

THE FISHES OF RIVER TAWI AND ITS TRIBUTARIES (JAMMU & KASHMIR STATE) WITH NOTES ON ECOLOGY

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(With 2 Text-figures and 4 Plates).

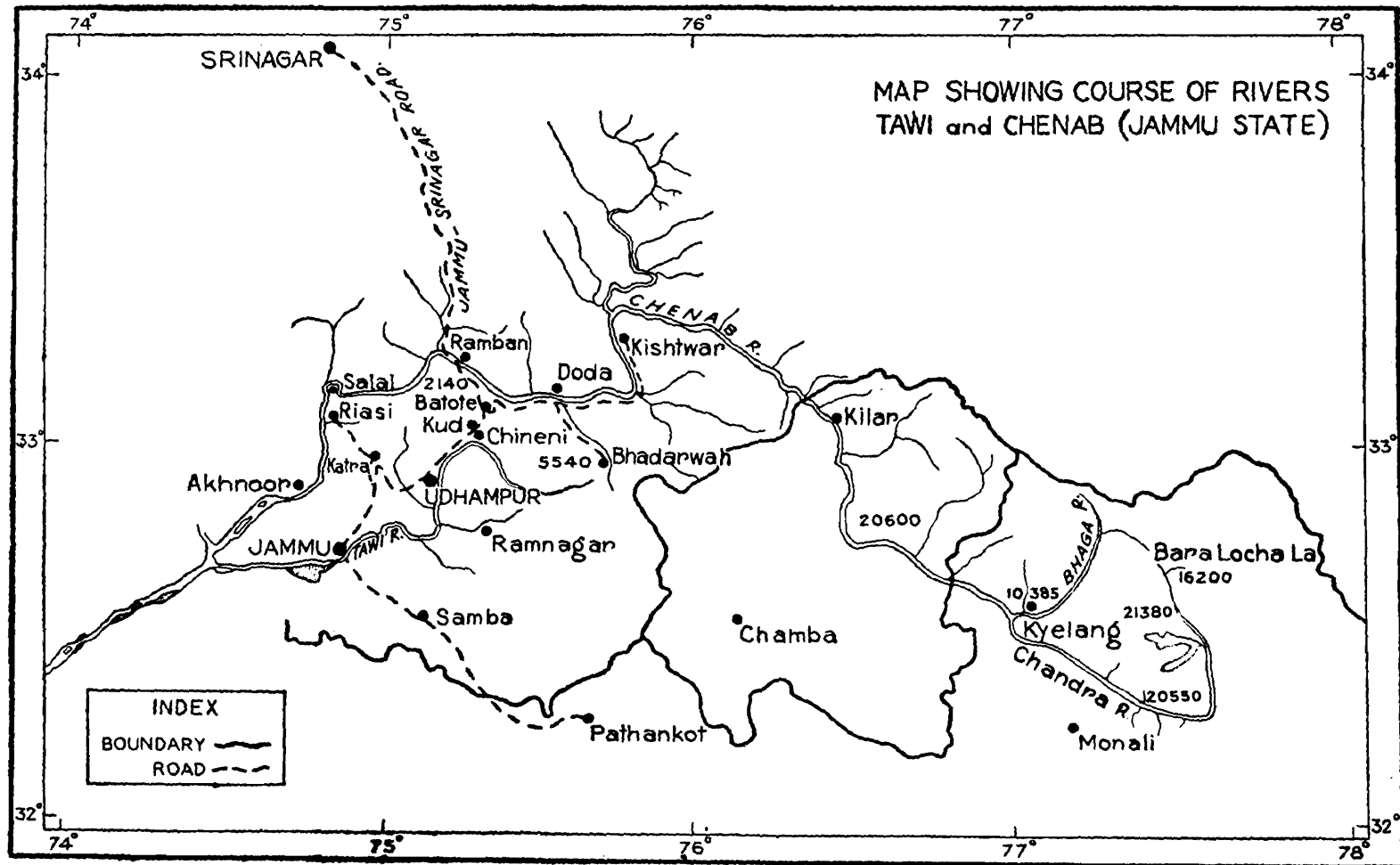
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I—INTRODUCTION

The fish fauna of Kashmir has been receiving considerable importance since 1838 when Heckel published 'Fische aus Caschmir', and thence after many important contributions have been made by Vigne (1842), Heckel (1844), Steindachner (1866), Chaudhuri (1909), Hora (1936b), Mukerji (1936), Misra (1949), Hora *et al.* (1955), Silas (1960) and Das and Subla (1963, 64). It appears quite surprising that the fish fauna of Jammu has never been studied by any of the above mentioned workers except a passing remark made by Silas (1960, 70) about the presence of a few fishes in this area. Although the scenic beauty of Jammu does not claim a reputation equivalent to that of Kashmir, this vast hilly land abounds in rivers and nullas of no less faunistic consequence than those of Kashmir.

Considering paucity of knowledge of the fish fauna of Jammu, an initial attempt was made by Zoological Survey of India, during September-October, 1964, to carry out a survey of the fish fauna of the river Tawi and its tributaries from a point nearly 9 kms. up-stream from Chineni town (Lat. 33.0', Long. 75.15', Alt. 1128 Mts.) down to the vicinity of the Indo-Pakistan border which lies nearly 19 kms. down-stream from Jammu city (Lat. 32.40', Long. 74.50', Alt. 503 Mts.). In the present paper the fish fauna of the river Tawi and its tributaries, together with notes on the ecology and fisheries of that area, is presented. Altogether 38 species belonging to 10 families of 5 orders of the Division Euteleostei of the Class Teleostomi



are included here, all of which are definitely recorded for the first time from river Tawi and are based on the collections made by the author (except one species, *Wallago attu*, for which no specimens were collected). The notes on the ecology and the fisheries of the area given here are also based on the personal and direct observations made in the field by the author.

II—THE RIVER TAWI

The river Tawi emerges out from a glacier tank, known as 'Kailash Kund' which lies at the top of 'Mahakailash choti' (Alt. approximately 3965 M.). The river flows down the southern face of the 'Mahakailash choti' in the form of a small stream and later gathers water from a large number of small streams on the way. Through a long circuitous hilly path it flows diagonally across Jammu area, roughly in the north-east to south-west axis (Pl. 4, Fig. 1; Map. 1). At Jammu it enters into plains and finally mingles with river Chenab within the boundry of Pakistan. It is bordered on both sides by high and low hills throughout its course. The bed of the river is narrow at many places with steep hills on both sides, while at some other places the bed is very wide. In winter months the river shrivels up in the form of a small nulla. It flows throughout the year but its tributaries are of two types; the perennial and the seasonal nullas. The perennial ones contain water throughout the year, the quantity of water being tremendous during rainy season and small during the other seasons of the year. During rains plenty of earth and stones flow down the nullas and due to the dirty colour and unknown depth of the huge body of water, fishing is impossible, rather perilous. The seasonal nullas become active only in rainy season, when high columns of water flow through them. The seasonal nullas contain no fishes. All these nullas either singly or conjointly fall into the river Tawi.

Through the course of the river, the water falls at many places even from a height of 3-5 meters (Pl. 4, Fig. 2). The small streamlets are formed by collecting water from a large number of springs coming out of the side of hills. At many places, the outlet of the spring is stone-lined, where the water collects in the form of a small pool and then flows out in the form of a streamlet. Such a ditch or a pool is called by the local name 'Bauli' (Pl. 4, Fig. 4).

III—SYSTEMATIC LIST OF FISHES

Order: CYPRINIFORMES Berg, 1940

Family: CYPRINIDAE (Bon., 1837) Gill, 1861

<i>Scientific names</i>	<i>Local Name</i>
(1) <i>Chela (Chela) cachi</i> (Ham.)	—
(2) <i>Oxygaster bacaila</i> (Ham.)	Daryai chaahl
(3) <i>Barilius bendelisis</i> (Ham.)	Pathrill chaahl
(4) <i>Barilius vagra</i> (Ham.)	—
(5) <i>Barilius barila</i> (Ham.)	—
(6) <i>Barilius shacra</i> (Ham.)	—
(7) <i>Barilius modestus</i> Day	Pathrili chaahl

<i>Scientific names</i>	<i>Local Name</i>
(8) <i>Danio devario</i> (Ham.)	—
(9) <i>Esomus danrica</i> (Ham.)	—
(10) <i>Schizothorax plagiostomus</i> Heckel	Alwaan
(11) <i>Garra gotyla gotyla</i> (Gray)	Khront
(12) <i>Tor putitora</i> (Ham.)	Mahseer
(13) <i>Tor mosal</i> (Ham.)	Soltihi
(14) <i>Puntius ticto</i> (Ham.)	Marakhi
(15) <i>Puntius sarana sarana</i> (Ham.)	Tichir
(16) <i>Puntius sophore</i> Ham.	—
(17) <i>Labeo dero</i> (Ham.)	Kayehri
(18) <i>Labeo dyocheilus</i> (McClelland)	Bharata
(19) <i>Labeo bata</i> (Ham.)	—
(20) <i>Aspidoparia morar</i> (Ham.)	—
(21) <i>Cirrhinus mrigala</i> (Ham.)	—
(22) <i>Crossocheilus diplochilus</i> (Heckel)	Bootal
Family: COBITIDAE (Swainson, 1839) Gill 1893	
(23) <i>Botia birdi</i> Chaudhuri	—
(24) <i>Lepidocephalus guntea</i> (Ham.)	—
(25) <i>Noemacheilus botia</i> (Ham.)	Tralwat
(26) <i>Noemacheilus corica</i> (Ham.)	Tralwat
(27) <i>Noemacheilus prashari</i> Hora	Tralwat
Order: SILURIFORMES Greenwood <i>et al.</i> , 1966.	
Family: SILURIDAE (Cuv., 1817) Gill, 1872.	
(28) <i>Wallago attu</i> (Bl. & Schn.)	Mallee
Family: BAGRIDAE (Bleeker, 1858; Günther, 1864) Gill, 1893	
(29) <i>Mystus (Aorichthys) seenghala</i> (Sykes)	Seeng
Family: AMBLYCIPITIDAE Regan, 1912.	
(30) <i>Amblyceps mangois</i> (Ham.)	chhota keengar
Family: SISORIDAE Gill, 1872	
(31) <i>Glyptothorax pectinopterus</i> (McClelland)	Keengar
Order: CHANNIFORMES Greenwood <i>et al.</i> , 1966.	
Family: OPHIOCEPHALIDAE (Bon., 1831) Bleeker, 1859	
(32) <i>Channa orientalis</i> Schn.	Mooree
(33) <i>Channa punctatus</i> (Bloch)	—
(34) <i>Channa marulius</i> (Ham.)	Sol
Order: PERCIFORMES Berg, 1940.	
Suborder: MASTACEMBELOIDEI Greenwood <i>et al.</i> 1966.	
Family: MASTACEMBELIDAE (Günther, 1861) Gill, 1893	
(35) <i>Mastacembelus armatus</i> (Lacépède)	Garoj
(36) <i>Mastacembelus pancalus</i> (Ham.)	—
Suborder: PERCOIDEI Berg, 1940	
Family: BADIDAE Liem, 1970.	
(37) <i>Badis badis</i> (Ham.)	—
Order: ATHERINIFORMES Greenwood <i>et al.</i> , 1966.	
Suborder: EXOCOETOIDEI Berg, 1940.	
Family: BELONIDAE Gill, 1872	
(38) <i>Xenentodon cancila</i> (Ham.)	Tarakla

IV—SYSTEMATIC NOTES

Genus *Chela* Hamilton, 1822(1) *Chela (Chela) cachinus* (Ham.)

1822. *Cyprinus (Chela) cachius* Hamilton, *Fishes of Ganges*, pp. 258, 384. (Type-locality: The Ganges, near the commencement of delta).

1958. *Chela (Chela) cachius*: Silas, *J. Bombay nat. Hist. Soc.*, **55**, pp. 64-66.

