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FISHES OF KALAKAD WILDLIFE SANCTUARY, TIRUNELVELI DISTRICT, TAMIL NADU, INDIA, WITH A REDESCRIPTION OF *HORALABIOSA JOSHUAI* SILAS

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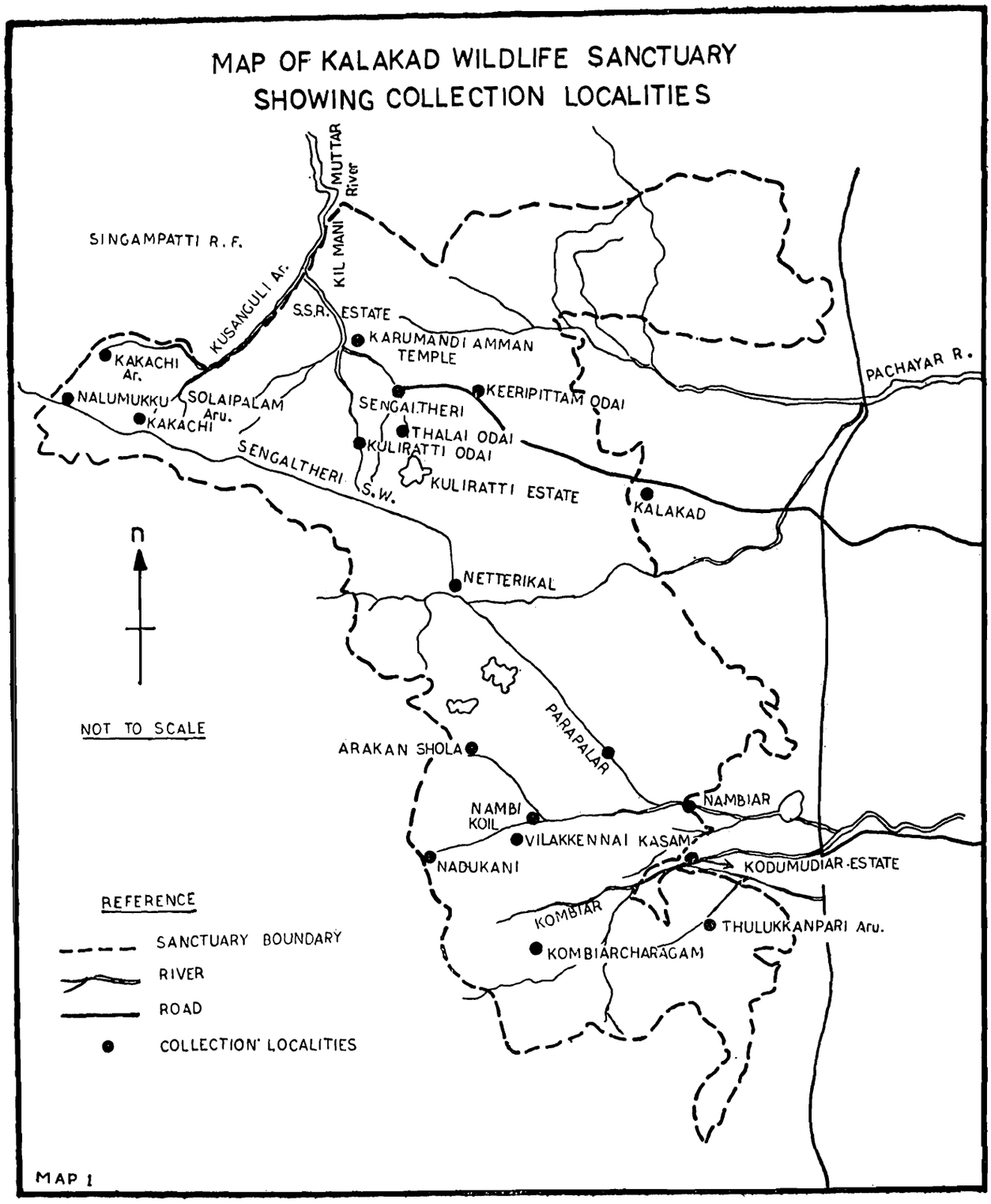
Introduction

Faunistic tours were conducted for the first time by the Southern Regional Station of the Zoological Survey of India, Madras, to Kalakad Wildlife Sanctuary during 1984 through 1987. Earlier reports of fishes from Tirunelveli District includes those of Silas (1953). He described 9 species from the head-waters of the Tambraparni River which drains the eastern face of the "Singampatty hill range" and from the Tambraparni watershed, Tirunelveli District. Of these, two were new to science viz. *Horalabiosa joshuai* gen. et sp. nov. and *Puntius arulius tambraparni* sub sp. nov. The present collection from the little explored Kalakad Wildlife Sanctuary (which includes the "Singampatty hill range" also), Tirunelveli District comprises of 19 species including one new species *Garra kalakadensis* Rema Devi (in press). The rich collection of different size groups of *Horalabiosa joshuai* Silas from different drainages and altitudes has facilitated its redescription. *Esomus thermoicos* (Val.) known from Ceylon is reported here along with 12 other species including the hill stream fish *Bhavania australis* (Jerdon). Colour variation in *Aplocheilus lineatus* (Val.) is also reported herein. In the systematic account of the species are included the first reference, material examined, length range in mm SL, date of collection, altitude in metres, register no., systematic remarks and distribution.

Physiography of The Kalakad Sanctuary

The Kalakad Wildlife Sanctuary is located in Nanguneri Taluk, Tirunelveli District of Tamil Nadu and lies between latitudes 8°25'N and 8°35'N and longitudes 77°25'E and 77°35'E. The sanctuary comprises the whole of the Kalakad Reserve Forests. The hills are covered with dry deciduous forest on the lower slopes and evergreen (shola type) forests on the upper reaches, traversed by rivers and mountain streams. Across the eastern slope of the sanctuary, the rivers Kodumudiar, Nambiar, Netterikal and Pachayar flow eastwards. The Kilmanimuthar with its tributaties, the Kulirattiar and Kusanguliar traverse the western aspect of the sanctuary. The highest peak is the Kalakad peak (1775 m) and the other noteworthy peaks are Velimalai (1011 m), Kakachi (1233 m), Netterikal (1350 m), Kuliratti (1396 m) and Thiruvannamalai peak (1378 m).


MAP OF KALAKAD WILDLIFE SANCTUARY
SHOWING COLLECTION LOCALITIES
MUTTAR River
KIL MANI
SINGAMPATTI R.F.
KUSANGULI Ar.
S.S.R. ESTATE
KARUMANDI AMMAN TEMPLE
KAKACHI Ar.
NALUMUKKU
SOLAIPALAM Aru.
KAKACHI
SENGALTHERI
KEERIPITTAM ODAI
THALAI ODAI
KULIRATTI ODAI
SENGALTHERI S.W.
KULIRATTI ESTATE
PACHAYAR R.
KALAKAD
N
NETTERIKAL
NOT TO SCALE
PARAPALAR
ARAKAN SHOLA
NAMBI KOIL
NAMBIAR
VILAKKENNAI KASAM
NADUKANI
KODUMUDIAR ESTATE
KOMBIAR
THULUKKANPARI Aru.
KOMBIARCHARAGAM
REFERENCE
SANCTUARY BOUNDARY
RIVER
ROAD
COLLECTION LOCALITIES
MAP 1

SYSTEMATIC ACCOUNT

1. **Danio aequipinnatus** (McClelland)

1839. *Perilampus aequipinnatus* McClelland, *Ind. Cyp.* p. 393, pl. 60, fig. 1.

