsal side dusky black (vs. greenish), paired fins hyaline (vs. yellow or yellowish green), branched rays of dorsal and anal fins black (vs. not black), scales present between dorsal fin and lateral line 4½ (vs. 5½) and caudal peduncle shorter (12.6- 17.5 % SL vs. 17.7- 20.0). *Puntius sophore* (Hamilton) [5] (Fig. 8) of Gangetic provinces can be easily distinguished from the present fish; In *Puntius sophore* body is deeper (36.2- 37.3 % SL vs. 32.9- 33.7 in *P. nelsoni*), head height less (80.0- 86.7 % HL vs. 89.3- 96.2), head width lesser (61.3- 63.0 % HL vs. 68.2- 70.9), width of gape of mouth shorter (26.7- 27.0 % HL vs. 29.2- 31.0), barbels absent (vs. one pair of maxillaries), a black spot present at the root of the dorsal fin (vs. absent), a faint band present on the lateral side (vs. absent) and color silvery with a bluish luster on the flanks (vs. greenish to silvery). *Puntius viridis* Plamoottil & Abraham[7] (Fig. 9) is a recently described fish from Kallumkal of Manimala River, Kerala. In *P. viridis*, head depth lesser (68.2- 80.0 % HL vs.89.3- 96.2 in *P. nelsoni*), head width lesser (56.5- 63.2 % HL vs. 68.2- 70.9), gape of mouth shorter (23.0- 27.3 % HL vs.

Fig 8: *Puntius sophore*, ZSI FF 4938, River Ganges

Fig 9: *Puntius viridis*, Holotype, ZSI/ WGRC/IR/2382.

29.2- 31.0), a row of distinct black spots present in the middle of dorsal fin (vs. absent), last dorsal ray divided to root (vs. undivided), dorsal fin base shorter (17.6- 19.2 % SL vs. 19.0- 21.8), ventral fin located nearer to vent (DVV 19.1- 22.8 % SL vs. 23.8- 27.2), last anal ray not divided to root (vs. divided to root) and caudal peduncle shorter (16.3- 17.8 % SL vs. 17.8- 20.0).

Fig 10: *Puntius stigma*, PCMP 35, Trichur

Fig 11: *Puntius mahecola*, PCMP 40, Thiruvalla.

Puntius stigma (Valenciennes) (Fig. 10) is considered as a synonym of *P. sophore* of Hamilton; but this author considers the former as a distinct species. *Puntius stigma* can be distinguished from the present species in having no barbels (vs. one pair of barbels in *P. nelsoni*), 22-23 scales along lateral line (vs. 25- 26) and a large deep black blotch present at dorsal fin base (vs. absent). *Puntius mahecola* (Valenciennes) (Fig. 11) can be distinguished from the present species in having 22 lateral line scales (vs. 25- 26 in *P. nelsoni*), 2½ scales between lateral line and ventral fin (vs. 3½) and last undivided dorsal fin ray feebly ossified and flexible (vs. osseous and rigid).

3.1.8. Comparative material

3.1.8.1. *Puntius dorsalis*: 27.10.95, 1 example, 62 mm SL, Thunakadavu dam, Parambikulam wild life sanctuary, Kerala, ZSI/WGRC/IR 8466, coll. P.M. Sureshan, identified by K. C. Gopi; 23.2.2000, 2 examples, 56- 63 mm SL, Pampa River at Parumala, Kerala, ZSI/WGRC/IR/10379, coll. K. C. Gopi; 11.02. 58; 1 example, 53 mm SL, Usteri tank, 7 miles north west of Pondicherry, ZSI/F 2801, coll. A.G.K. Menon; 16.02. 1996, 2 examples, 52- 53 mm SL, Sethumadai canal, Indira Gandhi Wild Life sanctuary, Tamil nadu, ZSI/SRC/F 4954, coll. M.B. Reghunathan; undated, 1 example, Madras, ZSI/F 2730, coll. Francis Day; undated, 1 example, 53 mm SL, Tunga River at Shimoga, ZSI/F 12320/1, coll. H.S. Rao; undated, 5 examples, 55- 62 mm SL, Cauvery River, Coorg, Karnataka, ZSI/F 12319/1, coll. C.R. Narayan Rao;

3.1.8.2. *Puntius parrah:* 10.01. 2012, 4 examples, 65.5- 78.0 mm SL, Arattupuzha, Karavannoor River, Iringalakuda, Kerala, ZSI FF 4934, coll. Mathews Plamoottil; 15.12.1994; 1 example, 60 mm SL, Kuruva Island, Wayanad, ZSI/WGRC/IR/742, coll. C. Radhakrishnan; 24.03.1997, 1 example, 44 mm SL, Parambikulam WLS, ZSI/WGRC/IR/10696, coll. K. C. Gopi; 10.8.2001, 2 examples, 100.0- 103.0 mm SL, Achankoil River, UOK/AQB/F/ 102, coll. Bijukumar; undated, 1 example, Kariavannoor River, Kerala, ZSI/F 2718 Syntype, coll. Francis Day; 08.05. 1977, 6 examples, 71 mm- 94 mm SL, Cauvery River at Chunchinagatte, ZSI/SRC Uncat, coll. K. C. Jayaram.