Material.—(i) 35 exs., Choe nulla, 16.8 kms west of Jammu, 19.10.1964 (ii) 2 exs., a branch of Tawi near Jammu city, 19.x.1964. (Size: 28-43 mm.).

Remarks.—It is characterised by the sharp edged abdomen, dorsal fin in the posterior half of the body, outer pelvic rays elongated, the predorsal scales not extending to the interorbital space, and the absence of a symphysial knob in the lower jaw.

It is found in slow moving nullas with muddy bottom, by the side of the river Tawi in the plains. This species is found only in the lower reaches of this river. It is a small laterally compressed fish and can be reared in aquaria.

Distribution.—Fresh waters of Jammu & Kashmir, West Bengal, Assam, Orissa, Madhya Pradesh, Madras and Mysore states; Pakistan and Burma.

Genus *Oxygaster* van Hasselt, 1823(2) *Oxygaster bacaila* (Ham.)

1822. *Cyprinus bacaila* Hamilton, *Fishes of Ganges*, pp. 265, 384 (Type-locality: Fresh water rivers of all gangetic provinces).

1959. *Oxygaster bacaila*: Misra, *Rec. Indian Mus.*, **57**, p. 140.

Material.—(i) 4 exs., River Tawi near Jammu city, 16.x.1964 and 24.x.1964. (Size: 75-127 mm.).

Remarks.—The fish can be distinguished by its cutting abdomen, the dorsal fin in the posterior half of the body, the outer rays of the pelvic fins not produced, the predorsal scales extending to interorbital region and the presence of a symphysial knob in the lower jaw. It is mostly found in slow moving waters in the lower reaches of the river Tawi. It is not of much commercial value but fishermen use them as bait for other big fishes. It could, however, serve as poor man's diet.

Distribution.—Fresh waters of Jammu & Kashmir, Punjab, Uttar Pradesh, Bihar, West Bengal, Orissa; Nepal and Pakistan.

Genus *Barilius* Hamilton, 1822(3) *Barilius bendelisis* (Ham.)

1807. *Cyprinus bendelisis* Hamilton, *Journey Mysore*, **3**, p. 345, pl. 32 (Type locality: rivers of Mysore).

1822. *Cyprinus (Barilius) bendelisis*: Hamilton, *Fishes of Ganges*, pp. 272, 385, pl. 3, fig. 77.

1822. *Cyprinus (Barilius) chedra* Hamilton, *Ibid.*, pp. 273, 385.

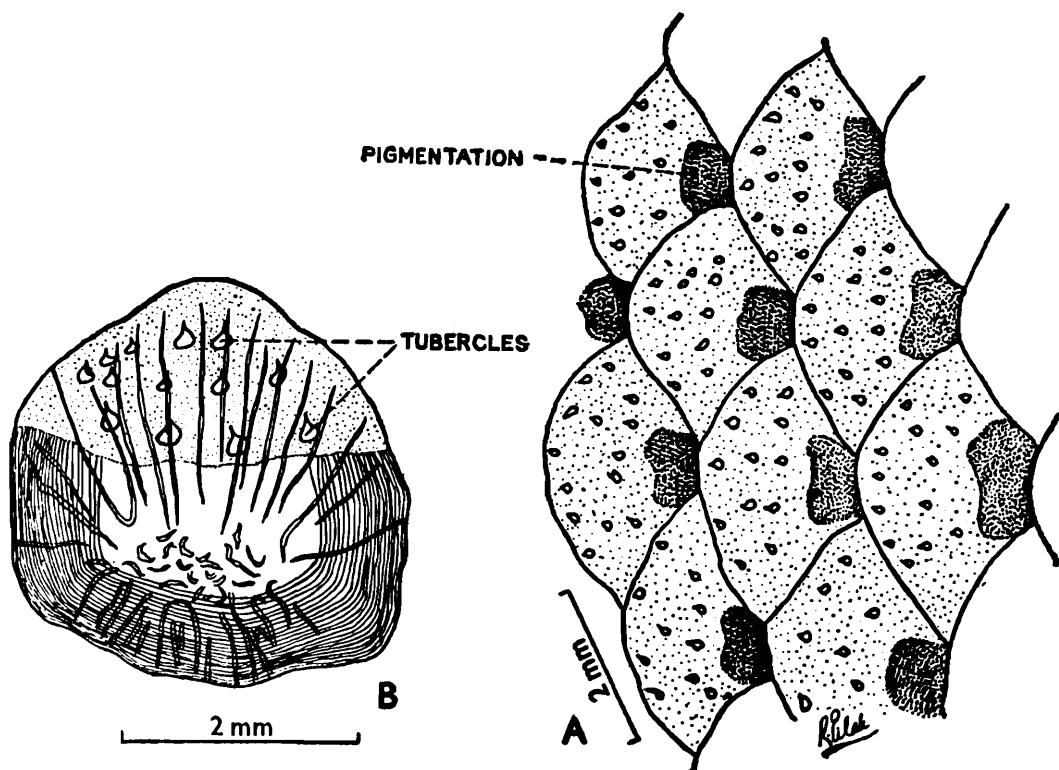
1822. *Cyprinus (Barilius) cocea* Hamilton, *Ibid.*, pp. 272, 385.

1924. *Barilius dogarsinghi* Hora, *Rec. Indian Mus.*, **22**, p. 191, fig. 3 (Type-locality: Manipur).

1959. *Barilius bendelisis*: Misra, *Ibid.*, **57**, p. 141.

Material.—(i) 2 exs., Power station, Udhampur 6.ix.1964 (ii) 17 exs., Birwan nulla, 6.ix.1964 (iii) 6 exs., Nadal nulla, after union with Nadijali nulla, Dist Udhampur, 6.ix.1964 (iv) 2 exs., Birwan nulla, Udhampur, 6.ix.1964 (v) 6 exs., Kawa daber, Udhampur, 7.ix.1964 (vi) 6 exs., Devak nulla, Udhampur, 8.ix.1964 (vii) 1 ex., Siaran nulla, Udhampur, 9.ix.1964 (viii) 9 exs., Dhanodi nulla, nearly 4.5 kms. west of Udhampur, 10.ix.1964 (ix) 1 ex., Ramnagar nulla, 24 kms., east of Udhampur, 14.ix.1964 (x) 9 exs., a small nulla near Gudhar village, Dist. Udhampur, 18.ix.1964 (xi) 5 exs., Dudder nulla, Dist. Udhampur, 18.ix.1964. (xii) 10 exs., River Tawi, south of village Gudhar, Dist. Udhampur, 21.ix.1964. (xiii) 3 exs., a daber by the side of Dudder nulla, Village Gudhar, Dist. Udhampur, 22.ix.1964 (xiv) 38 exs., Jhajjar nulla, 2 kms. east of P.W.D. Rest House, Jhajjar, Dist. Udhampur, 5.x.1964. (xv) 77 exs., Jhajjar nulla, 6 kms. downstream from P.W.D. Rest House, Jhajjar, Dist. Udhampur, 6-7.x.1964 (xvi) 72 exs., Junhi nulla, Village Jhajjar, Dist. Udhampur, 8-11.x.1964 (xvii) 85 exs., river Tawi, near Jammu city, 21-23.x.1964 (xviii) 30 exs., Nagrota nulla, Village Nagrota, Dist. Jammu, 27.x.1964 (xix) 15 exs., Pulin nulla, near Nagrota, Dist. Jammu, 7.x.1964. (xx) 56 exs., Sarande nulla, 2 kms. north of Nagrota, Dist. Jammu, 29.x.1964. (large number of examples are young, size: 23-127 mm.).

Remarks.—This is a very common species found in this area. The characters of the species are quite variable within the limits of the species. In most of them the anal fin has three spines and 8-9 branched rays. However, in the present collection there are specimens approximating *B. chedra* Ham. (pl. 3, figs. 3 & 4). In these specimens the scales are covered over with small tubercles arranged in two irregular rows (Text-fig. 1, a & b). The tubercles



TEXT-FIG. 1. (A) Showing arrangement, colouration and tubercles in scales of specimen of *Barilius bendelisis* (Ham.) (B) One scale of the same enlarged to show structures,

impart the fish a rough texture. There are big tubercles on the anterior tip of the snout, on the space anterior to the orbit and below the narial opening, and on the whole of the ventral side of the lower jaw. After dissection it has been confirmed that the tuberculated snout is present uniformly in male and female specimens and this character cannot be accredited to the difference of sexes alone. In one specimen from Jhajjar nulla the back is dark and only 5 colour bands, in the form of blotches, are present in the region of the body posterior to the dorsal fin. The dark blotches remain far above the lateral line. The anal fin of this species contains 10 branched rays and 3 spines. This specimen resembles *B. cocsa* Ham. Recently, the varieties *chedra* and *cocsa* have been synonymised with *bendelisis*. The author has, however, a feeling that they may have independent status. An analysis of the characters of *chedra* and *cocsa*, in comparison with *bendelisis*, is in progress and when completed the results will be published elsewhere.

Distribution.—Fresh waters of Jammu & Kashmir, Punjab, Himachal Pradesh, Uttar Pradesh, Bihar, West Bengal, Assam, and Madras : Pakistan and Ceylon.

(4) ***Barilius vagra*** (Ham.)

(Pl. 3, figs. 5, 6).

1822. *Cyprinus (Barilius) vagra* Hamilton, *Fishes of Ganges*, pp. 269, 385 (Type-locality: The Ganges at Patna).

1959. *Barilius vagra*: Misra, *Rec. Indian Mus.*, 57, p. 143.

Material.—(i) 3 exs., Thalli nulla, Dist. Udhampur 7.ix.1964 (ii) 11 exs., Sakanwahi bauli, near Udhampur 7.ix.1964 (iii) 16 exs., Dudder nulla, Dist. Udhampur 20.ix.1964 (iv) 1 ex., River Tawi, village Gudhar, Dist. Udhampur, 21.ix.1964 (v) 14 exs., Kud nulla, village Chineni, Dist. Udhampur 24.ix.1964 (vi) 8 exs., Jhajjar nulla, Dist. Udhampur, 5.x.1964 (vii) 1 ex., Bauli at Mian ka Bag, Dist. Udhampur, 7.x.1964 (viii) 3 exs., Junhi nulla, Dist. Udhampur, 8.x.1964 (ix) 2 exs., Union of Junhi and Jhajjar nullas, Dist. Udhampur, 9.x.1964. (Size: 44-122 mm.).

Remarks.—It is a fish of small size and is common in the nullas and river Tawi. The material studied here agrees with the description given by Day (1878). The points of distinction of this species from *B. barila* Ham. are given under the remarks of the latter species.

Distribution.—Fresh waters of Jammu & Kashmir, Punjab, along of base of Himalaya in Uttar Pradesh, Bihar, West Bengal, Assam ; Nepal, Pakistan and Ceylon.

(5) ***Barilius barila*** (Ham.)

(Pl. 3, figs. 7, 8)

1822. *Cyprinus (Barilius) barila* Hamilton, *Fishes of Ganges*, pp. 267, 389. (Type-locality: rivers of North Bengal).

1959. *Barilius vagra*: Misra, *Rec. Indian Mus.*, 57, p. 141.

Material.—(i) 15 exs., River Tawi, near Nagrota and Jammu, 16-24.x.1964 (ii) 21 exs., a branch of river Tawi, Jammu, 24-30.x.1964 (iii) 24 exs., Nagrota nulla, Nagrota, Dist. Jammu, 27.x.1964 (iv) 29

exs., Pullin nulla, Nagrota, Dist. Jammu, 28.x.1964 (v) 9 exs., Sarande nulla, Dist. Jammu, 29.x.1964. (Size: 30-105 mm.).

Remarks.—It is quite a common species of the lower reaches of river Tawi, although it is not a food fish of the area. Along with other small species of *Barilius*, it is made use of by the fishermen as a bait on hooks for other bigger and commercially important fishes.

Day (1878) overlooked the mandibular barbels; there are 4 small barbels instead of 2. Thus the separation of this species from others, on the basis of the number of barbels, as done by Day (1878), is not tenable. The study of the present collection brings out many other differences from the description of Day (1878), such as, there are 22 rows of pre-dorsal scales instead of 18 and the number of colour bands is also less than 14-15 in many of these specimens.