Type locality : Assam.

Material : 268 exs., 9.0-72.0 mm SL, 190 m-1320 m. (9 exs., F. 637, Nalumuku Kakachi Rd., 1140 m, 6.9.85 ; 150 exs., F. 639, Kakachi, 1320 m, 7.9.85 ; 14 exs., F. 635, between kakachi and Nalumuku solaipalam aru, 9.9.85 ; 13 exs., F. 638, along solaipalam aru, Nallankadu, 1120 m, 11.9.85 ; 3 exs., Pachayar near Thalaiaru, 190 m, 12.2.86 ; 15 exs., F. 654, Karikaran Thondu, Pachayar, 200 m, 13.2.86 ; 17 exs., F. 663, along the course of Nambiar upto Nambikoil, 190 m-350 m, 21.8.86 ; 4 exs., F. 666, along the course of Nambiar upto Nambikoil, 190-350 m, 21.8.1986 ; 35 exs., F. 704, Vilakkennai kasam, 300 m, 8.1.87 and 8 exs., F. 683, alcng Nambiar on way to Nambikoil, 260 m, 9.1.87).

Diagnostic features : D 2/10-11 ; A 3/13-16 ; L l 34-36, complete ; predorsal scales 17 ; fresh specimens orange in colour with bluish bands.

Distribution : India : Eastern Himalaya, Meghalaya and Deccan ; Nepal ; Bangladesh ; Myanmar ; Tenasserim provinces ; Thailand ; Sri Lanka.

2. **Esomus thermoicos** (Valenciennes)

(Plate 1, Fig. 1)

1842. *Nuria thermoicos* Cuvier and Valenciennes, *Hist. Nat. Poiss.*, XVI, p. 238.

Type locality : Sri Lanka.

Material : 10 exs., 35.0-37.0 mm SL, F. 3528, Karungal kasam, 250 m, 10.1.87.

Description : D 2/6 ; A 3/5 ; P 1/10-11 ; V 1/7 ; C 1/17/1 ; lateral line 33-34 (pored upto 30-32 scales) ; predorsal 18-20 ; preventral 21-22 ; rostral barbel extends upto posterior margin of eye ; maxillary barbel extends almost upto pectoral tip and in one specimen, 36.0 mm SL, it extends beyond ventral origin. Head 3.58 (3.40-3.70), depth of body 4.68 (4.36-5.18), predorsal distance 1.48 (1.42-1.56), postdorsal distance 2.86 (2.71-3.11), preventral distance 1.86 (1.80-1.94), preanal distance 1.40 (1.36-1.45), height of dorsal 5.46 (5.08-5.84), length of pectoral 3.57 (3.44-3.71), length of pelvic 6.94 (6.12-7.35), length of anal 5.15 (4.76-5.81), length of caudal peduncle 4.85 (4.59-5.34), height of caudal peduncle 10.10 (9.31-11.71), length of rostral barbel 10.51 (9.68-12.80) and length of maxillary barbel 2.38 (2.0-2.65) in standard length. Height of head 1.64 (1.54-1.74), snout 3.93 (3.73-4.06), eye diameter 4.23 (3.77-4.95) and interorbital width 2.86 (2.67-3.05) in head length ; width of body 1.69 (1.54-1.86) in depth of body ; postdorsal distance 1.93 (1.73-2.19) in predorsal distance. Sides with a black band ; abdomen dark in colour.

Affinities and distribution :

Esomus danrica thermoicos (Val.) is known only from Sri Lanka (Deraniyagala, 1952). Silas (1952) considers this a subspecies of *E. barbatus* (Jerdon), a peninsular form which lacks the lateral band. The material in the present collection answers to the description of *E. thermoicos* (Val.) mainly in the characteristic lateral band and in the predorsal row of scales (17 in *E. barbatus*).

3. **Rasbora daniconius** (Hamilton)

(Plate 1, Fig. 2)

1822. *Cyprinus daniconius* Hamilton, *Fish Ganges*, p. 327, pl. 15, fig. 89.

Type locality : Rivers of South Bengal.

Material : 86 exs., 17.0-84.0 mm SL, 100-350 m. (8 exs., F. 642 and F. 647, Keeripittam odai, 100 m, 9.2.86 ; 5 exs., F. 656, Pachayar near Thalaiaru, 190 m, 12.2.86 ; 1 ex., F. 655, Karikaran thondu, Pachayar, 200 m, 13.2.86 ; 11 exs., F. 664 and F. 665, along the course of Nambiar upto Nambikoil, 190-350 m, 21.8.86 ; 5 exs., F. 668, Thulukkan parai aru, 300 m, 23.8.86 ; 7 exs., stream near Kodumudiar estate, 200 m, 26.8.86 ; 12 exs., F. 684 and F. 690, along Nambiar on the way to Nambikoil, 260 m, 9.1.87 ; 4 exs., F. 691, Thulukkan parai, 240 m, 12.1.87 ; 27 exs., F. 681, Kombiar charagam, Thakkaru, 210 m, 13.1.87 and 6 exs. F. 682, Nambiar on the way to Nambikoil, 190-250 m, 14.1.87.)

Remarks : Lateral line with 33 pored scales ; predorsal scales 14 ; L. tr 5/2-2½ ; head length 3.55 (3.33-3.70), body depth 4.0 (3.82-4.13), predorsal distance 1.80 (1.75-1.87) and postdorsal distance 2.15 (2.1-2.2) in standard length ; postdorsal in predorsal distance 1.19 (1.16-1.26). Body with a bold lateral band from tip of snout to the fork of the caudal fin, a dark streak on mid dorsal surface, the first few scales along the lateral line have dark bases.

Distribution : Throughout India ; Pakistan ; Nepal ; Bangladesh ; Sri Lanka ; Myanmar ; Malay Archipelago and Zanzibar.

4. **Rasbora caverii** (Jerdon)

(Plate 1, Fig. 3)

1848. *Leuciscus caverii* Jerdon, *Madras J. Lit. & Sci.*, 15, p. 320.

Type locality : Cauvery river, Coorg State.

Material : 10 exs., 21.0-61.0 mm SL, 150-250 m. (9 exs., 21.0-61.0 mm, F. 687, Karungal kasam, 250 m, 10.1.87 and 1 ex., F. 698, stream near Kodamadi estate, 150 m, 15.1.87)

Remarks : Of these specimens the largest 60.0 mm SL has a short dorsal-hypural distance as characteristic of *R. caverii*. In the juveniles this character is found to be

subject to variation and these specimens differ very little from *R. daniconius*. The predorsal scales are more in number 16 (14 in daniconius). Lateral line with 33-35 pored scales ; lateral transverse 6/1½/2-2 ; head length 3.86 (3.57-4.14), body depth 4.62 (4.33-5.16), predorsal distance 1.75 (1.70-1.79), postdorsal distance 2.23 (2.09-2.41) in standard length ; postdorsal 1.28 (1.25-1.42) in predorsal. The lateral band is less faint and narrower and there are no faint stripes above and below this as in *daniconius*. These specimens differ from *daniconius* chiefly in the more number of predorsal scales and in its body depth.