3.1.8.3. *Puntius viridis*: Holotype, ZSI/ WGRC/IR/2382. 21.08.2011, 81 mm SL, Kallumkal, Manimala River, Kerala, India, 9˚20’0’’N, 76˚30’0’’E, coll. Mathews Plamoottil; Paratypes, ZSI/ WGRC/ IR/2383, 21.08.2011, 5 examples, 72- 76 mm SL, Kallumkal, Manimala River, Kerala, India, 9˚20’0’’N, 76˚30’0’’E, coll. Mathews Plamoottil; Topotypes, ZSI FF 4932, 10. 10. 2012, 2 examples, 63- 74 mm SL, Manimala River at Kallumkal, Kerala, coll. Mathews Plamoottil.

3.1.8.4. *Puntius madhusoodani*: 17.11.2010, Holotype, 91.43mm SL, Manimala River, near Thirumoolapuram, Thiruvalla, Kerala, CRG-SAC 456, coll. K. Krishnakumar; 17. 11. 2010, 3 examples, 67.6 - 80.91mm SL, Manimala River, near Thirumoolapuram,Thiruvalla, Pattanamthitta District, CRG-SAC 457 – 459 paratypes, coll. K. Krishnakumar and Benno Pereira.

3.1.8.5. *Puntius chola*: 08.11.1939, 1 example, 41.5 mm SL, Soni Gaon Bheel, Lokpa, Batipara, Assam, ZSI/F 2203, coll. S.L. Hora; 1963, 1 example, 54 mm SL, Sukla Talai, Jhalwar, Rajasthan, ZSI/F 4009/2, coll. N. Majumdar & R.N. Bhargava; 18.03.1958, 2 examples, 32.5- 55 mm SL, Raxanal, Bihar, ZSI/F/2804/2, coll. Keval Singh; 3 examples, 50- 62 mm SL, Rajastan, ZSI/F/4379/2, coll. Birla college, Pilani; 1 example, 71 mm SL, Mahanadi Irrigation Canal, Rudri, Orissa, ZSI/F 13082/1, coll. H.S. Rao.

3.1.8.6. *Puntius sophore:* 10.05.2012, 2 examples, 58- 59 mm SL, Serrampore, River Ganges, Kolkata, ZSI FF 4938, Coll. Mathews Plamoottil; 20.06. 1963, 4 examples, 62.5- 70.0 mm SL, Sukla Talai, Jhalawar, Rajasthan, ZSI/F 4008/2, coll. N. Majumdar & R. N. Bhargava; 24.10.1939, 1 example, 40 mm SL, Siwane River, east of Hazaribagh Barthi Road, ZSI/F

13827, H.S. Rao; 22.06.1963, 4 examples, 66- 102 mm SL, Gadhuli Talai, Shergarh, Rajasthan, ZSI/F 4023, SE Rajastan Survey of ZSI; 30.06.1983, 4 examples, 58.0- 67.5 mm SL, Talbi, N. of Bimmal Railway station, ZSI/F 4029/2, S. E. Rajasthan Survey of ZSI.

3.1.8.7. *Puntius stigma:* 10. 02.2010, 5 examples, 72- 86 mm SL, Trichur, PCMP 35, coll. Mathews Plamoottil.

3.1.8.8. *Puntius mahecola:* 20.01.2011, 7 examples, 70- 87 mm SL, Thiruvalla, PCMP 40, coll. Mathews Plamoottil.

3.2. *Systomus chryseus*, sp. nov.
urn:lsid:zoobank.org:act:DD56462F-7D60-4635-ABC6-608834CAE1D7
(Figure. 12 & Table 2)

Holotype: ZSI/FF 4625, 150 mm SL, Keezhvaipur, Manimala River, Kerala, India; collected by Mathews Plamoottil, 01 October 2011.

Paratypes: 4 specimens, ZSI/WGRC/IR/V 2421, 118- 152 mm SL, Keezhvaipur, Manimala River, Kerala, India; collected by Mathews Plamoottil, 14 May 2012.