Hora (1921) based the identification of this species on the inequality of the two lobes of the caudal fin. By the present material it has been found that this character is variable within the species and cannot be used as a taxonomic character. This species resembles *B. vagra* Ham. in many characters, but a clear distinction can be made between them in the following characters.

<i>Barilius barila</i> Ham.	<i>Barilius vagra</i> Ham.
(1) The colour bands are long and extend from the back to the lateral line. (pl. 3, figs. 7, 8).	(1) The colour bands are small and remain much above the lateral line. (pl. 3, figs. 5, 6).
(2) The maxillary barbels extend upto $\frac{1}{3}$ rd of the orbit.	(2) The Maxillary barbels extend upto the middle of the orbit.

Distribution.—Fresh waters of Jammu & Kashmir, Delhi, Uttar Pradesh, Madhya Pradesh, Bihar, West Bengal, Assam, Manipur, Orissa and Mysore; Pakistan.

(6) *Barilius shacra* (Ham.)

1822. *Cyprinus (Barilius) shacra* Hamilton, *Fishes of Ganges*, pp. 271, 385. (Type-locality: Kosi river).

1878. *Barilius shacra*: Day, *Fishes of India*, p. 590.

Material.—1 ex., Choe nulla, 15 kms. west of Pammu, 18.x.1964. (size: 70 mm.)

Remarks.—This is a rare species in that area and is represented in the present collection by only one specimen. It shows slight difference from the description given by Day (1878). The anal rays are $\frac{3}{8}$, scales along the lateral line are 59 with $6\frac{1}{2}$ rows of scales between the base of the pelvic fin and the lateral line and the middle of the dorsal fin rays bears a faint black band. There are no colour bands in this species.

Distribution.—Fresh waters of Jammu & Kashmir, Punjab, Uttar Pradesh, Bihar, West Bengal, Orissa, Assam; Pakistan.

(7) **Barilius modestus** Day

1872. *Barilius (Pachystomus) modestus* Day, *J. Asiat. Soc. Bengal*, **41**, p. 4.
(Type-locality: Ravi river at Lahore, West Pakistan).
1878. *Barilius modestus* Day, *Fishes of India*, p. 589.

Material.—1 ex., a small nulla, near village Gudhar, Dist. Udhampur. (Size : 105 mm.).

Remarks.—This is a rare fish in the area. The single specimen in the present collection agrees with the description given by Day (1878).

Distribution.—Fresh waters of Jammu & Kashmir, Punjab; Afghanistan and Pakistan.

Genus **Danio** Hamilton, 1822(8) **Danio devario** (Ham.)

1822. *Cyprinus (Danio) devario* Hamilton, *Fishes of Ganges*, pp. 311, 393, pl. 6, fig. 94. (Type-locality: Rivers and ponds of Bengal).
1934. *Danio devario*: Hora & Mukerji, *Rec. Indian Mus.*, **36**, p. 133.

Material.—(i) 6 exs., Choe nulla, 15 kms. west of Jammu, 18.x.1964
(ii) 1 ex., a branch of river Tawi, near Jammu city, 19.x.1964. (Size: 62-75 mm.).

Remarks.—It occurs in stagnant pools with muddy basin and plenty of water weeds. They move in shoals. In life they have a beautiful bluish and bright yellow lines on the sides. It is an important larvivorous fish and also an ornamental aquarium fish.

Distribution.—Fresh waters of Jammu & Kashmir, Punjab, Himachal Pradesh, Uttar Pradesh, Bihar, West Bengal, Assam, Orissa, Madhya Pradesh, Gujarat; Pakistan.

Genus **Esomus** Swainson, 1839(9) **Esomus danrica** (Ham.)

1822. *Cyprinus danrica* Hamilton, *Fishes of Ganges*, pp. 325, 390, pl. 16, fig. 88.
(Type-locality : Ponds and ditches of Bengal).
1878. *Nuria danrica*: Day, *Fishes of India*, p. 583.
1928. *Esomus danrica* Hora & Mukerji, *Rec. Indian Mus.*, **30**, p. 49.

Material.—(i) 16 exs., Choe nulla, 15 kms. west of Jammu city, 18.x.1964 (ii) 1 ex., branch of Tawi near Jammu city, 19.x.1964. (Size: 52-78 mm.).

Remarks.—It is a small sized fish and is found in slow moving waters with muddy bottom and plenty of weeds. It is one of the efficient larvivorous fishes and helps control the population of mosquitoes. But no effort appear to have been made in the state by the Health Department to make use of this as well as other fishes of this nature.

Distribution.—Fresh waters of Jammu & Kashmir, Punjab, Uttar Pradesh, Bihar, West Bengal, Assam, Orissa, Gujarat, Madras; Pakistan, Bangla Desh, Burma, Ceylon, Malaya, Archipelago, Thailand.

Genus *Schizothorax* Heckel, 1838.(10) *Schizothorax plagiostomus* Heckel

(Pl. 1, figs. 5, 6)

1838. *Schizothorax plagiostomus* Heckel, *Fische aus Caschmir*, p. 16, pl. 1, figs. a-m. (Type-locality : Kashmir).

1877. *Oreinus plagiostomus* : Day, *Fishes of India*, p. 530.

1919. *Schizothorax plagiostomus* : Misra, *J. zool Soc. India*, 1, p. 40.

Material.—(i) 18 exs., Kud nulla, near Chineni, Dist. Udhampur, 24.ix.1964 (ii) 17 exs., Mandir Dasala nulla, near Chineni, Dist. Udhampur, 25.ix.1964 (iii) 20 exs., Bini-sangh nulla, Chineni, Dist. Udhampur, 28.ix.1964 (iv) 18 exs., Katal nulla, Chineni, Dist. Udhampur (v) 3 exs., Motor Shed nulla, Chineni, Dist. Udhampur, 30.x.1964 (vi) 15 exs., River Tawi, Chineni, Dist. Udhampur, 1.x.1964. (Size: 40-320 mm.).

Remarks.—It is characterised by the cylindrical body, minute scales and a suctorial disc on the lower jaw. It is well adapted to the fast currents of high altitudes and is not met with in Tawi at an altitude lower than 760 meters. In the specimens of the present collection there is plenty of difference in colouration and the size and shape of the ventral suctorial disc. In the present lot, there appear to be two races, one with numerous dark spots on the dorso-lateral sides and the suctorial disc wide, and the second with a few spots or none and the suctorial disc narrow. A study of the races of this species, on this line, is in progress and the results will be published elsewhere. The local people consider it a very tasty fish and call it 'Indian Salmon'

Distribution.—Fresh waters of Jammu & Kashmir, Assam, Eastern Himalaya ; Pakistan, Afghanistan, Bhutan, Sikkim.

Genus *Garra* Hamilton, 1822(11) *Garra gotyla gotyla* (Gray)

1832. *Cyprinus gotyla* Gray, *Ill. Indian Zool.*, London, pl. 88, figs. 3, 3a.

1964. *Garra gotyla gotyla* : Menon, *Mem. Indian Mus.*, 14(3) p. 233.

Material.—(i) 6 exs., Sakanwahi bauli, Udhampur, 7.ix.1964 (ii) 2 exs., Thalli nulla, Udhampur, 7.ix.1964 (iii) 2 exs., Devak nulla, Udhampur, 8.ix.1964 (iv) 3 exs., Ramnagar nulla, 25 kms. east of Udhampur, 14.ix.1964 (v) 2 exs., Jhajjar nulla, Dist. Udhampur, 6.x.1964 (vi) 50 exs., River Tawi, near Jammu, 16-24.x.1964. (Size: 35-179 mm.)

Remarks.—It is quite a common fish of the area. Small groups of this fish can be seen rasping off algal encrustations from the stones in the midst of the stream in river Tawi and its tributaries. The fish is able to withstand the force of the fast flowing water due to the presence of a sucker on the ventral side of the head. In young examples there is a black spot at the base of the caudal fin. All the specimens of the present collection differ from the description of this species given by Menon (1964) in having the orbit completely in the posterior half of the head.

Distribution.—Fresh waters of Jammu & Kashmir, Punjab, Uttar Pradesh, Assam ; Pakistan and Bangla Desh,

Genus *Tor* Gray, 1833(12) *Tor putitora* (Ham.)

1822. *Cyprinus putitora* Hamilton, *Fishes of Ganges*, pp. 303, 388 (Type-locality: Eastern parts of Bengal).
 1959. *Tor putitora*: Misra, *Rec. Indian Mus.*, 57, p. 1950.

Material.—(i) 1 ex., Birwan nulla, Udhampur, 6.ix.1964 (ii) 33 exs., Nadiali nulla, Udhampur, 6.ix.1964 (iii) 2 exs., Kawa daber, by the side of river Tawi, Udhampur, 7.ix.1964 (iv) 7 exs., Siaran nulla, Udhampur, 8.ix.1964 (v) 5 exs., Dhanodi nulla, Udhampur, 10.ix.1964 (vi) 6 exs., Dudder nulla, Dist. Udhampur, 19-20.ix.1964 (vii) 27 exs., River Tawi, near Udhampur, 21.ix.1964 (viii) 36 exs., Jhajjar nulla, Dist. Udhampur, 5-13.x.1964 (ix) 1 ex., Junhi nulla, Udhampur, 8.x.1964 (x) 1 ex., union of Junhi and Jhajjar nullas, Dist. Udhampur, 9.x.1964 (xi) 36 exs., River Tawi, near Jammu, 16-24.x.1964 (xii) 1 ex., a branch of Pullin nulla, Jammu, 28.x.1964 (xiii) 8 exs., Sarande nulla, Jammu, 29.x.1964. (Size: 25-275 mm.).

Remarks.—It is one of the important commercial fishes of the area and is a common species found in the river Tawi, right from Jammu upto Chineni. It is well adapted to various altitudes and temperatures.

Distribution.—Fresh waters of Jammu & Kashmir, Punjab, Himachal Pradesh, Uttar Pradesh, West Bengal, Assam; Nepal and Pakistan.

(13) *Tor mosal* (Hamilton)

1822. *Cyprinus (Cyprinus) mosal* Hamilton, *Fishes of Ganges*, pp. 306, 388 (Type-locality: Kosi River).
 1934. *Barbus hexastichus*: Hora & Mukerji, *Rec. Indian Mus.*, 36, p. 127.
 1940. *Barbus (Tor) mosal*: Hora, *J. Bombay nat. Hist. Soc.*, 41, pp. 784-794.

Material.—(i) 4 exs. Jhajjar nulla, Dist. Udhampur, 6.x.1964. (Size: 27-35 mm.).

Remarks.—It is not a very common species and in the present collection it is represented by only a few young specimens.

Distribution.—Jammu and Kashmir, along Himalaya in Uttar Pradesh, Assam and Sikkim.

Genus *Puntius* Hamilton, 1822(14) *Puntius ticto* (Ham.)

1822. *Cyprinus (Puntius) ticto* Hamilton, *Fishes of Ganges*, pp. 314, 389, pl. 8, fig. 87 (Type-locality: South eastern parts of Bengal).
 1939. *Puntius ticto*: Hora, Misra & Malik, *Rec. Indian Mus.*, 41, p. 270.

Material.—(i) 1 ex., Birwan nulla, Udhampur, 6.ix.1964 (ii) 2 exs., a small bauli near Nadiali nulla, Udhampur, 6.ix.1964 (iii) 1 ex., a small streamlet, nearly 2 kms. east of Udhampur, 7.ix.1964 (iv) 17 exs., a bauli at Mian ka Bagh, Udhampur, 7.ix.1964 (v) 22 exs., Thalli nulla, Udhampur, 7.ix.1964 (vi) 8 exs., Siaran nulla, Udhampur, 8.ix.1964 (vii) 21 exs., Devak nulla, Udhampur, 8.ix.1964 (viii) 62 exs., Dhanodi nulla, Udhampur, 8-10.ix.1964 (ix) 5 exs., Siaran nulla, Udhampur, 9-10.ix.1964 (x) 39 exs., Puthi Khad nulla, Udhampur,

12.x.1964 (xi) 45 exs., a small streamlet near village Tikri, Dist. Udhampur, 12.x.1964 (xii) 28 exs., Choe nulla, near Jammu, 18.x.1964 (xiii) 35 exs., River Tawi, Jammu, 19-24.x.1964. (Size: 18-80 mm.).