Distribution : India : Southern India, notably Karnataka especially the Cauvery basin ; Sri Lanka.

5. **Puntius bimaculatus** (Bleeker)

(Plate 1, Fig. 4)

1864. *Gnathopogon bimaculatus* Bleekeer, *Verh. Nat. Holl. Maatsch. Haarlem* (2), xx, p. 17.

Type locality : Sri Lanka.

1868. *Puntius (Capoeta) puckelli* Day, *Proc. Zool. Soc. London,* : 197.

Type locality : Bangalore.

Material : 10 exs., 25.0-35.0 mm SL, 100-260 m. (2 exs., F. 3513, Keeripittam odai, 100 m, 9.2.86 ; 2 exs., F. 3512, along Nambiar on the way to Nambikoil, 260 m, 9.1.87 and 6 exs., F. 3510, stream near Kodamadi estate, 150 m, 15.1.87.

Remarks : D 3/7 ; P 1/12-14 ; V 1/6-7 ; C 1/17/1 ; L1 23-26 ; L tr 4-5/3-3½/2 ; predorsal scales 8-9½/2. A spot in dorsal base from the 3rd to the 7th branched rays and one on caudal base. These specimens agree in most details to *P. puckelli* Day. A note on *P. bimaculatus* (Blkr.) (=*P. puckelli* Day) from Javadi hills is published elsewhere.

Distribution : Peninsular India, Sri Lanka.

6. **Puntius chola** (Hamilton)

1822. *Cyprinus chola* Hamilton, *Fish Ganges*, p. 312, 389.

Type locality : North-Eastern parts of Bengal.

Material : 5 exs., 39.0-45.0 mm SL, F. 3511, Stream near Kodamadi estate, 150 m. 15.1.87.

Remarks : Suborbital sensory canal pores radiating from eye in short rows are observed also in these specimens.

Distribution : Throughout India ; Pakistan ; Bangladesh ; Myanmar ; Sri Lanka.

7. **Puntius dorsalis** (Jerdon)

(Plate 1, Fig. 5)

1849. *Systomus dorsalis* Jerdon, *Madras J. Lit. & Sci.*, pp. 314, 316.

Type locality : Madras.

Material : 94 exs., 13.0-52.0 mm SL. 100-1100 m. (3 exs., F. 628. stream near Nalumuku estate, 1100 m, 4.9.85 ; 16 exs., F. 629, Nalumuku estate, 1100 m, 11.9.85 ; 14 exs., F. 641, Keeripittam odai, 100 m, 9.2.86 ; 2 exs., Poochithondu odai, Mudalliruppan bridge, 10.2.86 ; 6 exs., Pachayar near Thalaiar, 190 m, 12.2.86 ; 39 exs., F. 662, Aruval theeti odai, 185 m, 14.2.86 and 14 exs., F. 697, stream near Kodamadi estate, 150 m. 15.1.86).

Remarks : These specimens conform to *P. dorsalis* (Jerdon) in most of its meristic and morphometric characters and in the general body colouration. However, it differs in the presence of articulated dorsal and the dark spot before caudal base, characters attributable to young ones (Hora, 1936). Another feature observed in these specimens from Kalakad is the presence of numerous vertical sensory canal pores radiating from eye.

Distribution : South India, Rajasthan ; Sri Lanka.

8. **Puntius sarana subnasutus** (Valenciennes)

1865. *Cyclochelichthys pinnauratus* Day, *Proc. Zool. Soc. London*, p. 300 ; *Fish Malabar*, p. 209, pl. 15, fig. 2.

Type locality : Wynaad.

Material : 2 exs., 54.0 mm and 123.0 mm SL. F. 685 and F. 699. along Nambiar on the way to Nambikoil, 260 m, 9.1.87.

Distribution : India : Peninsular India, South of Krishna river, Goa ; Sri Lanka.

9. **Puntius ticto punctatus** (Day)

1822. *Cyprinus ticto* Hamilton, *Fish Ganges*, pp. 314. 389, pl. 8, fig. 87.

Type locality : Southeastern parts of Bengal.

Material : 1 ex., 39.0 mm. SL. F. 660, Pachayar near Thalaiyaru, 190 m, 12.2.86.

Diagnostic features : D 3/8 ; P 1/13 ; V 1/7/1 ; A 3/5 ; L l 25-26 ; L tr $5/3^{1}/2$; predorsal scales 9 ; a black spot below lateral line behind opercle on the 3rd scale, a diffused black ocellus on caudal peduncle ; each scale on body with a black base ; the lateral line is complete.

Distribution : Peninsular India.

10. **Horalabiosa joshuai** Silas

(Plate 2, Figs. 1 & 2)

1953. *Horalabiosa joshuai* Silas, *Rec. Ind. Mus.*, 51 : 28-33.

Type locality : Headwaters of Tambraparni river, Tirunelveli.

Material : 598 exs., 12.0-90.0 mm SL, 730-1330 m. (28 exs., F. 585, Sengaltheri east, 900 m, 19.8.84 ; 17 exs., F. 612, Sengaltheri west, 730 m, 20.8.84 ; 6 exs., F. 590, arround Sengaltheri, 980 m, 21.8.84 ; 11 exs., F. 597, Sengaltheri south east in Kuliratti odai ; 22.8.84 ; 20 exs., F. 596, Sengaltheri east, Thalai odai ; 850 m, 23.8.84 ; 50 exs., F. 599, Sengaltheri south east, 870 m, 24.8.84 ; 31 exs., F. 588, Sengaltheri to Kakachi path, 1200 m, 25.8.84 ; 8 exs., F. 602, Karumandi Amman temple, Sengaltheri, 970 m, 26.8.84 ; 12 exs., F.601, Thalaiodai, Sengaltheri east, 850 m, 19.11.84 ; 15 exs., F. 607, rocky pool in front of Karumandi Amman temple, 1000 m, 20.11.84 ; 11 exs., F. 604, Karumandi Amman temple, west of Sengaltheri rest house, 970 m, 24.11.84 ; 8 exs., F. 608, east of Sengaltheri along the course of Pachayar, 840 m, 25.11.84 ; 7 exs., F. 616, Kilmanimutharu, 740 m, 28.2.85 ; 14 exs., F. 617 & F. 623, Pachayar, 840 m, 2.3.85 ; 8 exs., F. 622, way to Netterikkal, 1330 m, 3.3.85 ; 23 exs., F. 621, Pachayar, 890 m, 4.3.85 ; 19 exs., F. 619, Pachayar, 890 m, 6.3.85 ; 36 exs., F. 632, way to Kakachi from Nalumuku, 1200 m, 5.9.85 ; 32 exs., Nalumuku kakachi road, 1140 m, 6.9.85 ; 147 exs., F. 634, along Solaipalam aru, stream, on the way to kakachi from Nalumuku, 1130 m, 8.9.85 ; 26 exs., F. 626, way to kakachi from Nalumuku, 1080 m, 9.9.85 ; 13 exs., F. 625, nullah near 10 acres tea estate, 1030 m, 10.9.85 ; 11 exs., F. 630, stream near Nalumuku estate, 1100 m, 11.9.85 ; 8 exs., F. 627, along Solaipalam aru, Nallankadu, 1120 m, 11.9.85 ; 1 ex., F. 651, Poochi thondu odai, Mudaliruppan bridge, 10.2.86 ; 12 exs., F. 650, Thalaiodai, 810 m, 11.2.86 ; 17 exs., F. 703, Pachayar, east of Sengaltheri, 850 m, 25.4.87 ; 6 exs., Sengaltheri to Kuliratti aru, 890-900 m, 26.4.87 ; and 1 ex., Nature trail to Karumandi Amman temple, 900-980 m. 27.4.87).