3.2.1. Diagnosis: *Systomus chryseus* can be distinguished from congeners in having an unusually elongated body, body depth at dorsal fin origin 25.0- 28.6 in percent of standard length; a golden to yellowish golden color on flanks; pectoral, pelvic and anal fins orange red; pectoral fin long and its tip reaches origin of ventral fin; dorsal fin inserted a little behind ventral origin and nearer to snout tip than to caudal base; lateral line scales 29- 30 and pre dorsal scales 11.

3.2.2. Description
General body shape and appearance is shown in Fig. 4. Morphometric data of holotype and paratypes are provided in Table 2. Body elongate; dorsal profile from snout to occiput arched, roughly straight thereafter. Mid dorsal ridge in front of the dorsal fin origin very narrow, it becomes more wide and rounded just behind the occiput.
Head moderate; snout round; mouth terminal, forwardly directed and moderately protrusible; its width greater than inter narial distance. Eyes bulging above the surface of head and can be seen from below ventral surface. Orbit diameter 22.5- 28.0 in percent of head length; Nostrils covered by a membranous lid which originates from the anterior median side of nares. Inter orbital distance wide, fairly greater than eye diameter. Nostrils located close to eyes, lid of it touch front part of eyes. Two pairs of barbels- maxillaries and rostrals; maxillaries reach behind orbit and nostrils; rostrals extend to front border of eyes and nostrils.
Dorsal fin inserted above pectoral tip and a little behind ventral origin, nearer to snout tip than caudal base. Its base with a row of 6- 8 scales. Upper margin of dorsal fairly concave; dorsal fin with three simple and 8 branched rays; first ray of it very small, osseous and moderately hard, second one longer than the former, osseous and moderately hard. Last unbranched ray osseous, moderately strong, inner side serrated moderately, with 18- 20 fine serrations, its distal end soft and filamentous. Tip of dorsal reach behind anal origin. Pectorals inserted on ventro lateral side, tip of it reach pelvic fin origin. It is triangular and its outer margin nearly straight.
Pectoral fin with one simple and 16 branched rays. Ventral placed a little in front of dorsal origin, tip of it not reaching anal fin or vent. Its upper margin is fairly convex; an elongated and smooth auxiliary scale consisting of two pieces one above the other, present on either side of ventral. Ventral fin with one simple and 8 branched rays. Anal fin rectangular; it is provided with three

Fig 12: A fresh specimen of *Systomus chryseus*, Holotype, ZSI FF 4625.

simple and 5 branched rays; first anal ray very small and seemingly absent; second one osseous, smooth and longer than the former; third ray osseous, smooth and is the longest one. Sixth anal ray branched to root. Anal fin inserted fairly away from the ventral tip and a little in front of dorsal fin tip and tip of it when laid flat not reaching root of caudal fin, but reach middle of caudal spot. Base of anal with a row of 5 yellow scales; its outer margin is concave. Caudal fin with 19 rays; its lobes deeply forked.
Lateral line complete and distinct, slopes gradually down from the superior margin of opercle to opposite the middle of the pectoral from where it proceeds direct to centre of the caudal. Scales comparatively larger, those of the breast region moderate. Lateral line scales 29-30; pre dorsal scales 11; scales between lateral line and dorsal fin 5½ - 6½; scales between lateral line and ventral fin 3½ - 4½; scales between lateral line and anal fin 4½; circum peduncular scales 7.

3.2.3. Coloration: Fresh specimens. - Lateral sides golden or yellowish golden; back greenish black; ventral side white; pectoral, pelvic and anal fins orange red; dorsal fin blackish green; marginal rays and proximal half of caudal fin blackish green, distal half reddish; operculum light reddish; a diffuse black band present behind operculum; a greenish black shade present at the base of every scales, but it do not appear as lateral lines on sides. A dark diffused spot present on caudal base.
Formalin preserved specimens. – Dorsal side greenish; lateral and ventral sides light yellowish white to hyaline; dorsal and caudal fins blackish green; pectoral, pelvic and anal fins hyaline; caudal spot deep black.

3.2.4. Etymology: The species name of the new fish refers to its colour; the Latin word "*Chryseus*" means golden yellow.