Remarks.—It is quite a variable species. The usual caudal and shoulder spots are present with incomplete lateral line and no barbels. In one specimen tip of the posterior dorsal rays is black as in the case of *P. conchoni* Ham. but the height of the body in this specimen is 3.2 times in the total length and thus it is kept under *P. ticto* Ham. This fish is not of much commercial value except that it can be kept in the aquaria. It moves slowly in showls of hundreds in dabers, formed in the course of slow moving nullas. This species is absent in the main Tawi river.

Distribution.—Fresh waters throughout India ; Pakistan, Burma, Ceylon and Thailand.

(15) *Puntius sarana sarana* (Ham.)

1822. *Cyprinus (Puntius) sarana* Hamilton, *Fishes of Ganges*, pp. 307, 389. (Type-locality: ponds and rivers of India).

1963. *Puntius sarana sarana* : Menon, *Spolia Zey.*, 30 (1), p. 68.

Material.—(i) 1 ex., Choe nulla, nearly 15 kms. west of Jammu city, 18.x.1964 (ii) 7 exs., a branch of river Tawi, Jammu city, 19.x.1964. (Size: 81-112 mm.).

Remarks.—It is a common species found in this area. The lateral bands are faintly represented in some specimens and usually a dark spot is present at the base of the caudal. This fish has four barbels and the last undivided ray of the dorsal fin is serrated.

Distribution.—Fresh waters throughout India ; Pakistan, Burma, Ceylon, Thailand and China.

(16) *Puntius sophore* Ham.

1822. *Puntius sophore* Hamilton, *Fishes of Ganges*, pp. 310, 389. (Type-locality: Ponds of Bengal).

1877. *Barbus stigma* Day, *Fishes of India*, p. 579.

Material.—(i) 2 exs., Garhi nulla, Udhampur, 12.ix.1964 (ii) 10 exs., Choe nulla, nearly 15 kms. west of Jammu city, 18.x.1964 (iii) 6 exs., River Tawi, Jammu city, 20.x.1964. (Size: 44-85 mm.).

Remarks.—The species bears a characteristic black spot across the base of the middle of the dorsal fin rays. In some specimens a faintly marked dark spot is present at the base of the caudal. It is found in very slow moving waters or in big dabers, with plenty of vegetation. It is a good aquarium fish and has larvivorous habits.

Distribution.—Fresh waters throughout India at low altitudes and plains ; Pakistan, Burma and China.

Genus *Labeo* Cuvier, 1817

(17) *Labeo dero* (Ham.)

(Pl. 1, figs. 3, 4. Pl. 2, figs. 1, 2)

1822. *Cyprinus dero* Hamilton, *Fishes of Ganges*, pp. 277, 385, pl. 17, fig. 78. (Type-locality: Brahmaputra river).

1877. *Labeo diplostomus* : Day, *Fishes of India*, p. 540.
 1936. *Labeo dero* : Hora, *Rec., Indian Mus.*, **38**, p. 320.
 1936. *Labeo dero* : Hora & Misra, *Ibid.*, **38**, p. 340.
 1965. *Schismatorynchus* sp. Tandon, *Curr. Sci.*, **34**, p. 640.

Material.—(i) 4 exs., Nadal nulla, Udhampur, 10.ix.1964 (ii) 1 ex., Duddar nulla, Udhampur, 12.ix.1964 (iii) 42 exs., Jhajjar nulla, Dist. Udhampur, 6-13.x.1964 (iv) 1 ex., Junhi nulla, Dist. Udhampur, 8.x.1964 (v) 2 exs., Choe nulla, nearly 15 kms. west of Jammu, 18.x.1964 (vi) 117 exs., River Tawi, at many places near Jammu, 19-30.x.1964 (vii) 2 exs., Sarande nulla, Dist. Jammu, 24-29.x.1964. (Size: 46-232 mm.).

Remarks.—It is an important food fish of the area. There is well pronounced sexual dimorphism in this species as studied by Hora and Misra (1936). In the present collection the males are proportionately better represented than the females. In many specimens it has been observed that the maxillary barbels on one or both the sides are bifid. In some specimens an additional barbel like structure is also observed near the maxillary barbel. These could be fortuitous variations of little taxonomic importance. A sort of proboscis is formed on the snout in males. There are large number of pores on the snout and they are plugged by spiny tubercles.

Distribution.—Fresh waters of Jammu & Kashmir, Punjab, Himachal Pradesh, Uttar Pradesh, West Bengal, Assam ; Pakistan and China.

(18) *Labeo dyocheilus* (McClelland)

(Pl. 2 figs. 3, 4)

1839. *Cyprinus dyocheilus* McClelland, *Asiatic Researches*, **19**, 268, 330, pl. 37, fig. 1. (Type-locality: Assam).
 1936. *Labeo dyocheilus* : Hora, *Rec. Indian Mus.*, **38**, p. 340.

Material.—(i) 1 ex., Junhi nulla, Dist. Udhampur, 8.x.1964 (ii) 117 exs., River Tawi at various places, Dist. Jammu, 16-30.x.1964 (iii) 2 exs., Choe nulla, nearly 15 kms. west of Jammu city, 18.x.1964 (iv) 3 exs., Sarande nulla, Dist. Jammu, 29.x.1964. (Size: 46-177 mm.).

Remarks.—It is an important food fish of the area and is relished by the local people. The material in the present collection agrees with the description given by Day (1877) except that in these specimens the pectorals do not reach the ventral fins and the latter do not reach the anal. A study of the racial analysis of this species is in progress and the results will be published elsewhere. The material from river Tawi appears to belong to a variety.

Distribution.—Fresh waters of Jammu & Kashmir, Punjab, Uttar Pradesh, Assam ; Pakistan, Sikkim.

(19) *Labeo bata* (Ham.)

1822. *Cyprinus bata* Hamilton, *Fishes of Ganges*, pp. 283, 386. (Type-locality: Rivers and ponds of Bengal).
 1959. *Labeo bata* : Misra, *Rec. Indian Mus.*, **57**, p. 159.

Material.—(i) 1 ex., Choe nulla, nearly 15 kms. west of Jammu city, 18.x.1964. (Size: 115 mm.).

Remarks.—This species is found in slow moving waters of nullas by the side of the river Tawi in the plains. It is characterised by the presence of a tubercle inside the lower jaw above the symphysis, a few black marks near about the 4th or 5th scale on the lateral line and about 37-40 scales along the lateral line.

Distribution.—Fresh waters of Jammu & Kashmir, Punjab, Uttar Pradesh, Bihar, Madhya Pradesh, Orissa, West Bengal, Assam, Andhra Pradesh ; Pakistan.

Genus *Aspidoparia* Heckel, 1843

(20) *Aspidoparia morar* (Ham.)

1822. *Cyprinus morar* Hamilton, *Fishes of Ganges*, pp. 264, 381. (Type-locality: Jamuna and Tista rivers).

1959. *Aspidoparia morar*: Misra, *Rec. Indian Mus.*, **57**, p. 147.

Material.—(i) 71 exs., River Tawi at various places near Jammu city, 16-23.x.1964. (Size: 53-110 mm.).

Remarks.—This species is found in the lower reaches of the river Tawi and is found among the species of the genera *Barilius* and *Oxygaster*. It is characterised by the absence of the lower lip.

Distribution.—Fresh waters of Jammu & Kashmir, and plains of all Indian states except the peninsular states ; Pakistan, Burma and Thailand.

Genus *Cirrhinus* (Oken) Cuvier, 1817

(21) *Cirrhinus mrigala* (Ham.)

1822. *Cyprinus mrigala* Hamilton, *Fishes of Ganges*, pp. 279, 386. (Type-locality: Ponds and Freshwater rivers of Gangetic Provinces).

1959. *Cirrhinus mrigala*: Misra, *Rec. Indian Mus.*, **57**, p. 157.

Material.—(i) 1 ex., River Tawi, Jammu, 20.x.1964. (size: 123 mm.).

Remarks.—It is not a very common species of this area. It is found usually in slow moving waters or in dabbers by the side of the nullas and feeds on debris and algal incrustation on mud. Ordinarily it is a slow moving fish but at the time of danger it becomes very agile. It is an important food fish.

Distribution.—Fresh waters throughout India ; Pakistan and Burma.

Genus *Crossocheilus* van Hasselt, 1823

(22) *Crossocheilus diplochilus* (Heckel)

(Pl. 2, 3, fig. 1, 2, 5, 6)

1838. *Barbus diplochilus* Heckel, *Fische aus Caschmir*, p. 53, pl. 10, fig. 1. (Type-locality: Kashmir).

1934. *Crossocheilus punjabensis*: Mukerji, *J. Bombay nat. Hist. Soc.*, **37**, p. 53.

1938. *Crossocheilus punjabensis*: Hora & Misra, *Ibid.*, **40**, p. 31, pl. 11, fig. 4.

Material.—(i) 4 exs., Nadiali nulla, Udhampur, 6.ix.1964 (ii) 27 exs., Devak nulla, Udhampur, 8.ix.1964 (iii) 6 exs., Siaran nulla, Udhampur, 8-9.ix.1964 (iv) ex., Ramnagar nulla, Dist. Udhampur, 14.ix.1964 (v) 2 exs., Dudder nulla, Udhampur, 19.ix.1964 (iv) 1 ex., Union of Junhi and

Jhajjar nullas, Dist. Udhampur, 9.x.1964 (vii) 1 ex., Dhanodi nulla, Udhampur, 10.ix.1964 (viii) 1 ex., River Tawi, Jammu city, 20.x.1964. (ix) 2 exs., Sakanwahi bauli, Udhampur, 7.ix.1964. (Size: 39-127 mm.).

Remarks.—The study of a large number of specimens from the present lot indicates that there is lot of variation in characters of this species. The length of snout is contained 2.1-3.0 times in the length of the head. The length of the head lies 4.6-5.1 times in the standard length of the head. The length of the dorsal fin may be equal, more or may be less than the depth of the body below it. The colour of the body is much lighter than that of *C. latius* (Ham.).

There are two interesting specimens from Sakanwahi bauli (Pl. 2, figs. 5, 6) which are much darker in colour and comparatively longer than other specimens of *C. diplochilus*. The length of the snout lies 2.1-2.2 times in the length of the head. The length of the head lies 5 times in the standard length. The diameter of the eye is contained 3.6-3.8 times in the length of the head. The length of the dorsal fin is more than the depth of the body below it.

These two specimens could be referable to *C. latius* (Ham.) *forma typica*, which was restricted to Brahmaputra and Gangetic river systems by Mukerji (1934). Hora and Mukerji (1935) and Hora and Misra (1938) have shown the presence of *C. latius forma typica* in Naga hills (Assam) and in Deolali (Bombay Presidency) respectively. Hora and Mukerji (1935) separated the Assamese and Burmese forms as a separate species; *C. burmanicus* Hora because of the fact that both *forma typica* and the Assamese and Burmese form of *C. latius* were found co-existing in the Naga Hills. For the time being these two specimens from Jammu are kept under *C. diplochilus* which is a regional species. If more specimens resembling these and conforming to *C. latius forma typica* are procured in future from Jammu, it would be interpreted only in one way that *C. latius* is a widely distributed species that co-exists in the eastern Himalaya with *C. burmanicus* and in the western Himalaya with *C. diplochilus* (Heckel).

Distribution.—Fresh waters of Jammu & Kashmir, Punjab, Himachal Pradesh and Uttar Pradesh.