Redescription : D 3/7-8 ; P 1/12-14 ; V 1/6-7/1 ; A 2-3/5 ; C 19 ; L l 32-35 ; predorsal scales 10-12 ; L tr 4-4½ and 2½-3½. Body moderately elongate ; dorsal profile convex to slightly compressed, its greatest height below the commencement of the dorsal fin 5.81 (5.08-7.22) in total length, 4.45 (3.92-5.56) in standard length ; head small, rounded anteriorly, somewhat depressed, its length 4.59 (4.00-5.08) in total length, 3.53 (3.09-3.92) in standard length ; height of head 1.59 (1.27-1.76), width of head 1.41 (1.23-1.70), eye diameter 4.42 (3.40-5.75), interorbital width 2.35 (1.50-2.77), snout 2.70 (2.39-3.17) in length of head ; eye in snout 1.65 (1.27-2.28), in interorbital 1.88 (1.37-2.63) ; eye is of moderate size but comparatively larger and anterior in position in young specimens, with increase in length of fish the eye becomes proportionately smaller and is placed more or less in the centre. Well developed rostral groove is present separating the upper lip from the rostrum ; lips are moderate to well developed, thick and fleshy at the angles where they are continuous and minutely

papillated ; post labial groove is interrupted in the middle ; post labial callous pad extends to almost half the distance between the anterior end of the lower jaw and the isthmus. Length of pad 3.54 (2.92-4.57), width of mental pad 4.57 (3.60-5.81) in head length ; width of callous pad 1.30 (0.83-1.75) in its own length. In fishes from higher altitudes the pad is thickened along its anterior end into a hood-like structure (in fishes above 35.0 mm SL), in lower altitudes this structure is observed in fishes of greater length range only. However in some fishes collected in Sengaltheri east, Thalaiodai, 850 m. the hood-like structure was not well developed even in the largest specimen collected i. e. 50.0 mm. SL. Incidently specimens collected from this locality answers exactly to the description given by Silas (1953), the maximum length of the fish collected and studied by him was 65.0 mm TL. Anteriorly the callous pad is confluent with the lower lip at the symphysis while posteriorly its margin is slightly lobed and somewhat free ; the surface of the fleshy pad is minutely and sparcely papillated.

The rostral and maxillary barbels are well developed, the former is equal to or a little less than diameter of eye, does not reach the anterior border of the eye, while the latter is much longer than the diameter of eye and extends to beyond the posterior margin of eye. Scales are of moderate size ; sensory canal pores well developed in fishes found in lower altitudes.

Height of dorsal 1.01 (0.83-1.19), anal 1.26 (0.75-1.63) in body depth ; base of dorsal 7.39 (6.38-9.43), base of anal 12.86 (10.0-17.90) in standard length ; length of pectoral 4.02 (3.42-5.10), pelvic 4.75 (4.09-6.00), predorsal distance 1.94 (1.75-2.09) in SL ; postdorsal in predorsal distance 1.00 (0.93-1.15). Length of body cavity 1.95 (1.74-2.23) in SL. distance from vent to anal fin 3.99 (2.50-5.99) in the distance between pelvic to anal fin ; height of caudal peduncle 1.24 (0.92-1.60) in its length ; air bladder 3.56 (3.27-3.81) and length of intestine 1.07 (0.83-1.33) in TL in six specimens measured from an altitude of 730 m.

Distribution : India, Western Ghats of Tirunelveli District.

Discussion : Silas (1953) described a new genus and species, *Horalabiosa joshuai* from the Western Ghats of Tirunelveli District, Madras State, at a general elevation of 4000 above sea level, from the head-waters of the Tambraparni river at Singampatty, which drains the eastern face of this hill range. This is characterized by the presence of a post-labial callous structure in the mental region which is minutely and sparcely papillated. Silas (*op. cit.*) while remarking on the resemblance of this genus *Horalabiosa* to *Garra* observed that the main differences were in the nature of the rostrum (a rostral groove is present in the former), the mental region and the gut length/body length ratio. His description was based on 13 specimens (27.0-49.0 mm SL). The present collections from Kalakad Wildlife Sanctuary collected from different drainages and altitudes which flow into the Tambraparni river constitutes several specimens ranging from 12.0-90.0 mm SL some of which exhibit a few variations. Hence it is felt

desirable to redescribe the species. Of the different fish genera found in the headwaters of Kalakad, *Horalabiosa* is the most well established.

Marked differences in the general shape and certain other characters were observed in specimens collected from higher altitudes ; the typical and most commonly found form has an arched back (Fig. 1, Plate 2) whereas in specimens collected from Sengaltheri east which answer to the original description, the dorsal profile is almost straight and in some specimens collected from the same locality the back is slightly flexed inwards and mouth widely opened, which may be the result of contortion in the fish on death. A striking difference is seen in the nature of the callous pad in the mental region between populations collected from Sengaltheri to Kakkachi path, at an altitude of 1200 m. The callous pad is longer than broad in young forms and in the adults it is more or less squarish. The major differences observed in specimens from Sengaltheri east are the slightly smaller head, subterminal mouth, less muscular and less well developed pectoral and pelvic fins, shortened predorsal distance and the straight or slightly arched dorsal contour, compared to the specimens collected from other regions and altitudes which has a longer head, subterminal mouth with snout projecting beyond this on ventral side, the encapsulated callous pad, well developed and highly muscular fan-shaped and longer paired fins and convex dorsal profile.

To ascertain whether any specific differences between this and other populations, samples collected from 3 different altitudes and drainages were compared. For this study 22 morphometric characters were measured (no variation was observed in meristic characters) and statistically analysed following Snedecor (1961). The variance ratio test was employed to compare the means of two samples from normal population and the students t-Distribution was done to study the significance in variation.

The 26 body proportions studied were : head width, height of head, length and width of callous pad, eye diameter, interorbital width and snout length in relation to head length ; body depth, head length, length of pectoral and pelvic fins, predorsal distance, distance from pectoral base to anus, base of dorsal and anal fins in relation to SL ; length to width ratio of callous pad ; length of snout and interorbital width in relation to eye ; height of dorsal and anal fins in relation to body depth ; the distance from anus to anal fin in the distance between pelvic to anal fins ; height of caudal peduncle in relation to its length ; predorsal/postdorsal ratio and length of caudal fin in total length.