Table 2: Morphometric features of *Systomus chryseus* (n= 5)

Sl. No	Characters	Holotype	Range	Mean	SD
1	Standard length (mm)	150	118- 152	127.3	17.8
	% SL				
2	Head length	24.7	23.4-26.3	24.6	1.4
3	Head depth	20.0	19.8- 23.6	20.6	1.4
4	Head width	16.0	16.0- 18.3	17.1	0.7
5	Body depth at dorsal origin	28.0	25.0-28.6	26.6	1.8
6	Body depth at anal origin	20.7	19.1-22.8	20.8	1.2
7	Body width at dorsal origin	19.3	18.6- 20.0	19.1	1.4
8	Body width at anal origin	14.7	12.7- 14.9	13.4	1.2
9	Pre dorsal length	50.7	46.1-50.7	48.3	2.3
10	Post dorsal length	52.7	47.6- 53.3	49.5	2.8
11	Pre pectoral length	24.7	23.1- 26.8	24.6	1.2
12	Pre pelvic length	48.7	48.0- 50.4	48.4	2.11
13	Pre anal length	72.7	68.1-75.6	72.7	2.82
14	Length of dorsal fin	24.0	21.4- 24.4	23.6	1.12
15	Length of pectoral fin	21.5	19.9- 22.4	21.1	1.33
16	Length of pelvic fin	18.7	17.1- 19.1	17.3	1.41
17	Length of anal fin	14.3	14.2- 15.5	14.5	0.91
18	Length of base of dorsal fin	16	15.1- 16.0	15.4	1.31
19	Length of base of pectoral	6.0	4.6- 6.0	5.2	0.62
20	Length of base of pelvic fin	6.0	4.2-6.0	5.1	0.71
21	Length of base of anal fin	9.0	8.3- 10.5	8.9	1.22
22	Length of caudal peduncle	17.3	17.3- 21.4	18.3	2.81
23	Depth of caudal peduncle	13.3	12.7- 13.8	13.3	0.7
24	Width of caudal peduncle	5.3	5.3- 7.3	6.1	1.0
25	DCP/LCP	76.9	70.2- 102.8	80.5	12.0
26	WCP/LCP	37.7	37.5- 44.7	40.0	7.2
27	DP-PL	25.3	22.0- 25.3	23.6	1.0
28	DPL-A	26.7	23.8- 26.7	25.2	1.0
29	DAV	1.6	1.6- 2.4	2.0	0.6
30	D V V	21.8	21.6- 24.7	23.0	1.4
	% HL				
31	Head depth	81.1	77.5-93.6	84.6	5.2
32	Head width	64.9	64.9-71.9	70.0	3.0
33	Eye diameter	27.0	22.5- 28.0	25.4	3.5
34	Inter orbital width	40.5	40.0-42.4	41.3	1.0
35	Inter narial width	25.6	23.0- 25.8	24.0	1.4
36	Snout length	27.0	27.0- 29.0	28.7	2.2
37	Width of gape of mouth	29.7	28.0- 33.3	30.2	2.1
38	Length of maxillary barbels	31.1	25.0- 31.1	27.8	3.0

3.2.5. Distribution.- Currently known only from the type locality in Kerala.

3.2.6. Habitat.- River bed of Keezhvaipur of Manimala River, the type locality of the *Systomus chryseus*, is generally occupied by sand and gravel; bed rocks and black clays are occasionally present. This stretch of the River has a width of 40 m- 120 m, depth of the water column in summer season ranges from 0.5 to 7 m and bank height varies from 4 to 7 m with respect to general water level. The area is covered by more or less dense riparian vegetation; the flora includes *Dendrocalamus strictus, Ochreinauclea missionis, Acacia caesia, Bambusa bambos, B. vulgaris, Hydnocarpus pentandra* etc. *Colocasia esculenta, Cynodon dactylon* and *Nymphaea* form the major in stream vegetation. *Anguilla bengalensis, A. bicolor, Salmostoma boopis, Barilius bakeri, Rasbora dandia, Osteobrama bakeri, Puntius mahecola, Pethia punctatus, Dawkinsia filamentosa, Gonoproktopterus kurali, Catla catla, Labeo ariza, L. dussumieri, Garra mullya, Horabagrus brachysoma, Mystus oculatus, M. gulio, Wallago attu, Xenentodon cancila, Ambassis commersoni, A. gymnocephalus, Pseudambassis ranga, Pristolepis malabarica, Etroplus maculatus, E. suratensis, Glossogobius giuris* etc are the co-occurring fish species present in this region.

3.2.7. Comparisons: *Systomus sarana* (Hamilton), *S. subnasutus* (Valenciennes), *Systomus spilurus* (Gunther), *Systomus orphoides* (Valenciennes), *Puntius pinnauratus* Day and *Barbus chrysopoma* Valenciennes are the relative species of the new species. The new species can be

Fig 13: *Systomus sarana*, ZSI FF 4317;

Fig 14: *Systomus subnasutus*, ZSI FF 1551

Fig 15: *Systomus pinnauratus*, PCMP 10

distinctly differentiated from *Systomus sarana* (Fig. 13) of Gangetic system of West Bengal; body of the latter is devoid of well-defined marks of color and is green and silvery (vs. yellowish golden in *Systomus chryseus*), fins are whitish or yellowish (vs. paired and anal fin orange red), dorsal fin located opposite the insertion of ventral (vs. little behind the ventral origin), pectoral fin never reach ventral fin (vs. reaches ventral origin), lateral line scales 30 – 34 (vs. 29- 30) and body higher (body depth 33.3- 62.5 % SL vs. 25.0- 28.6); Above all, populations of *Systomus sarana* is restricted to northern parts of India [8 , 9] .