Genus *Botia* Gray, 1831

(23) *Botia birdi* Chaudhuri

1877. *Botia geto* Day (nec Hamilton), *Fishes of India*, p. 606, pl. 154, fig. 2.

1909. *Botia birdi*: Chaudhuri, *Rec. Indian Mus.*, 3, p. 339. (Type-locality: Sirhind canal at Rupar, Dist. Ambala, Panjab).

1922. *Botia birdi*: Hora, *Rec. Indian Mus.*, 24, p. 319.

Material.—(i) 1 ex., Jhajjar nulla, Dist. Udhampur, 5.x.1964. (Size: 225 mm.).

Remarks.—Only one dead specimen was 'procured in the shallow stream by the side of Jhajjar nulla. The rare species is difficult to procure because of its typical habit to live under huge stones or in crevices between big stones. It is a bottom feeder and is very agile.

Distribution.—Jammu & Kashmir, Punjab; Pakistan.

Genus *Lepidocephalus* Bleeker, 1863(24) *Lepidocephalus guntea* (Ham.)

1822. *Cobitis guntea* Hamilton, *Fishes of Ganges*, pp. 353, 394. (Type-locality: Ponds and fresh water rivers of Bengal).
 1822. *Cobitis balgara* : Hamilton, *Ibid.*, pp. 356, 394. (Type-locality: Kosi river).
 1878. *Lepidocephalichthys guntea* : Day, *Fishes of India*, p. 609.
 1878. *Lepidocephalichthys guntea* : var. *balgara* Day, *Ibid.*, p. 609, pl. 156, fig. 12.

Material.—(i) 31 exs., a small bauli by the side of Nadiali nulla, Udhampur, 6.ix.1964 (ii) 23 exs., a stream by the side of Birwan nulla, Udhampur, 6.ix.1964 (iii) 1 ex., a ditch near Siaran nulla, Udhampur, 9.ix.1964 (iv) 24 exs., Dhanodi nulla, Udhampur, 10.ix.1964 (v) 5 exs., Choe nulla, 15 kms. west of Jammu, 18.x.1964. (Size: 18-74 mm.).

Remarks.—The study of these specimens indicates that the characters of the origin of the dorsal fin in relation to that of the ventral fin and the relation of the depth of the body to total length are variable within the species. *L. balgara* is an intraspecific variant of *L. guntea*. It is a bottom feeder and feeds on small larvae and insects along with algae on mud.

Distribution.—Jammu & Kashmir, Punjab, throughout India except Mysore and south of Kistna river and Malabar coast ; Pakistan, Ceylon.

Genus *Noemacheilus* van Hasselt, 1823(25) *Noemacheilus botia* (Ham.)

1822. *Cobitis botia* Hamilton, *Fishes of Ganges*, pp. 350, 394. (Type-locality: Rivers of North-eastern Bengal).
 1878. *Nemacheilus botia* : Day, *Fishes of India*, p. 614.
 1878. *Nemacheilus botia* var. *aureus* Day, *Ibid.*, p. 614.

Material.—(i) 1 ex., Birwan nulla, Udhampur, 6.ix.1964. (ii) 6 exs., a small bauli by the side of Nadiali nulla, 6.ix.1964 (iii) 127 exs., Dhanodi nulla, Udhampur, 10.ix.1964. (iv) 8 exs., Jhajjar nulla, Dist. Udhampur, 6-13.x.1964. (v) 61 exs., River Tawi, Jammu city, 19-23.x.1964. (Size: 13-78 mm.).

Remarks.—It is quite a common species in muddy ditches by the side of a nulla. The height of the body of the specimens of the present lot is less than that described by Day (1878). The depth of the body lies 6-6.6 times in the total length (against $4\frac{3}{4}$ in total length mentioned by Day). There are 5 '>' shaped bars on the caudal fin while Day (1878) mentioned 7 such bars. Day (1878) stated that in some specimens the preorbital has a projection which is movable below the orbit (*N. botia*) but in others (*N. bilturio*) it is concealed under the skin. It has been observed in the present collection that the specimens with a preorbital movable process are males while those without it are females.

Day (1878) recognised a subspecies, *N. botia aureus* Day, collected from Poona, with 9-10 branched rays in the dorsal fin and the lateral line incomplete. In the present collection there are many specimens with 10 or 11 branched rays and with incomplete lateral line. The lateral line is a variable character and hence 'aureus' should be an

intraspecific variant of *botia*. A comparison of the present material with those from Ceylon Museum also yields the same result.

Distribution.—Fresh waters of Jammu & Kashmir, Punjab, Uttar Pradesh, Himachal Pradesh, West Bengal, Assam, Bihar; Pakistan, Ceylon.

(26) *Noemacheilus corica* (Ham.)

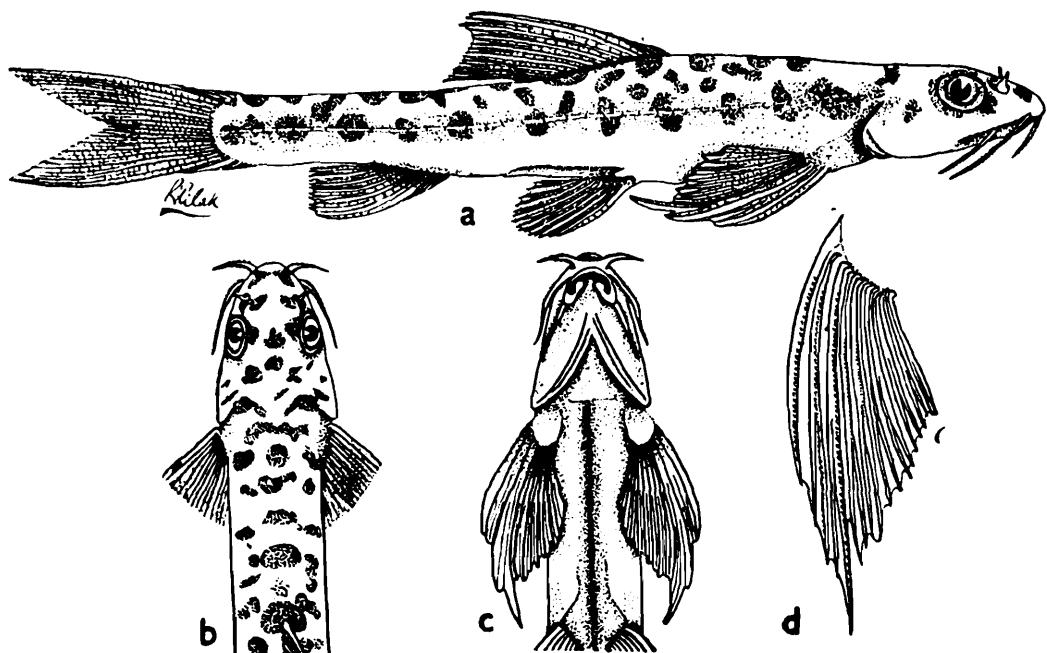
(Text-fig. 2, a-d)

1822. *Cobitis corica* Hamilton, *Fishes of Ganges*, pp. 359, 395. (Type-locality: Kosi river).

1878. *Nemacheilus corica*: Day, *Fishes of India*, pp. 613, 616, pl. 156, fig. 1.

Material.—(i) 20 exs., Tawi river, Jammu city, 21-22.x.1964 (ii) 1 ex., Nagrota nulla Jammu city, 27.x.1964 (iii) 14 exs., Sarande nulla, Jammu city, 29.x.1964. (Size: 22-41 mm.).

Remarks.—It has been observed that the description of this species given by Day (1878) is meagre and also shows difference when compared with the present material, hence the material from Jammu has been described here in detail.



TEXT-FIG. 2. *Noemacheilus corica* (Ham.) (a) Lateral view of the fish. (b) Dorsal view of the anterior part of body. (c) Ventral view of the anterior part of body. (d) A pectoral fin enlarged.

D 4/8-9, P 1/9-10, V 1/7, A 3/5, C 17.

The body is moderately elongated with the dorsal profile gradually rising from the tip of the snout to the origin of the dorsal fin. The ventral surface is also slightly arched. The head length is contained 5.3-6.0 times in the standard length.

The tip of the snout is rounded. The lips are fleshy. The lower lip is interrupted in the middle. There are three pairs of barbels. The rostral pair reaches the front edge of the orbit and the mandibular pair is slightly longer. There are minute nodular outgrowths on the barbels, making their texture rough.

The membranous flaps between the nostrils is directed ventrally up and ends in a fine tendril simulating a barbel.

The eyes are visible from the ventral side. The major portion of the eyes lies in the anterior half of the head. The eye is contained 3-3.5 times in the length of the head. The length of the longest ray of the dorsal fin is more than the depth of the body below it but less than the length of the pectoral fin. Its origin lies nearer to the tip of the snout than the base of the caudal fin. The pectoral fin is longer than the head. Its third outer ray is longer than all the rays and reaches the middle of the base of the pelvic fin. Each pectoral ray bears on its outer side a row of fine projections which make the surface of the fin rather rough. On the outer side of the base of each pelvic fin there is a small axillary process. The pelvic fin extends slightly posterior to the anal opening, but does not reach the anal fin. The length of the anal fin is more than the depth of the body. The caudal fin is elongated and deeply forked. The two lobes of the caudal fin are nearly of the same length. The length of the caudal fin is contained 4.4-4.8 times in the total length and 3.4-3.8 times in the standard length.

The height of the body is contained 8.5-9.0 times in the total length and 6.6-7.0 times in the standard length.

The length of the caudal peduncle is contained 7.2-8.0 times in the total length and 5.5-6.2 times in the standard length. The least height of the caudal peduncle is contained 1.6-2.0 times in its length.

The lateral line is complete and reaches the centre of the base of the caudal fin. The scales are minute and are absent on the head and the ventral side of the body.

In some specimens a small fleshy process, directed posteriorly, is present on the anterior border of the eye. According to Hora (1922), this could be a character of male specimens in loaches. Hence there is sexual dimorphism in this species.

Colouration:—The ground colour of the body is yellowish brown. There is a row of deep brown blotches along the lateral line. The blotches remain distinct, anterior to the dorsal fin while in the posterior region of the body they may, in some cases, amalgamate with one another, forming a sort of band extending upto the base of the caudal fin. There is a row of smaller dots of similar colour on the dorsal anterior aspect. This row extends from the posterior end of the head to a place just above the origin of the anal fin. In some specimens these dots are very light and the posterior ones fade out. Along the mid-dorsal line of the body there is a row of bigger blotches. The blotches are single in the region posterior to the dorsal fin while those lying anterior to the dorsal fin, may be single or broken up into smaller ones.

There is a very lightly stippled band across the dorsal fin rays. The other fins do not bear any markings.

Locality: The lower reaches of river Tawi and small nullas flowing into it, Jammu and Kashmir state.

Habits:—This fish has always been found in small streams by the side of the river Tawi, with sandy bed and clear water not deeper than 0.5 meters. On approach, the fish darts into the sand and hides

itself completely. After a few seconds, it moves a little, the sand over the region of the head washes off and only a pair of eyes are exposed which clearly watch the movements of those who chase it. On further approach it dashes out of the sand and swims swiftly. The best way to catch this fish is to sweep it along with the sand where it gets burried, with the help of a small water net.

Distribution.—Jammu & Kashmir, Punjab, West Bengal, Assam.

(27) *Noemacheilus prashari* Hora

(Pl. 3, figs. 9, 10)

1933. *Nemachilus prashari* Hora, *Rec. Indian Mus.*, **35**, p. 189, pl. 5, figs. 1, 2. (Type-locality: North of Kohat city, N. W. Frontier, Pakistan).