Comparative study of the samples collected from different altitudes and localities revealed that specimens collected from Sengaltheri east showed some differences to specimens collected from Pachaiyar and specimens from between Sengaltheri and Kakachi and Sengaltheri west, in the nature of the callous pad, snout length, eye diameter, length of paired fins, height of dorsal and in the length of the body cavity.

In order to find out whether any specific differences existed between populations from different altitudes the students t-Distribution was employed and differences were observed in 4 characters as in Table 2. Fishes collected from 1200 m (Sample A) showed significant difference from samples from 850 m (Sample C) in the length of body cavity (distance from pectoral base to anal) and in the position of anus in relation to pelvic and anal fin. Samples from 890 m (sample B) showed an intermediate character. From this it could be deduced that probably life in higher altitudes has brought about certain adaptive changes as in the better developed paired fins and the position of the anus being shifted towards the anal fin, probably to provide greater ventral surface for adhesion to the substratum.

From Table 1 it is seen that populations from 900 m also show greater similarity to those from 850 m. This could be possible since specimens from 900 m and 850 m were collected from Sengaltheri east ; on the other hand populations from Sengaltheri west, Pachaiyar and those from Sengaltheri to Kakachi path showed greater affinity to one another inspite of altitudinal difference.

From this study it could be concluded that though slight altitudinal variations were observed, greater differences were observed between those from different drainages, and the phenetic differences could be attributed to the differences in ecological conditions of the different water bodies and segregation of population for a long period of time. While redescribing *Horalabiosa* the mean of all these samples have been taken into account to include the wide range in the morphometic characters.

Subfamily : Garrinae

11. **Garra kalakadensis** Rema Devi

Garra kalakadensis Rema Devi, *Rec. Zool. Surv.*, 8 pp., pl. 1, figs. 2., Table 1, (in press).

Type locality : Kalakad Wildlife Sanctuary, Tirunelveli Dt.

Material : 642 exs., 17.0-77.0 mm, 190-1000 m. (38 exs., F. 584, Sengaltheri east, 900 m, 19.8.84 ; 1 ex., F. 586, Sengaltheri south west, 850 m, 20.8.84 ; 36 exs., F. 595, Sengaltheri east, Kulliratti odai, 850 m, 22.8.84 ; 11 exs., F. 611, Sengaltheri east, Thalaiodai, 850 m, 23.8.84 ; 9 exs., F. 592, in front of Karumandi Amman temple, 970 m, 26.8.84 ; 26 exs., F. 594, Sengaltheri west, 730 m, 20.9.84 ; 6 exs., F. 605, Sengaltheri east, Thalai odai, 850 m, 19.11.84 ; 7 exs., F. 606, Karumandi Amman temple, 1000 m, 20.11.84 ; 17 exs., F. 603, Karumandi Amman temple, west of Sengaltheri guest house, 970 m, 24.11.84 ; 23 exs., F. 624, Pachayar, 840 m, 2.3.85 ; 5 exs., F. 633, way to Kakachi from Nalumuku Solaipalam aru, 1080 m, 9.9.85 ; 11 exs., F. 631, stream near Nalumuku Estate, 1100 m, 11.9.85 ; 154 exs., F. 643, Keeripittam odai, 4 km from Sengaltheri road, 100 m, 9.2.86 ; 38 exs., F. 648, Thalai odai, 810 m, 11.2.86 ; 4 exs., along the course of Nambiar upto Nambikoil, 190-350 m, 21.8.86 ; 1 ex., Kombiaru, Thakkaru charagam,

TABLE 1. Comparison of morphometric characters of populations of *Horalabiosa joshuai* Sailas from different altitudes and drainages.

Altitude : Locality :	1200 m Between Sengal-theri and Kakachi	900 m Sengal-theri east	890 m Pachayar	850 m Sengal-theri east, Thalai-odai	730 m Sengal-theri west
Characters					
TL/body depth	6.00	5.63	5.84	5.70	5.86
SL/body depth	4.55	4.31	4.47	4.42	4.50
TL/head length	4.67	4.61	4.66	4.31	4.71
SL/head length	3.55	3.53	3.58	3.35	3.63
Head length/head width	1.33	1.43	1.34	1.46	1.50
Head length/height of head	1.62	1.57	1.64	1.57	1.56
Head length/length of mental pad	3.55	3.41	3.82	3.29	3.63
Head length/width of mental pad	4.62	4.43	4.30	4.70	4.80
Length of mental pad/width of mental pad	1.31	1.31	1.14	1.44	1.32
Head length/eye diameter	4.60	4.24	4.66	4.35	4.27
Head length/interorbital width	2.16	2.32	2.43	2.35	2.50
Head length/length of snout	2.66	2.79	2.54	2.76	2.75
Length of snout/eye diameter	1.73	1.52	1.84	1.57	1.57
Interorbital width/eye diameter	2.06	1.83	1.92	1.85	1.72
SL/length of pectoral fin	3.86	4.01	3.87	4.30	4.06
SL/length of pelvic fin	4.53	4.66	4.69	5.03	4.84
Body depth/height of dorsal fin	0.99	1.03	0.99	1 06	0.98
Body depth/length of anal fin	1.23	1.26	1.18	1.33	1.30
SL/base of dorsal fin	7.32	7.17	7.40	7.79	7.28
SL/base of anal fin	12.94	11.75	14.10	12.89	12.61
SL/predorsal distance	1.96	1.88	1.93	1.92	2.00
Predorsal dist./postdorsal dist.	1.04	1.01	1.01	1.01	0.96
SL/dist. from pectoral base to anus	1.82	2.06	1.96	2.09	1.82
Dist. from pelvic base to anal fin/dist. from anus to anal fin	4.31	4.29	4.08	3.30	3.97
Length of caudal peduncle/height of caudal peduncle	1.36	1.16	1.26	1.20	1.20
TL/length of caudal fin	4.17	4.28	4.27	4.51	4.34

TABLE 2. Comparison of certain morphometric characters of *Horalabiosa joshuai* from three different altitudes using students t-Distribution test.

	A and B d. f. 28	B and C d. f. 28	A and C d. f. 18
Characters			
SL/distance from pectoral fin base to anus	1.4270 not significant	1.1971 not significant	2.0252 significant at 1%
Pelvic to anal fin/ anus to anal fin	0.7190 not significant	2.4385 significant at 5%	3.186 significant at 1%
SL/length of pectoral fin	0.0589 not significant	2.1457 significant at 5%	1.7484 significant at 10%
SL/length of pelvic fin	0.8639 not significant	1.6030 not significant	1.9366 significant at 10%

290 m, 22.8.86 ; 4 exs., Thulukkan parai aru, 300 m, 23.8.86 ; 26 exs., F. 854, Thodathi odai, 390 m, 25.8.86 ; 5 exs., along Nambiar, on the way to Nambikoil, 190-350 m 9.1.87 ; 40 exs., Thulukkanparai, 240 m, 12.1.87 ; 8 exs., Thalai odai, 810 m, 23.4.87 ; 28 exs., F. 856, Karumandi Amman temple, 980 m, 24.4.87 ; 145 exs., F. 852, Pachayar, east of Sengaltheri, 850 m, 25.4.87 ; 1 ex., F. 851, east of Sengaltheri, Pachayar, 850 m, 25.4.87 ; 5 exs., 900-980 m, nature trail to Karumandi Amman temple, 26.4.87).