Systomus chryseus can be distinctly separated from *Systomus subnasutus* [10] (Fig. 14) described from Pondicherry; in the latter dorsal profile not straight (vs. nearly straight in *Systomus chryseus*), pectoral fin with 16 rays (vs. 17), pre dorsal scales are 8-10 (vs. 11), scales between lateral line and ventral fin are 3½ (vs. 3½- 4½), pectorals never reach ventral fin (vs. pectoral reaches ventral), dorsal fin inserted above pelvic fin (vs. a little behind the ventral origin), dorsal fin situated equidistant between the snout tip and base of caudal fin (vs. nearer to snout tip than caudal base), body silvery (vs. yellowish golden) and fins are hyaline or yellowish white (vs. paired and anal fins reddish).

The present species can be distinctly demarcated from *S. spilurus*[11] found in the inland water bodies of Sri Lanka. In *Systomus spilurus* lateral line scales are 26- 27 (vs. 29- 30 in new species), scales between lateral line and dorsal fin 3½- 4½ (vs. 5½- 6½) and scales between lateral line and anal fin 2½- 3½ (vs. 4½).

In *Systomus orphoides* [10] of Java differs from the new species in having 3½ scales between lateral line and anal fin (vs. 4½ in the new species), body deeper (31.6-42.4 % SL vs. 25.0- 28.6) and head width lesser (45.5- 60.0 % HL vs. 64.9- 71.9). In India *Systomus orphoides* has been reported only from Manipur [10, 12, 9].

Puntius (Cyclocheilichthys) pinnauratus Day, *Barbus chrysopoma* Valenciennes and *Barbus gibbosus* Valenciennes are relative species of *S. chryseus*. *Puntius pinnauratus* (Day [4]), (Fig. 15) described originally from Malabar, may be the closest relative species of the present species; but the former is considered as a synonym of *Systomus subnasutus* by many taxonomists [13, 9, 14]; but this author could collect and examine many specimens of this red finned *Systomus* from Trichur from where Francis Day [4] collected and described it; this author considers *Puntius pinnauratus* Day as a valid species; In *P. pinnauratus* body is silvery (vs. golden or yellowish golden in *S. chryseus*), pre dorsal scales are 9- 10 (vs. 11), body depth greater (33.3- 34.8 % SL vs. 25.0- 28.6), head is longer (27.6- 29.1 % SL vs. 23.4- 26.3), snout is shorter (23.8- 24.0 % HL vs. 27.0- 29.0) and head width lesser (58.0- 59.0 % HL vs. 64.9- 71.9).

Fig 16: *Systomus chrysopoma*, PCMP 11

Barbus chrysopoma [10, 4, 11] (Fig. 16) was also described originally from Malabar. In *B. chrysopoma* pectoral fin with 15 rays (vs. 17 in *S. chryseus*), lateral line scales 28 (vs. 29- 30), pre dorsal scales 10 (vs. 11), height of body 3.0- 3.5 in SL (vs. 3.6- 4.0), dorsal arises midway between the snout and base of caudal (vs. nearer to snout tip than caudal base), body silvery (vs. body golden to yellowish golden) and ventral fin orange in colour and the other fins grey (vs. paired and anal fins reddish).

Barbus gibbosus Valenciennes was originally described from Alleppey in Kerala; it was considered as synonym of *Systomus subnasutus* by many taxonomists [13, 9, 14]; but Silas [15] considered it as a synonym of *Systomus pinnauratus*, who considered the latter as a valid species; *Barbus gibbosus* can be distinguished from the present species in many taxonomic characters; in *B. gibbosus* pectoral fin with 16 rays (vs. 17 in *Systomus chryseus*), head very small 6 in TL (vs. 4.8- 5.3 in TL and 3.8- 4.3 in SL), body depth 3.5 in TL (vs. 4.3- 5.1 in TL and 3.5- 4.0 in SL) and pre dorsal scales 9 (vs.11).

3.3. *Systomus rufus*, sp. nov

urn:lsid:zoobank.org:act:3A6D078E-0F0A-4EE9-A637-D9BA1C26E709

(Figure 17 & Table 3)

Holotype: ZSI/WGRC/IR/2367, 106 mm standard length, Venpala, Manimala river, Kerala,India; collected by Mathews Plamoottil, 10 October 2011.