Material.—(i) 13 exs., Bali nulla, Udhampur, 11.ix.1964 (ii) 15 exs., a choe, 18 kms. east of Udhampur, 13.ix.1964 (iii) 24 exs., Kud nulla, Udhampur, 24.ix.1964 (iv) 25 exs., Mandir Dasala nulla, Udhampur, 25.ix.1964 (v) 5 exs., Motor Shed nulla, Udhampur, 27.ix.1964 (vi) 28 exs., Mandir Dasala nulla, Dist. Udhampur, 29.ix.1964 (vii) exs., a branch of Binisangh nulla, Dist. Udhampur, 28.ix.1964 (viii) 94 exs., River Tawi, Dist. Udhampur, 1.x.1964 (ix) 10 exs., Samroli nulla, Dist. Udhampur, 2.x.1964 (x) 2 exs., Arsa nulla, Dist. Udhampur, 2.x.1964 (xi) 33 exs., River Tawi, Dist. Udhampur, 2.x.1964 (xii) 12 exs., Junhi nulla, Dist. Udhampur, 8-9.x.1964 (xiii) 36 exs., Jhajjar nulla, Udhampur, 10-13.x.1964 (xiv) 20 exs., River Tawi, Jammu city, 20-23.x.1964 (xv) 2 exs., Nagrota nulla, Jammu, 27.x.1964. (Size: 16-82 mm.).

Remarks.—The specimens collected from the river Tawi and its tributaries have been kept under *N. prashari* Hora, although they exhibit many differences from this as shown below. Unfortunately, the type material of *N. prashari* is not traceable in the collection of Zoological Survey of India for sake of comparison and hence only the description and figure given by Hora (1933 a) have been compared here. A comparison has also been made with another closely allied species from Punjab, *N. punjabensis* Hora. The points of comparison are presented in table 1.

Genus *Wallago* Bleeker, 1851

(28) *Wallago attu* (Bl. & Schn.)

1801. *Silurus attu* Schneider, *Syst. Ichth. Blochii*, p. 378, pl. 75. (Type-locality: Malabar).

1877. *Wallago attu*: Day, *Fishes of India*, p. 479.

Material.—No specimen was collected.

Remarks.—This fish has not been actually caught in the river Tawi but according to information of the local fishermen, the fish comes from river Chenab and travels up to a height of about 1075 meters in the river Tawi for a month or so during the monsoon, and then goes back to its original habitat.

Distribution.—Freshwaters of Jammu & Kashmir, Punjab, Himachal Pradesh, Uttar Pradesh, Bihar, West Bengal, Manipur, Assam, Orissa,

Bombay, Gujarat, Madras, Malabar ; Pakistan, Burma, Ceylon, Malaya Archipelago, Thailand, Laos, Cambodia, Viet-Nam, W. Yunan.

Genus *Mystus* (Gronow) Scopoli, 1777.

(29) *Mystus (Aorichthys) seenghala* (Sykes)

1839. *Platystomus seenghala* Sykes, *Trans. Zool. Soc. London*, **2**, p. 371, pl. 65, fig. 2. (Type-locality: Mota mula river, Poona).
 1953. *Mystus (Osteobagrus) seenghala* : Jayaram, *Rec. Indian Mus.*, **51**, p. 550.

Material.—(i) 1 ex., Choe nulla, 15 kms. west of Jammu, 18.x.1964. (Size: 324 mm.).

Remarks.—This is a commercially important fish of this area and is liked much by the people. It is quite common in the lower reaches of river Tawi.

Distribution.—Jammu & Kashmir, Punjab, Delhi, Uttar Pradesh, Bihar, West Bengal, and in the South India it extends upto Kistna river ; Pakistan, Burma, Yunnan.

Genus *Amblyceps* Blyth, 1858

(30) *Amblyceps mangois* (Ham.)

1822. *Pimelodus mangois* Hamilton, *Fishes of Ganges*, pp. 199, 379. (Type-locality: Nathpur, Northern Bihar).
 1933. *Amblyceps mangois* : Hora, *Rec. Indian Mus.*, **35**, p. 617.

Material.—(i) 1 ex., Jhajjar nulla, Dist. Udhampur, 11.x.1964. (ii) 19 exs., Tawi river, Jammu, 17-30.x.1964. (Size: 26-49 mm.).

Remarks.—This fish remains hidden under the pebbles and small stones in shallow waters at the base of hills and rarely found above an altitude of about 914 meters. The colouration of the specimens is uniformly reddish. In the present collection the caudal fin is deeply bifid in all the specimens, the dorsal lobe being slightly longer than the ventral. None of the specimens showed any sign of truncated caudal fin as shown by Hora (1933 b). Regarding its distribution Hora (1933 b) remarked that the species has not been definitely recorded from any place west of Kangra valley. However, its presence in Tawi river extends its range of distribution to area west of Kangra valley.

Distribution.—In rapid running streams at base of Himalayas Northern Burma, Thailand.

Genus *Glyptothorax* Blyth, 1860

(31) *Glyptothorax pectinopterus* (McClelland)

(Pl. 1, Figs. 1,2)

1842. *Glyptosternon pectinopterus* McClelland, *Calcutta J. Nat. Hist.*, **2**, p. 587. (Type-locality: Simla hills, Punjab).
 1954. *Glyptothorax pectinopterus* : Menon, *Rec. Indian Mus.*, **52**, p. 47.

Material.—(i) 9 exs., Devak nulla, Udhampur, 8.ix.1964 ; (ii) 1 ex., Dhanodi nulla, Udhampur, 9.ix.1964 ; (iii) 7 exs., Kud nulla, Dist.

TABLE 1.

Comparison of the characters of *Noemacheilus prashari* from Tawi River with those of *N. prashari* and *N. punjabensis* from Pakistan.

S. No.	Characters	<i>N. prashari</i> Hora from river Tawi and its tributaries (Jammu & Kashmir state)	<i>N. prashari</i> Hora from Kohat; N.W.F. Provinces, Pakistan	<i>N. punjabensis</i> Hora from Salt range, Pakistan
1.	Fin ray count	D 3-4/7, P 1/9-10, V 1/7, A 3/5, C 18	D 2/7, P 9, V 7, A 2/5, C 18	D 2/7, P 1/9, V 1/7, A 2/5
2.	Total length/head length	5.1 — 5.8 (mean 5.3)	5.3 — 5.7	5.2 (in young) to 6.1 in adult.
3.	Standard length/head Length	4.0 — 4.8 (mean 4.3)	4.4 — 4.8	4.1 — 5.1
4.	<u>Width of head at eye</u>			
	Height of head at occiput	Almost equal	Almost equal	Height of head at occiput more.
5	Greatest width of head			
	Length of head behind the nostril	Almost equal	Almost equal	Almost equal
6.	<u>Length of snout</u>			
	Postorbital length of head	Almost equal	Almost equal	Almost equal
7.	Total length/depth of body	6.6 — 10.6 (mean 8.6)	6.8 — 8.1	9.0
8.	Standard length/depth of body	5.4 — 8.8 (mean 7.1)	5.4 — 6.8	5.5 — 7.4
9.	Head length/pectoral fin length	Pectoral shorter than head and away from the ventrals by a distance equal to more than half the length of pectoral.	Pectoral shorter than head and separated from ventrals by a considerable distance.	Pectoral longer than head and separated from ventrals by a distance equal to half of its own length.
10.	<u>Length of pectoral</u> Length of ventral	almost equal in many but ventral is usually smaller than pectoral.	Almost equal	Ventral smaller than pectoral.

11.	<u>Length of caudal peduncle</u> Least height of caudal peduncle	1.0 — 1.6 (mean 1.2)	1.4 — 1.6	1.1 — 1.8
12.	Number of bars on the lateral side	9-15 (mean). There may be one, two or more interrupted bars at the end (near caudal base)	15 — 17	11 — 13
13.	Lateral line	Complete in one example, it usually stops near the end of ventral fin or slightly behind.	Disappears above the base of ventral fin.	Complete.
14.	Commencement of dorsal fin	Either nearer to caudal base or midway between the anterior end of snout and caudal base. Arises always in advance of ventrals.	Nearer to base of caudal than tip of snout. Arises opposite to that of ventral.	Equidistant or somewhat nearer the base of caudal than tip of snout.
15.	Bars on caudal	2-4 '>' shaped wavy bars,	2 Wavy bars in distal half of caudal.	Bars faint with greyish band across middle of their length.
16.	Bars on dorsal	1-2 cross bars	One oblique band in middle of dorsal.	Band faintly marked.
17.	Spot on base of caudal	An elongated 2 piece black bar at base of caudal	Usually an interrupted band at base of caudal.	Dark band at base of caudal.
18.	Situation of eye	Middle of head	Middle of head.	In anterior half of head.
19.	Spot on dorsal	One black spot on first 2-3 rays of dorsal	One spot of dark colour on anterior 3 rays.	Spot on first two rays.
20.	<u>Length of head</u> Length of caudal fin	Caudal may be smaller, equal or longer than head.	Caudal smaller or equal.	Caudal longer than head.

Udhampur, 24.ix.1964 ; (iv) 2 exs., Motor Shed nulla, 27.ix.1964 ; (v) 10 exs., Junhi nulla, 8.x.1964 ; (vi) 5 exs., union of Junhi and Jhajjar nullas, Dist. Udhampur, 9.x.1964 ; (vii) 5 exs., Jhajjar nulla, Dist. Udhampur, 10.x.1964 ; (viii) 16 exs., Puthi Khad nulla, Dist. Udhampur, 12.x.1964 ; (ix) 172 exs., River Tawi at various places, Jammu, 16-24.x.1964. (Size: 29-77 mm.).

Remarks.—This species is quite common in nullas where there are small stones and the blepharocerid larvae are in abundance. Probably the fish feeds on blepharocerid larvae. The specimens in the present collection agree with the description given by Day (1877) and Menon (1954) except that the pectoral fins are not longer than the head. In life the stripes on the mid-dorsal side and the tip of the caudal fin are golden yellow. In spirit the colour fades away and becomes whitish yellow.

Distribution.—Jammu & Kashmir, Punjab, Himachal Pradesh, Uttar Pradesh ; Pakistan.

Genus *Channa* (Gronow) Scopoli, 1777

(32) *Channa orientalis* Schn.

1801. *Channa orientalis* Schneider, *Syst. Ichth. Blochii*, p. 496, pl. 90, fig. 2. (Type-locality: Indian orientali).
 1822. *Ophiocephalus gachua* : Hamilton, *Fishes of Ganges*, pp. 68, 367, pl. 21, fig. 21. (Type-locality: Ponds and ditches of Bengal).
 1876. *Ophiocephalus gachua* : Day, *Fishes of India*, p. 367.
 1918. *Ophiocephalus harcourt-butlari* Annandale, *Rec. Indian Mus.*, 14, p. 54 text-fig. 2 ; pl. 2, fig. 7 ; pl. 4, fig. 16.17. (Type-locality: Fort stedman, a town on the shore of Inle lake Burma).
 1960. *Channa orientalis* : De Witt, *Stanford Ichth. Bull.*, 7, 81.

Material.—(i) 4 exs., Nadiali nulla, Udhampur, 6.ix.1964 ; (ii) 1 ex., a small bauli near village Tinaur, Udhampur, 6.ix.1964 ; (iii) 18 exs., Birwan nulla, Udhampur, 6.ix.1964 ; (iv) 3 exs., Thalli nulla, Udhampur, 7.ix.1964 ; (v) 1 ex., Devak nulla, Udhampur, 8.ix.1964 ; (vi) 4 exs., Dhanodi nulla, Udhampur, 10.ix.1964 ; (vii) 1 ex., Siaran nulla, Udhampur, 10.ix.1964 ; (viii) 9 exs., Garhi nulla, Udhampur, 12.ix.1964 ; (ix) 11 exs., Jhajjar nulla and its surroundings, Dist. Udhampur, 6-11.x.1964 ; (x) 12 exs., Choe nulla, Dist. Jammu, 18.x.1964 ; (xi) 1 ex., Sarande nulla, Jammu, 29.x.1964. (Size: 25-128 mm.).

Remarks.—This is a widely distributed species and is usually found in small ditches by the side of the nullas or in slow moving waters. Mostly it inhabits marshy places and is not found in fast running brooks. Day (1877) mentioned that a dark blotch is sometimes present on the last five rays of the dorsal fin in young examples of this species. In the present collection there are two young specimens of this species from a marshy tract of land by the side of Jhajjar nulla, Dist. Udhampur, and they bear two rounded black blotches on the dorsal fin, one on the last 5 rays and the other on the 6th and the 7th rays from behind.