Holotype : 77.0 mm SL, Reg. No. FF2664 (of the Indian Museum, National type collections of freshwater fishes, Calcutta), Pachayar, east of Sengaltheri, Kalakad Wildlife Sanctuary, Tirunelveli District, Tamil Nadu, 850 m, 25.4.87, Coll. Dr. M. Vasanth.

Relationship : *Garra kalakadensis* differs from the widely distrubuted *G. mullya* (Sykes) in several characters viz. the marked difference in the position of vent which is near to anal fin in the former while in the latter it is well in advance of the anal fin, the mental disc is well developed, head length longer and body slender whereas in *G. mullya* the body is deeper, head shorter and mental disc restricted to the anterior third of the head. The two differ in colour pattern also. *G. kalakadensis* shows some resemblance to *G. lamta* (Ham.) in the presence of well developed lateral tubercular area (secondary sexual character) in the snout, the well developed mental disc and the slender form. However in *G. lamta* (Ham.) the vent is very close to the anal fin, the pectoral fin is shorter and the air bladder is much reduced (Menon, 1864).

12. **Garra mullya** (Sykes)

1841. *Chondrostoma mullya* Sykes, *Trans. Zool. Soc. London*, 2, p. 359, pl. 62, fig. 3.

1864. *Garra mullya*, Menon, *Mem. Indian Mus.*, 14 (4), p. 212.

Type locality : Poona waterways.

Material : 55 exs., 18.0-63.0 mm, 100-1120 m, (2 exs., F. 613, Sengaltheri west, 730 m, 20.8.84 ; 4 exs., F. 589, around Sengaltheri, 980 m, 21.8.84 ; 3 exs., Sengaltheri south east, Kuliratti odai, 850 m, 22.8.84 ; 7 exs., Sengaltheri east, Thalaiodai, 850 m, 23.8.84 ; 6 exs., F. 615, Karumandi Amman temple, Sengaltheri, 470 m, 26.8.84 ; 2 exs., F. 610, Thalai odai, Sengaltheri east, 850 m, 19.11.84 ; 8 exs., F. 587, way to S. S. R. Estate, Sengaltheri west, 21.11.84 ; 5 exs., Pachayar, 840 m, 2.3.85 ; 4 exs., F. 640, along Solaipalam aru, Nallankadu, 1120 m, 11.9.85 ; 1 ex., F. 646, Keeripittam odai, 4 km from Sengaltheri, 100 m ; 4 exs., Poochithondu odai, Mudaliruppan bridge, 10.2.86 ; 5 exs., Parapalar near Pachayar, 240 m, 15.2.86 ; 4 exs., Aruval theeti odai, 185 m, 14.2.86).

Remarks : Occasionally *G. mullya* and *G. kalakadensis* were collected from the same locality. *G. mullya* can be segregated on the basis of the vent being positioned at a greater distance from the anal fin and the mental disc being smaller, less well developed and restricted to the anterior third of the head.

Distribution : Throught India except Assam and Himalaya.

Family : HOMALOPTERIDAE

Subfamily : HOMALOPTERINAE

13. **Bhavania australis** (Jerdon)

1848. *Platycara australis* Jerdon, Madras J. Lit. Sci., 15, p. 333.

Type locality : Waltair.

1987. *Bhavania australis*, Menon, *Fauna India*, Cobitoidea : Homalopteridae. p. 234-236, pl. 9. figs. 5 & 6.

Material : 1 ex., 40.0 mm SL, F. 593, Sengaltheri east, Thalaiodai, 850 m, 23.8.84.

Diagnostic features : D. 2/8 ; P. 7/10 ; V. 2/7 ; A. 2/5 ; C. 19 ; Ll. more than 70 scales, complete ; gill openings small and restricted to above base of pectoral ; 2 pairs of rostral and one pair of maxillary barbels ; behind lower central portion of lip there are two prominent papillae.

Distribution ; India : Western Ghats : Karnataka, Tamil Nadu (Nilgiris, Kalakad, Tiruneveli Dt.) and Kerala.

Subfamily : NOEMACHEILINAE

14. **Noemacheilus triangularis triangularis** Day

1865. *Nemacheilus triangularis* Day, *Proc. Zool. Soc.* p. 295 and Fish India, p. 619, pl. CLIII, fig. 10.

Type locality : Travancore Hills.

1987. *Noemacheilus triangularis triangularis*, Menon, *Fauna India*, Cobitoidea : Homalopteridae, p. 168, pl. 11 figs. 4, 5 & 8.

Material : 42 exs., 29.0-60.0 mm, 153-730 m. (25 exs., F. 930, Karikaran thondu, 13.2.86 ; 5 exs., Pachayar, 12.2.86 ; 2 exs., F. 614, Sengaltheri west, 730 m, 20.8.84 ; 6 exs., F. 694, Vilakkennai kasam, west of Nambikoil, 300 m, 8.1.87 ; 1 ex., F. 686, Thulukkan parai, 240 m, 12.1.87 ; 1 ex., F. 701, Namibiar, on the way to Nambikoil, 190-250 m, 14.1.87 ; 1 ex., F. 693, along Nambiar, 260 m, 9.1.87 ; 1 ex., F. 689, stream near Kodamadi estate, 150 m, 15.1.87).

Remarks : D. 3/7-8 ; P. 10-11 ; A. 3/5 ; C. 1/17/1 ; Showing a slight extension of range in the fin formula than that given by Menon (1987). Barbels are well developed, the outer rostral reaching the anterior, middle or posterior border of eye ; maxillary reaches the posterior border of eye. Body slender being 14.99 (11.65-20.0) percent of SL ; distance from anus to anal fin 20.65 (19.18-22.86) percent or 4.86 (4.37-5.21) times in the distance from pelvic to anal fin as typical of the subspecies *N. triangularis triangularis* (Menon, op. cit.).

Distribution : Peninsular India : Western Ghats, Kallar, Pamba, Periyar, Bharathapuzha drainages and Kalakad, Tirunelveli.

Family : COBITIDAE

Subfamily : COBITINAE

15. **Lepidocephalus thermalis** (Valenciennes)

1846. *Cobitis thermalis* Valenciennes, *Hist. Nat. Poiss.*, 17, p. 78.

Type locality : Sri Lanka.

Material : 27 exs., 19.0-39.0 mm, 150-260 m. (11 exs., Keeripittam odai, 9.2.86 ; 1 ex., F. 692, along Nambiar on the way to Nambikoil, 260 m. 9.1.87 ; 1 ex., F. 700, Nambiar, on the way to Nambikoil, 190–250 m, 14.1.87 ; 10 exs., F. 688, stream near Kodamadi Estate, 150 m, 15.1.87 ; 4 exs., stream near Kodumudi aru Estate, 200 m, 26.8.87).

Distribution : India : South India south of Krishna, Karnataka, Kerala, Tamil Nadu ; Sri Lanka.