Paratype: ZSI/WGRC/IR/ 2368, 102 mm standard length, Venpala, Manimala River, Kerala, India; collected by Mathews Plamoottil, 10 October 2011.

3.3.1. Diagnosis: *Systomus rufus* differs from its relative species in having a higher body, body depth at dorsal fin origin 39.2- 41.5 % SL, dorsal fin situated nearer to caudal fin base than snout tip and a little behind ventral origin; dorsal fin green and other fins red; 11-12 pre dorsal scales, 30 lateral line scales and 6½ scales between lateral line and dorsal fin base.

3.3.2. Description

General body shape and appearance are shown in Figure 5. Morphometric data for type specimens are given in Table 3. Dorsal and ventral profiles equally convex. Body laterally compressed and deep, 39.2- 41.5 % SL, upper jaw slightly longer than lower jaw. Mouth terminal and upwardly directed. Eyes a little bulging above the surface of head but cannot be seen from below the ventral surface. Nostrils inserted nearer to eyes than snout tip and are covered by a membranous lid.

Barbels are two pairs- maxillaries and rostrals; maxillaries never reach outer border of opercle; it roughly reaches posterior border of orbit and nostrils; rostrals reach front border of eyes and nostrils; maxillaries 22.2- 23.3 and rostrals 16.7- 18.5 in percentage of head length.

Dorsal fin inserted above a little behind the ventral origin and far behind pectoral tip, near to caudal base than snout tip; its base with a row of 6-8 scales. Upper margin of dorsal fairly concave; dorsal fin with three simple and 8 branched rays; first ray very small, osseous and hard, second one longer than the former, osseous and hard. Inner side of the third ray, the longest ray, serrated moderately except its basal part, the distal end is soft and filamentous. Pectoral fin nearly triangular, its outer margin slightly convex and its tip never reaches ventral origin.

Fig 17: Fresh specimen of *Systomus rufus*, Holotype, ZSI/WGRC/IR/2367, 106 mm SL.

Pectoral fin with one simple and 15 branched rays. Ventral inserted a little in front of dorsal fin, its tip does not reach anal or vent; a smooth auxiliary scale present on its base. Ventral fin two simple and 6-7 branched rays. Anal fin rectangular, arises a little behind the tip of dorsal, its tip never reach caudal base. Outer margin of anal concave; its base with a row of five yellow scales. Anal fin with three unbranched and 5 branched rays; First anal ray very small. Second ray osseous, smooth and longer than the former. Third ray osseous, smooth and is the longest one. Sixth anal ray branched to root and very delicate. Caudal fin with 19 rays; its lobes deeply forked. Scales are comparatively larger; those of the breast region are very small; lateral line scales-30; circumpeduncular scales 7; pre dorsal scales 11-12; scales between lateral line and dorsal fin base 6½; scales between lateral line and ventral fin base 4½; scales between lateral line and anal fin base 4½; lateral line distinct, starts superior to opercle and slightly descends above the centre of pectoral and then goes nearly straight up to posterior base of anal and then turns up and goes straight to caudal base.

3.3.3. Coloration: Fresh specimens.- Back greenish brown; lateral sides light brown; ventral side yellow; dorsal fin light green; pectoral and pelvic fins deep red; distal half of anal red; proximal half-light brownish white. Caudal generally green but its distal half red. A deep black blotch on caudal base on 23/24-27 scales. Outer opercle scarlet; an elongated black band present behind operculum. Eyes yellow, lens bluish black. Barbels pale green.

Formalin preserved specimens. - Opercle with black spots. Anal and ventral fins turns to whitish yellow, caudal to greenish black and its marginal rays became black. Appear to have 4 or 5 light greenish black bands on lateral sides by the coincidence of light greenish black spots on the scales.

Table 3: Morphometric characters of *Systomus rufus*

Sl.No.	Characters	Holotype	Paratype
1	Standard Length (mm)	106.0	102.0
	% SL		
2	Body depth at dorsal origin	41.5	39.2
3	Body depth at anal origin	28.3	25.5
4	Body width at dorsal origin	19.3	18.6
5	Body width at anal origin	10.8	11.8
6	Pre dorsal length	51.8	52.0
7	Post dorsal length	46.2	45.1
8	Pre pectoral length	28.3	25.5
9	Pre pelvic length	56.6	50.0
10	Pre anal length	82.1	73.5
11	Length of dorsal fin	19.8	18.6
12	Length of pectoral fin	16.0	15.7
13	Length of pelvic fin	14.1	14.7
14	Length of anal fin	11.3	10.8
15	Length of base of dorsal fin	13.2	12.7
16	Length of base of anal fin	8.5	7.8
17	Length of base of pectoral fin	4.7	4.9
18	Length of base of pelvic fin	4.7	3.9
19	Length of caudal peduncle	14.2	13.7
20	Depth of caudal peduncle	13.2	12.8
21	DCP/LCP	93.8	92.8
22	Width of caudal peduncle	6.6	5.9
23	Distance from ventral to vent	19.8	19.6