Distribution.—Freshwaters throughout India, Andaman ; Pakistan, Burma, Ceylon, Afghanistan, Malaya Archipelago, Thailand, Laos, Cambodia, Viet-Nam, Yunnan, Hainan.

(33) *Channa punctatus* (Bloch)

1797. *Ophicephalus punctatus* Bloch, *Naturl. Ausland. Fische*, 7, p. 139, pl. 358. (Type-locality: Rivers and lakes of Coromandel coast).
 1960. *Channa punctatus*: De Witt, *Stanford Ichth. Bull.*, 7, 82.

Material.—(i) 2 exs., Choe nulla, Jammu, 18.x.1964 (ii) 4 exs., a branch of River Tawi, Jammu, 19-21.x.1964. (Size: 43-181 mm.).

Remarks.—This species is found only in very slow moving marshy nullas not above an altitude of 360 meters. It is a fairly common species and is eaten by the poor people.

Distribution.—Freshwaters throughout India; Pakistan, Burma, Ceylon, Malaya, China.

(34) *Channa marulius* (Ham.)

1822. *Ophiocephalus marulius* Hamilton, *Fishes of Ganges*, pp. 65, 367, pl. 17, fig. 19. (Type-locality: Ganges).
 1876. *Ophiocephalus marulius*: Day, *Fishes of India*, p. 363.

Material.—(i) 1 ex., Choe nulla, 15 kms. west of Jammu, 18.x.1964. (Size: 345 mm.).

Remarks.—It is a common species found in muddy and slow moving nullas by the side of river Tawi and is a commercially important fish. A large black ocellus is clearly seen at the upper part of the base of the caudal fin.

Distribution.—Freshwaters of Jammu, West Bengal, Bombay, Mysore, Kerala, Gujarat; Pakistan, Burma, Ceylon, Thailand, China.

Genus *Mastacembelus* Scopoli, 1777(35) *Mastacembelus armatus* (Lacépède)

1800. *Macrognathus armatus* Lacépède, *Hist. Nat. Poiss.*, 2, p. 286. (Type-locality: unknown).
 1956. *Mastacembelus armatus*: Sufi, *Bull. Raffles Mus.*, 27, p. 134, pls. 25, 26, figs. 29-32.

Material.—(i) 13 exs., a small bauli by the side of Nadiali nulla, Udhampur, 6.ix.1964; (ii) 13 exs., Dhanodi nulla, Udhampur, 10.ix.1964; (iii) 1 ex., River Tawi Dist. Udhampur, 21.ix. 1964; (iv) 3 exs., Jhajjar nulla, Dist. Udhampur, 10-13.x.1964; (v) 1 ex., Junhi nulla, Dist. Udhampur, 8.x.1964; (vi) 21 exs., River Tawi, Dist. Jammu, 17-30.x.1964. (Size: 19-338 mm.).

Remarks.—This is a very commonly found species at quite high altitudes in river Tawi as well as in its tributaries. Due to its shy habits it remains hidden under and between the stones. The flesh of this fish is considered very delicious by the local people who are seen hunting them under the stones.

Distribution.—Fresh and brakish waters throughout India; Pakistan, Burma, Ceylon, Malaya, Thailand, Sumatra, Hainan, China.

(36) *Mastacembelus pancalus* (Ham.)

1822. *Macrognathus pancalus* Hamilton, *Fishes of Ganges*, pp. 30, 364. (Type-locality: Tanks of Gangetic Provinces).
 1956. *Mastacembelus pancalus*: Sufi, *Bull. Raffles Mus.*, 27, p. 120.

Material.—(i) 1 ex., a branch of River Tawi, Jammu city, 19.x.1964. (Size: 75 mm.).

Remarks.—Only a young example is represented in the present collection. It is a species of the plains in slow and shallow waters. This fish is not available above an altitude of 366 meters. It is of little commercial importance. It can be easily recognised from the other species of its genus, found in this area, in having the caudal fin free from the dorsal and the anal.

Distribution.—Fresh and brakish waters throughout India ; Pakistan.

Genus **Badis** Bleeker, 1853

(37) **Badis badis** (Ham.)

1822. *Labrus badis* Hamilton, *Fishes of Ganges*, pp. 70, 368, pl. 25, fig. 23. (Type-locality: Ponds and ditches of Gangetic Provinces).

1875. *Badis buchamani* : Day, *Fishes of India*, 128, pl. 31, fig. 6.

Material.—(i) 4 exs., Choe nulla, 15 kms. west of Jammu city, 18.x.1964. (Size: 27-35 mm.).

Remarks.—The examples of this species were captured from a muddy slow moving nulla by the side of river Tawi in plains. This species has not earlier been recorded from any locality west of Kali river. The presence of this species in river Tawi shows its uniform distribution along southern face of Himalaya.

Distribution.—Freshwaters along southern face of Himalayas ; Pakistan, Burma.

Genus **Xenentodon** Regan, 1911

(38) **Xenentodon cancila** (Ham.)

1822. *Esox cancila* Hamilton, *Fishes of Ganges*, pp. 213, 380. (Type-locality: Ponds and small rivers of Gangetic Provinces).

1938. *Xenentodon cancila* : Shaw & Shebbeare, *J. Asiat. Soc. Bengal*, 3, p. 108.

Material.—(i) 2 exs., a branch of river Tawi, Jammu city, 19.x.1964. (Size: 177-228 mm.).

Remarks.—Two specimens of this species were captured from a slow moving nulla by the side of river Tawi. Ordinarily this fish swims like an arrow on the surface of water and can be easily caught with a water net. It is not a very common species in the area. The specimens in the present collection agree with the description given by Day (1877).

Distribution.—Freshwaters throughout India ; Bangladesh, Pakistan, Burma, Malaya, Ceylon.

V—A KEY TO THE IDENTIFICATION OF FISHES OF RIVER TAWI

1. Body much elongated and eel shaped. .(2)
- Body neither much elongated nor eel shaped. .(3)
2. The dorsal and anal fins confluent with caudal. .. *Mastacembelus armatus* (Lac.)

- The dorsal and anal fins distinct from the caudal. .*Mastacembelus pancalus* (Ham.)
3. Both jaws produced into a beak shaped structure. .*Xenentodon cancila* (Ham.)
- Jaws not produced into a beak shaped structure (4)
4. Suprabranchial accessory respiratory organs present ; head snake like. .(5)
- Suprabranchial accessory respiratory organs absent ; head not snake like. .(7)
5. Lateral line scales 60-70 ; dorsal with 45-55 rays. .*Channa marulius* (Ham.)
- Lateral line scales 37-45 ; dorsal with 29-37 rays. (6)
6. Body with vertical bands. .*Channa orientalis* (Bl. & Schn.)
- Body without vertical bands. .*Channa punctatus* (Bl.)
7. Dorsal with distinct spinous and soft parts. . .*Badis badis* (Ham.)
- Dorsal without distinct spinous and soft parts (8)
8. Scales absent ; pectoral fin with a strong and hard spine. (9)
- Scales present ; pectoral fin without a spine. (12)
9. Dorsal fin spineless. .*Wallago attu* (Bl. & Schn.)
- Dorsal fin with a spine. (10)
10. Anterior nostrils widely separated from the posterior. .*Mystus (Aorichthys) seenghala* (Sykes)
- Anterior and posterior nostrils close together. .. (11)
11. Adhesive apparatus on chest present. .*Glyptothorax pectinopterus* (McClelland)
- No adhesive apparatus present on chest. .*Amblyceps mangois* (Ham.)
12. Three pairs of barbels. (13)
- None, one or two pairs of barbels. (17)
13. An erectile spine present near the orbit. (14)
- No erectile spine present near the orbit. (15)
14. Caudal forked ; body with oblique cross bands. .*Botia birdi Chaudhuri*
- Caudal entire ; body with dark festooned blotches. .*Lepidocephalus guntea* (Ham.)
15. Third and fourth rays of pectoral fin produced upto ventrals .*Noemacheilus corica* (Ham.)
- Rays of pectoral fins not produced much.. . (16)

16. 7 branched rays in dorsal ; 9-15 bars on side of body .*Noemacheilus prashari* Hora
 10-12 branched rays in the dorsal ; body irregularly blotched. .*Noemacheilus botia* (Ham.)
17. Abdomen keeled. (18)
 Abdomen not keeled. (19)
18. Outer pelvic rays produced. .*Chela (Chela) cachi* (Ham.)
 Outer pelvic rays not produced. .*Oxygaster bacaila* (Ham.)
19. Lower jaw with a knob at the symphysis, fitting into emargination of upper jaw (Except *Esomus*) ; lateral line markedly curved downward behind the base of pectoral. (20)
 No symphyseal knob in lower jaw (Except *Cirrhinus*) ; lateral line with slight, if at all, downward bend. (26)
20. Maxillary barbels very long reaching beyond pelvic base ; no symphyseal knob in lower jaw
 Maxillary barbels short or absent ; symphyseal knob in lower jaw present. (21)
21. Cleft of mouth shallow ; sub-orbital bones not broad. .*Danio devario* (Ham.)
 Cleft of mouth deep, extending to below the eye ; sub-orbital bones prominent. (22)
22. Sides of body silvery .*Barilius modestus* Day (23)
 Sides of body with vertical bars. (23)
23. Anal with 10-12 branched rays (24)
 Anal with 7-8 branched rays. (25)
24. Colour bands long and extend from back to lateral line ; maxillary barbel extends upto $\frac{1}{3}$ rd of the orbit..... .*Barilius barila* (Ham.)
 Colour bands small and remain much above lateral line ; maxillary extends upto middle of orbit .*Barilius vagra* (Ham.)
25. Lateral line scales 40-43 . .*Barilius bendelisis* (Ham.)
 Lateral line scales 60-70.....*Barilius shacra* (Ham.)
26. Anal opening surrounded by a sheath of large tile like scales ; lateral line scales 108-110. .*Schizothorax plagiostomus* Heckel
 Anal opening not surrounded by a sheath of large tile like scales ; lateral line scales less than 90. .(27)
27. Upper lip separated from snout by a deep groove ; no sucker on the chin. (28)
 Upper lip not separated from the snout by a groove ; the chin bears a sucker. .*Garra gotyla gotyla* (Gray)

28. Lower lip not continuous with the upper. .*Crossocheilus diplochilus* (Heckel)
Lower and upper lips continuous at the corners of the mouth. .(29)
29. A symphyial knob present in lower jaw. .*Cirrhinus mrigala* (Ham.)
No symphyial knob in lower jaw. .(30)
30. Lower lip absent ; origin of dorsal fin distinctly posterior to the ventrals but not extending above the anal. .*Aspidoparia morar* (Ham.)
Lower lip present ; origin of dorsal fin nearly opposite the ventrals or anterior to them. .(31)
31. Mouth terminal or subterminal. .(32)
Mouth inferior .(36)
32. Lower lip with a continuous transverse fold forming a posteriorly free median lobe. .(33)
Lower lip with an interrupted fold and no free median lobe formed. .(34)
33. Head 4-4.5 and height 5.5-7.0 times in total length. .*Tor putitora* (Ham.)
Head 5-6 and height 4.5-5.0 times in total length. .*Tor mosal* (Ham.)
34. Barbel: absent .(35)
Barbels two pairs. .*Puntius sarana sarana* (Ham.)
35. Last spine of dorsal fin serrated ; lateral line incomplete ; no dark mark at base of dorsal fin.....*Puntius ticto* (Ham.)
Last spine of dorsal fin entire ; lateral line complete ; a dark mark at base of dorsal fin rays.....*Puntius sophore* Ham.
36. Scales along lateral line 37-40. .*Labeo bata* (Ham.)
Scales along lateral line 41-44. .(37)
37. Dorsal fin with 9-10 branched rays ; inner surface of lower lip papillated. .*Labeo dero* (Ham.)
Dorsal fin with 11 branched rays ; inner surface of lower lip beset with transverse folds. .*Labeo dyocheilus* (McClelland)

VI—THE FISHING METHODS USED IN THE AREA

A variety of different legal and illegal methods of fishing are practised in this area and are described below. According to the regulations, only those persons who possess a valid fishing license, issued by the Department of Fisheries and Fish Preservation, Srinagar, (J. & K.), can fish in the waters of river Tawi and its tributaries. In spite of a large number of fisheries-watchers posted by the Department of Fisheries, Srinagar, along the river Tawi and its tributaries, illegal fishing by unapproved methods is widely in practice.