Order : SILURIFORMES

Family : BAGRIDAE

16. **Mystus montanus** (Jerdon)

1849. *Bagrus montanus* Jerdon, *Madras J. Lit. & Sci.*, 15 (2), p. 338.

Type locality : Manantody river, Wynaad.

1954. *Mystus* (*Mystus*) *montanus*, Jayaram, *Rec. Indian Mus.*, 51 (4), p. 533.

Material : 10 exs., 43.0-77.0 mm SL. 150-190 m. (2 exs., F. 653, Pachayar near Thalaiaru, 190 m, 12.2.86 ; 2 exs., F. 661, Aruval theeti odai, 185 m, 14.2.86 ; 6 exs., F. 703, stream near Kodamadi estate, 150 m. 15.1.87).

Distribution : Kerala state : Wynaad range of hills, Tamil Nadu : Cauvery head-waters, Kalakad (Tirunelveli Dt.), Madhya Pradesh, Hoshangabad Dt., Assam.

17. **Mystus vittatus** (Bloch)

1797. *Silurus vittatus* Bloch, *Ichthyol. Hist. Nat.*, p. 40, pl. 371, fig. 2.

Type locality : Trancebar.

1954. *Mystus* (*Mystus*) *vittatus*, Jayaram, *Rec, Indian Mus.*, 51 (4), p. 534.

Material : 1 ex., 63.0 mm SL. F. 644, Keeripittam odai, 4 km on Sengaltheri road, 100 m, 9.2.86.

Distribution : Throughout India ; Pakistan ; Myanmar ; Thailand ; Bangladesh ; Sri Lanka.

Superorder : ATHERINOMORPHA

Order : ATHERINIFORMES

Family : CYPRINODONTIDAE

18. **Aplocheilus lineatus** (Valenciennes)

(Plate 2, Figs. 3 & 4)

1846. *Panchax lineatus* Valenciennes, *Hist. Nat. Poiss.*, 18, p. 381.

Type locality : Bombay.

1849. *Aplocheilus rubrostigma* Jerdon, *Madras Jour. L. S.* XV, p. 331.

Material : 24 exs., 12.0-46.0 mm, 150-200 m. (9 exs., F. 652, Pachayar near Thalaiaru, 190 m, 12.2.86 ; 8 exs., F. 699, stream near Kodumudiar Estate, 200 m, 26.8.86 ; 1 ex , F. 705, stream near Kodumudiaru Estate, 200 m, 26 8.86 ; 5 exs., F. 695, stream near Kodamadi Estate, 150 m, 15.1.87 ; 1 ex., stream near Kodumudi aru Estate, 200 m, 26.8.87).

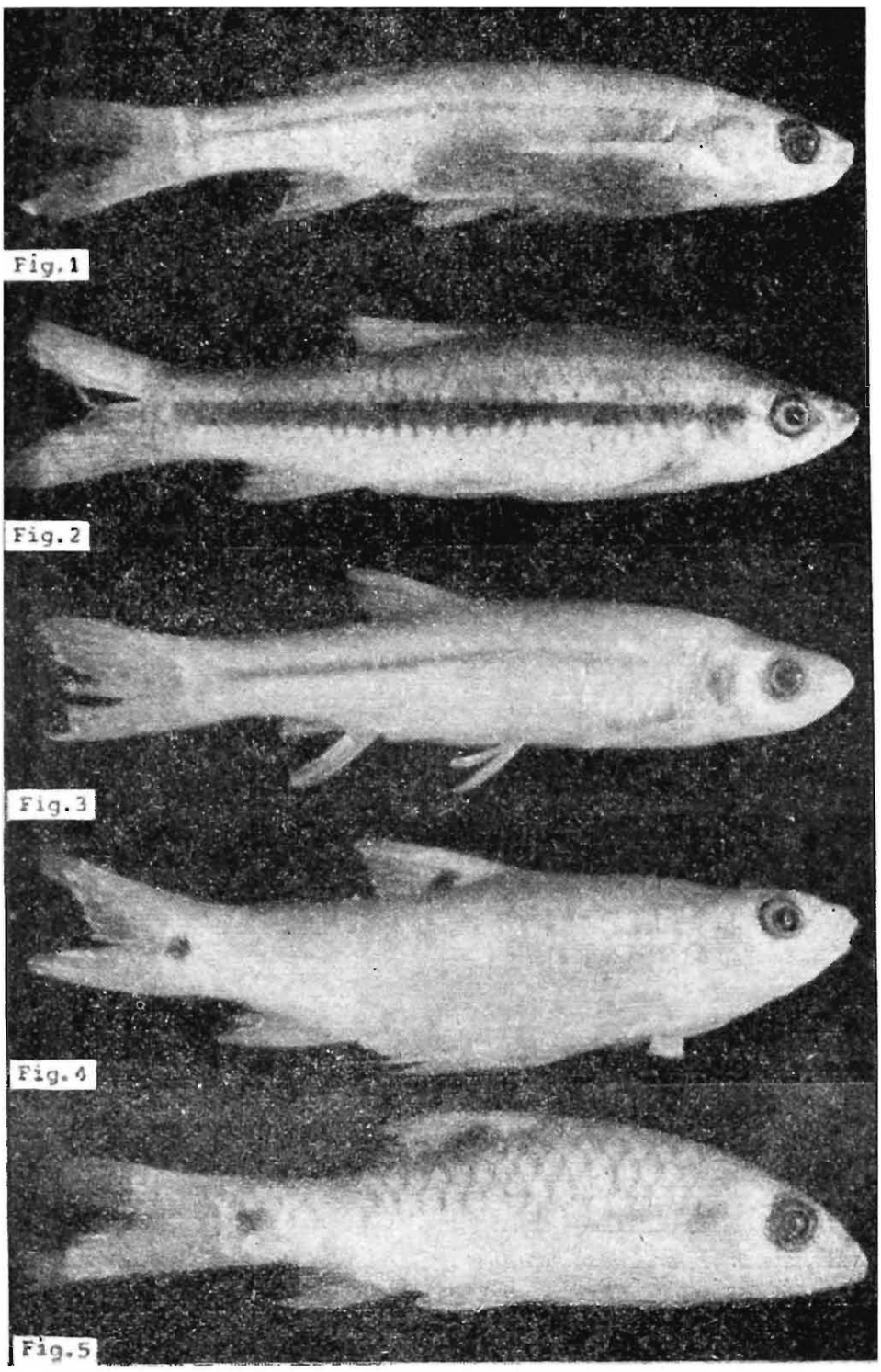


PLATE-1

PLATE 1

Fig. 1. Lateral view of *Esomus thermoicos* (Val.), 35.0 mm SL.
Fig. 2. Lateral view of *Rasbora daniconius* (Ham.), 75.0 mm SL.
Fig. 3. Lateral view of *Rasbora caverii* (Jerdon), 60.0 mm SL.
Fig. 4. Lateral view of *Puntius bimaculatus* (Blks.), 35.0 mm SL.
Fig. 5. Lateral view of *Puntius dorsalis* (Jerdon), 43.0 mm SL.