24	Distance from anal to vent	3.8	3.0
25	Head length	28.3	26.5
26	Head depth	24.5	22.6
27	Head width	15.1	15.7
28	Head length (mm)	30.0	27.0
% HL			
29	Head depth	86.7	85.2
30	Head width	53.3	59.3
31	Eye diameter	20.0	20.4
32	Inter orbital width	40.0	44.4
33	Inter narial width	23.3	26.0
34	Snout length	36.7	29.6
35	Length of maxillary barbels	23.3	22.2
36	Length of rostral barbels	16.7	18.5
37	Width of gape of mouth	30.0	29.6

3.3.4. Distribution. – Currently known only from the type locality in Kerala.

3.3.5. Habitat. - The width of the Manimal River at Venpala, the type locality of *Systomus rufus,* is less than 50 m wide and 1- 5 m deep. The bank height is about 1m with respect to the general water level in summer season. The sediments in this stretch are generally silty clays with occasional patches of sand. Channel bed is blanketed by mud dominated sediments. This stretch of river is covered by moderately dense riparian vegetation.

3.3.6. Etymology. - Species name '*rufus*' refers to the red color of fins of the new species; in Latin '*rufus*' means red.

3.3.7. Comparisons: *Systomus sarana* can be distinguished from the new species. In *Systomus sarana* body is green and silvery (vs. light brown in *Systomus rufus*), fins are whitish (vs. dorsal fin light green; pectoral and pelvic fins deep red and distal half of anal fin red), back arched equally from snout to the dorsal fin (vs. pre dorsal region not arched equally), dorsal fin situated opposite the insertion of ventral (vs. a little behind ventral origin) and 10 pre dorsal scales (vs. 11- 12 pre dorsal scales).

Systomus rufus can be distinctly demarcated from S*ystomus subnasutus* in some meristic and morphometric characters. In *Systomus subnasutus* body depth lesser ((25.8- 39.0 % SL vs. 39.2- 41.5 in *S. rufus*), pre dorsal scales are 8- 10 (vs. 11- 12), 3½ scales between lateral line and ventral fin (vs. 4½), pectoral and pelvic fins are hyaline or yellowish white (vs. deep red) and least depth of caudal peduncle 56.2- 77.0 in percent of its length (vs. 92.8- 93.3).

The present species can be distinctly demarcated from *Systomus spilurus*[11] in many meristic counts. In *Systomus spilurus* scales between lateral line and ventral fin are 3½ (vs. 4½ in the new species), scales between lateral line and dorsal fin 3½- 4½ (vs. 6½), lateral line scales 26- 28 (vs. 30) and pre dorsal scales 8- 10 (vs. 11- 12).

Systomus orphoides [10] differs from the present fish in possessing 5½ scales between lateral line and dorsal fin (vs. 6½ in *Systomus rufus),* 3½ scales between lateral line and ventral fin (vs. 4½) and in having larger eyes (orbit diameter 26.0- 33.0 in % HL vs. 20.0- 20.4 % HL).

Puntius pinnauratus (Day) shows some similarities to present fish especially in possessing reddish fins; in *P. pinnauratus* pre dorsal scales are 9- 10 (vs. 11- 12 in *Systomus rufus*), lateral line scales 29 (vs. 30), scales between lateral line and dorsal fin 5½ (vs. 6½), body height lesser (body depth at dorsal fin origin 33.3- 34.8 % SL vs. 39.2- 41.5), no distance from anal to vent (vs. distance from anal to vent 3.0- 3.8 % SL), eyes larger (orbit diameter 27.8- 28.0 % HL vs. 20.0- 20.4), and snout shorter (23.8- 24.0 % HL vs. 29.6- 36.7).

Barbus chrysopoma (Valenciennes) differs from the new species in a number of characters. In *B. chrysopoma* pre dorsal region is equally arched (vs. not equally arched in *Systomus rufus*), four undivided rays present in dorsal fin (vs.3), pectoral rays are 15 (vs. 16), lateral line scales are 28 (vs. 30), dorsal arises mid-way between the snout and base of caudal (vs. nearer to caudal fin base than snout tip) and ventral fin orange in color and the other fins grey (vs. dorsal fin light green, pectoral and ventral fins deep red, upper half of anal red and remaining part light brownish white).