Illegal methods of fishing

(a) *Blasting*—A gun-powder cracker, similar to the one used for blasting rocks on a road under construction, is used to blast a portion of the water where the fish is presumably in plenty. As a result of a strong jerky motion some fishes get stunned, become unbalanced and even die of shock—so much so that all forms of aquatic life of the blasted area is more or less completely wiped out. A few fishes which float upon the surface of the water are caught by the poachers and the rest are simply washed down by the strong current. Those fishes which survive this shock are not likely to breed. Thus this method is a kind of death blow to the fishing industry of that area and, if remained unchecked, may cause an extermination of aquatic fauna.

(b) *Poisoning*—Some people mix the seeds of a local herb, named 'Bichchoo Booti', in wheat flour and throw small pallets of the flour in water. Those fishes which eat the pallets feel extremely uneasy, get unbalanced, and float helplessly on the surface of the water. The floating fish is then caught. Such fishes lose their body colouration and become more or less colourless. The poison, probably, acts on the nervous control of the fish.

(c) *Chlorination*—At some places along the river, big ditches are formed. The water in these ditches (locally called 'Dabers') is more or less still, although connected with the main stream. In case there are some fishes, people put bleaching powder in the ditch, and as a result of chlorine action, the fishes helplessly float on the surface of the water and are caught easily.

(d) *Tin-trapping*—The bottom feeding fishes are trapped in small tins, bearing a small hole (nearly 5 cm. diameter) on its top. The tin contains some food as a bait and is placed at the bottom of water in a ditch by the side of the river or a nulla. The fishes enter the tin through the hole and are lifted out immediately before they go out. Some people apply the same method with the help of a wide mouthed basin, by tying over its opening a piece of cloth. A hole of a suitable size is pierced in the centre of the cloth and some food, as bait, is put in the basin. Once a fish enters the hole, it finds it difficult to escape.

Legal methods of fishing

Hook and line and cast net (1 sq. inch mesh size) are allowed to be operated in the waters of that state by the Department of Fisheries and Fish Preservation, Srinagar. At certain portions of the river near Jammu town, the use of cast net is prohibited. Such portions of the river act as fish sanctuaries where fishes have a free and uninterrupted terrain to live and breed.

For the purpose of scientific studies (faunistic studies) fishes of even little commercial value, whatsoever, are also important and are required to be collected. For this purpose certain special devices, in addition to those mentioned above, were employed by the present author to catch certain fishes which live among small stones, pebbles and under big rocks etc. The methods employed are described below.

(a) *Dredging*—A special dredging device has been designed and used in the field. The dredge is a bag of copper wire netting with a 'D' shaped cross section (Size: 30 × 45 cm.). The mouth of the bag is strengthened by a thick copper or brass sheet. A threaded strong nail is welded to the rim and a strong bamboo rod, with a nut welded to its tip can be fixed to it. The dredge can be operated through heap of stones and pebbles under water where fishes like *Noemacheilus*, *Glyptothorax* and *Amblyceps* get into it and are caught easily. The dredge is a good replacement for cloth water net, which gets worn out soon in a stony bed and does not stand the pressure of strong current of water.

(b) *Fine mesh nylon water nets*—Special strong nylon cloth (fine mesh) nets of the shape of dredge described above, were prepared. The net is supported by a bamboo pole and is moved quickly through water. Fishes of small sizes such as *Chela*, *Danio*, *Esomus*, *Barilius*, *Oxygaster*, etc., are easily caught in this manner. At many places, where the bed contains stones, the net is simply held in water against the current and some of the stones towards the upstream are moved so that the fishes adhering to them get washed into the net placed immediately behind.

(c) *Diversion of the channel*—At certain places, where the water in a channel is not very deep and it flows in a part of its bed, a portion of the channel can be diverted by putting a bandh across it. The fishes which hide below the stones flutter out in the partly dried portion of the channel and can be easily caught. This method has also been employed by Dr. S. L. Hora for collection of hill stream fishes.

VII—MIGRATION

Most of the species of fishes are common both to the river Tawi and the nullas flowing into it. Only perennial nullas are inhabited by the aquatic fauna. There is an intermigration of aquatic fauna between the river Tawi and the various nullas flowing into it. During and after rainy season, the aquatic fauna, particularly fishes, ascend into the nullas and during the winter season and early summer, they again return back to the river where water is still plentiful.

In the river Tawi itself there is a remarkable difference in the fish fauna occurring at high altitudes and that occurring at low altitudes. In addition to those species which stick to their particular habitat, there are some like *Mystus (Aorichthys) seenghala*, *Wallago attu* and *Tor putitora*, which are capable of moving as far up as to the height of 1200 metres during summer months. According to local fishermen species of *Mystus* and *Wallago* are completely absent in this river after the rainy season.

There are two phenomena of fish migration in this river as under:—

(1) The migration of fish fauna between river Tawi and its tributaries. The fishes ascend into the nullas, probably, due to two reasons (a) for sake of reproduction because the flow of the water in the nullas is much less as compared to the main river and the fishes find there convenient and quiet holes for breeding, (b) for sake of safety of their young ones, which spend most of their time in nullas

till they grow up in order to withstand the rigours of the flow of the mountain river.

(2) The up and down movement of the fish fauna at various altitudes in the river Tawi itself.

The phenomenon of fish migration in the river Tawi is interesting from physiological and ecological points of view. Some of the climatic and physiological factors which govern this phenomenon need careful study and analysis. The dependence of the fishes on other vertebrate and invertebrate animals could also control these movements. The migration of fish in river Tawi is a sort of micro-migration.

According to local fishermen, during floods the waters of the river Chenab and river Tawi get mixed up near their confluence. The fishes from river Chenab ascend into Tawi during this time. Moreover, small nullas come out of the river Chenab and join river Tawi before it finally mixes with Chenab. In the plains, i.e. a few kms. down from Jammu town, the fish fauna of the side branches of the river Tawi resembles that of the nullas coming out of the river Chenab. This is a clear indication that during floods the Chenab fishes come up into Tawi and after the water recedes down, some of them remain in the side branches of Tawi where the water is shallow and slow moving.

VIII—THE BED

The bed of the river Tawi as well as its tributaries contains huge stony boulders which have been washed down from the hilly sides through heavy rains (Pl. 4, figs. 5, 6) and at places still down there are only pebbles and sand (Pl. 4, figs. 7, 8). In no section of the river or its tributaries at altitudes higher than 500 meters there is any trace of aquatic vegetation because it gets uprooted easily and does not stand. The only form of vegetation observed is the deposition of a layer of algal mass on the stones under water. The vegetable feeders eat these algae while the insectivorous ones feed on the insects and their larvae entangled in the algal mass. On the sides of the nullas, where rain-water collects between stony boulders, thick growth of marshy plants exists. This forms a good habitat for young and larval fishes as well as species of *Channa*. Hora (1936 a) made some observations regarding the smooth and rough rocks in the bed of hill streams and their relationship with the aquatic fauna. The tributaries of the river Tawi have two types of beds:

(a) In some nullas the small stones are covered with layers of calcium carbonate and get adhered to each other firmly. The surface of stones is rough.

(b) In many other places the stones are small, smooth and not united firmly with one another (Pl. 4, fig. 3). They are not covered by layer of calcium carbonate. Hora (1936 a) referred Auden and correlated the rough deposition of calcium carbonate on stones with hard water of the stream whereas the smoothness of stones to the softness of the water. However, it has been observed that the tributaries of river Tawi with small and smooth stones, having a deposition of small amount of algae and having a few blepharocerid

larvae offer a good habitat for *Glyptothorax pectinopterus*. This species of fish is altogether absent in the nullas with rough stones which get strongly adhered to each other as well as to the substratum. The presence of *Glyptothorax pectinopterus* is directly correlated with the presence of blepharocerid larvae on which this insectivorous fish feeds. The blepharocerid larvae probably find a convenient habitat among smooth stones. This relationship offers a chain of interdependence i.e. *G. pectinopterus* on blepharocerid larvae and the latter on the smooth stones. In the plains the bed consists of fine stony sand and at some places there is mud. The muddy banks invariably bear a thick growth of grasses and reeds.

A particular difference has been observed in the manner of feeding of two phytophagous fishes viz. *Schizothorax plagiostomus* Heckel and *Garra gotyla gotyla* (Gray). *S. plagiostomus*, while feeding on the algal layer from the surface of a stone under water, makes crescent shaped impressions on the stones; *G. gotyla gotyla* makes a straight and irregular type of impression on the stones. The impression is formed where the algal mass has been rasped away by the fish. The difference in the pattern of feeding-marks on stones can be attributed to the fact that *Garra* possesses a suction disc by the help of which it can fix itself on stone and can withstand the current of water. While fixing itself on the stone covered with algae and moving forward against the current it makes a straight but irregular feeding mark on the stone. On the other hand the suction disc on the ventral side of the lower jaw of *Schizothorax* does not enable the fish to fix itself on the stone while it feeds on algae from a rock under strong current of water. It rasps off algae in small instalments making a series of crescentic impressions on the rock.

IX—ZOOGEOGRAPHICAL REMARKS

The fishes in the higher reaches of the river Tawi and its tributaries are no doubt hill-stream fishes but not fishes of torrential stream, except one genus i.e. *Schizothorax*. The fishes probably, migrated to the western Himalaya from the eastern Himalaya in the Pleistocene. The only fossil record of freshwater fishes in this part of Himalaya is that of *Schizothorax* sp. of the Pleistocene age (Hora, 1937). This substantiates the view that the torrential fish fauna of eastern Himalaya did not migrate to the west up to the early Pleistocene due to unfavourable ecological conditions created by the presence of a gap between the eastern and western Himalaya (Krishnan, 1952, Menon, 1954). The majority of the fishes of the western Himalaya are not truly torrential and migrated from the eastern parts only before the gap was bridged i.e. in the early Pleistocene. After a comparison of the fish fauna of the Kashmir Valley (Silas, 1960, Das and Subla, 1964) with that of river Tawi and its tributaries it can be deduced that the former shows central asiatic elements while the latter is purely Himalayan.

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XI—SUMMARY

1. Thirty-eight species of fishes have been recorded for the first time from river Tawi and its tributaries (J. & K. State). The important variations shown by the different species have been noted. *Noemacheilus corica* (Ham.) has been redescribed in detail while the material of *Noemacheilus prashari* Hora has been thoroughly compared with those of *Noemacheilus prashari* from Kohat (Pakistan) (published account alone) and of *N. punjabensis* Hora from Salt Range (Pakistan). A list of the material studied is given. A key to the identification of the 38 species has been added.

2. A record of the illegal and unapproved fishing methods practised by the poachers in the waters of river Tawi and its tributaries has been made. The fishing methods employed by the author and allowed by the Department of Fisheries and Fish Preservation, Jammu & Kashmir are also described in brief.

3. Two types of the phenomenon of micro-migration of fishes observed in river Tawi and its tributaries are described. The migration of fishes, it is held, is related to climatic and physiological factors which need a careful study.

4. The relationship of the species of fishes with the particular type and make up of the bed of the river and nullas has been noted, particularly in the case of *Glyptothorax pectinopterus*. The feeding habits of *Garra gotyla gotyla* (Gray) and *Schizothorax plagiosomus* Heckel have been studied.

5. The study of the fishes of the area shows that they constitute purely Himalayan fauna. They are not purely torrential fishes and could have migrated to their present abode only in the Pleistocene.

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