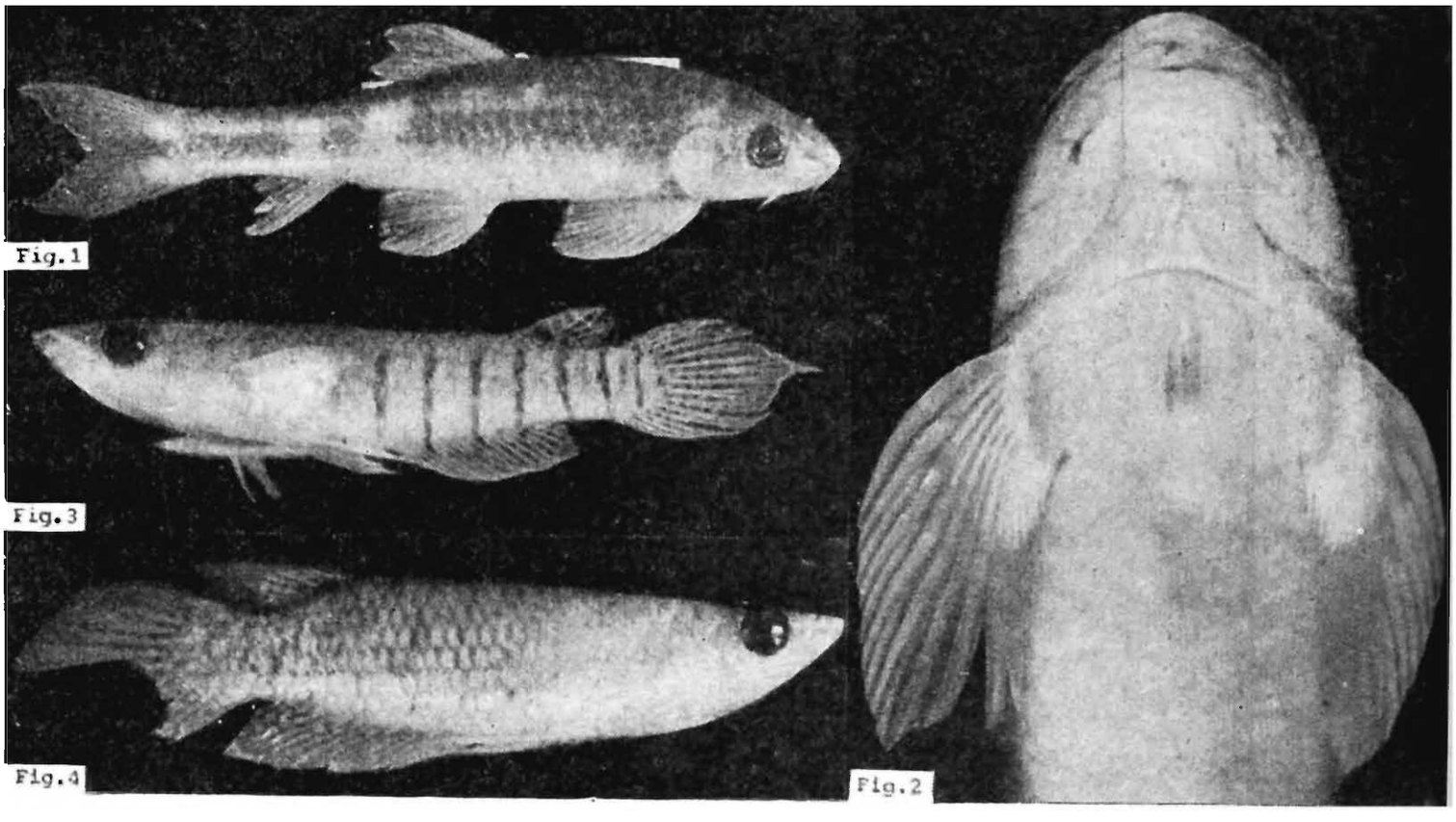


PLATE-2

PLATE 2

Fig. 1. Lateral view of *Horalabiosa joshuai* Silas, 75.0 mm SL.

Fig. 2. Lateral view of *Horalabiosa joshuai* Silas, 90.0 mm SL.

Fig. 3. Lateral view of *Aplocheilus lineatus* (Val.), 55.0 mm SL.

Fig. 4. Lateral view of *Aplocheilus lineatus* (V.), without bonds, 59.0 mm SL.

Remarks : D 8 ; A 16-19 ; L l 29-30 (upto caudal base) ; predorsal scales 24-25. Each scale bordered with black ; 8-10 vertical bands on sides, absent on the upper one third of the body, but almost encircling caudal peduncle ; dorsal with a dark spot on the middle of its base followed above by rows of spots ; anal and caudal fins spotted in radiating rows, pectoral and pelvic fins not spotted ; in larger specimens dorsal blotch extends throughout its base and the bands along the sides disappear or are less prominent and merge with the dark ground colour. Live specimens are irridescent green, eyes are deep green and black and caudal tinged yellow ; in caudal fin three central rays are prolonged ; second branch of second ray of pelvic fin greatly prolonged.

In *A. rubrostigma* of Jerdon the bands are absent and the anal ray count is 17-18. In typical *A. lineatus* the lateral band is of specific nature and the anal ray count is 15-17. In the present collection the colour variation observed in *A. lineatus* (lateral bands merging with the ground colour in larger male specimens) and the range in anal count substantiates that *A. rubrostigma* is a synonym of *A. lineatus*.

Distribution : Peninsular India ; Sri Lanka.

Superorder : ACANTHOPTERIGII

Order : CHANNIFORMES

Family : CHANNIDAE

19. **Channa orientalis** (Schneider)

1801. *Channa orientalis* Schneider, *Syst. Ichth.*, p. 496, pl. 90, fig. 2.

Material : 26 exs., 23.0-70.0 mm. 150-350 m. (2 exs., Keeripittam odai, Sengaltheri, 100 m, 9.2. 86 ; 9 exs., Keeripittam odai, Sengaltheri, 100 m. 9.2.86 ; 1 ex., Pachayar near Thalaiaru, 190 m, 12.2.86 ; 7 exs., F. 667, along the course of Nambiar upto Nambikoil, 190-350 m, 21.8.86 ; 3 exs., F. 706, stream near Kodumudi aru Estate, 200 m, 26.8.86 ; 2 exs., F. 707, along Nambiar, on the way to Nambikoil, 190-350 m, 9.1.87 ; 1 ex., F. 696, Kombiar charagam, Thakkaru, 210 m, 13.1.87 ; 1 ex., stream near Kodamadi Estate, 150 m, 15.1.87).

Distribution : Throughout India ; Nepal ; Sri Lanka ; Bangladesh ; Myanmar ; Pakistan.

SUMMARY

A collection of fishes from Kalakad Wildlife Sanctuary, Western Ghats, Tirunelveli District, Tamil Nadu, India is reported. Eight faunistic surveys were conducted by the Southern Regional Station, Z. S. I., Madras from 1984 to 1987. Nineteen species are reported here including *Garra kalakadensis*, described by me earlier. *Horalabiosa joshuai*

Silas is redescribed. *Esomus thermoicos* (Valenciennes), a Sri Lankan species is reported for the first time from the Indian Peninsula.

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