Barbus gibbosus can be distinguished from the present species in many taxonomic characters; in *B. gibbosus* pre dorsal scales are 9 (vs. 11- 12 in *S. rufus*), body height 3.5 in TL (vs. 3.1- 3.2 in TL and 2.4- 2.6 in SL), head length 6 in TL (vs. 4.5- 4.7 in TL and 3.5- 3.8 in SL) and eye diameter 4 in HL (vs. 4.9- 5.0).

Systomus chryseus sp. nov. can be easily distinguished from *Systomus rufus* in having an elongated body with lesser height (body height at dorsal fin 25.0- 28.6 % SL vs. 39.2- 41.5 in *S. rufus*). In *Systomus chryseus* head width greater (64.9- 71.9 % HL vs. 53.3- 59.3 in *S. rufus),* snout shorter (27.0- 29.0 % HL vs. 29.6- 36.7), pectoral fin long, 19.9- 22.4 % SL and it reach pelvic fin origin (vs. pectoral short, 15.7- 16.0 % SL and it never reach pelvic fin origin), caudal peduncle longer (17.3- 21.4 % SL vs. 13.7- 14.2) and body yellowish golden in color (vs. brownish).

3.3.8. Conclusion

Most of the freshwater fishes of Kerala were originally described from northern parts of Kerala; many foreign scientists including Jerdon [3], Day [4] and Valenciennes [10] discovered, named and described many fishes from rivers north of Cochin. Taxonomic studies conducted on fishes of rivers south of Cochin are very rare. Recently a number of fishes have been discovered from the central and southern regions of Kerala; *Puntius madhusoodani* Kumar et al, *Puntius viridis* Plamoottil & Abraham, *Macrognathus fasciatus* Plamoottil & Abraham, *Macrognathus albus* Plamoottil & Abraham, *Mystus heoki* Plamoottil & Abraham, *M. indicus* Plamoottil & Abraham, *M. menoni* Plamoottil & Abraham, *M. keralai* Plamoottil & Abraham, *Glyptothorax elankadensis* Plamoottil & Abraham etc are some of them. It is interesting to note that all the above fishes were described from a single river namely Manimala River. The presently described cyprinid fishes are also new additions to the fish fauna of the same river. It re-emphasizes this area's importance as a

biodiversity hotspot of freshwater fishes. It is expected that more fishes will be described from Kerala state in coming years.

3.3.9. Comparative material

3.3.9.1. ***Systomus sarana****:* ZSI/F 4317, 2 examples, Imphal River, Manipur, A. G. K. Menon, 1963; ZSI/F 13430, 1 example, 84mm SL, Kalimpong Duars, Siliguri Teesta River, coll. S. L. Hora; ZSI/F 12558- 12560, 3 examples, Darna River, coll. A. G. L. Fraser, 20 oct, 7 nov and 26 dec, 1935; ZSI/F 11399, 1 example, Stream below Darjling, Himalayas, coll. G.E. Shaw & E. O. Shebbeare.

3.3.9.2. ***Systomus subnasutus*****:** ZSI/F 1551, 1 example, Kokamurihee, Pondicherry, coll. A. G. K. Menon, 06.03.1958; ZSI/F 1549, 2 examples, Gadilaru River, Guddallore, Arcot Dt, Madras State, coll. A. G. K. Menon, Pondicherry-Karakkal Survey, 1958; ZSI/WGRC/IR 1132O, 1 example, Chaliyar River, K. C. Gopi.

3.3.9.3. ***Puntius pinnaurarus***: PCMP/10, 2 examples, 86.5-90.5 mm SL, Nandikkara, Thrichur, coll. Mathews Plamoottil, 01.02. 2014.

3.3.9.4. ***Barbus chrysopoma*****;** PCMP/ 11, 150 mm SL, Arattupuzha, Thrichur, Kerala, coll. Mathews Plamoottil

3.3.9.5. ***Systomus spilurus***: ZSI/F 2181/2, 1 example, 28 mm SL, SriLanka, coll. A. G. K. Menon. ***Systomus gibbosus:*** PCMP/ 12, 160.0 mm SL, Aleppey, Kerala.

3.3.9.6. ***Systomus orphoides***: ZSI/F 5459/1, 1 example, 79 mm SL Prome, coll. Francis Day; ZSI/F 5466/1, 1 example, Burma, coll. Francis Day. ZSI/F 9370/1, 5 examples, Fort Steadman, Inle Lake, S. Shan States, coll. N. Annandale.

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