# FISH OF THE EASTERN DOONS, UNITED PROVINCES.

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## INTRODUCTION AND REMARKS ON MAHSEER FISHERIES.

During a short tour to the Dehra Dun Hills in September-October 1935, an opportunity was taken to study the ecology and bionomics of the fish fauna of this area. Through the kindness of the officers of the Forest Department and the Dehra Dun Fishing Association we were provided with all facilities for investigating the fish of the Song river and Ray Nadi at Lachhiwala and the Song and Suswa rivers at Satnarain. From the torrential streams in the neighbourhood of Mussoorie specimens of a *Nemachilus* and some young Cyprinid fishes, which cannot be identified, were collected.

The Song and the Suswa are the principal rivers of the Eastern Doons and are fed by a large number of tributary streams, some of which are of considerable dimensions. The rivers flow over broad rocky beds and are characterised by rapids in their courses. With the exception of filamentous algae and aquatic plants in the side pools, the streams are generally devoid of any vegetation. The exposed surfaces of rocks are, however, covered with a brownish, slippery organic growth which provides food for certain types of fish. 20 species of fish were collected from the Song and Suswa rivers and 1 from the Bhatta stream near Mussoorie. In the following table the species are listed; their vernacular names, places of collection in the Eastern Doons and general distribution are also given.

| Scientific and Vernacular Names. | Localities in the Eastern Doons. | | Distribution. |
|---|---|---|---|
| | Lachhiwala: Song and Suswa. | Satnarain: Song and Suswa. | |
| *Amblyceps mangois* (Hamilton). *Singhi.* | × | × | Along the Himalayas to Burma and Siam. |
| *Glyptothorax pectinopterus* (McClell.). *Patharchatti.* | × | .. | Simla Hills, Kangra Valley and Dehra Dun Hills. |
| *Danio (Brachydanio) rerio* (Hamilton). *Salari.* | × | × | Throughout India and Burma. |
| *Rasbora daniconius* (Hamilton). *Bhuri.* | × | × | India, Burma, Siam, Ceylon, Andaman Islands to Malay Archipelago. |

| Scientific and Vernacular Names. | Localities in the Eastern Doons. | | Distribution. |
|---|---|---|---|
| | Lachhiwala : Song and Suswa. | Satnarain : Song and Suswa. | |
| *Barilius bendelesis* var. *chedra* (Hamilton). *Chilwa.* | × | × | Simla Hills, along the Himalayas to Assam. |
| *Raiamas bola* (Hamilton). *Balala* or *Naulia.* | × | .. | Punjab, United Provinces, Orissa, Bengal, Assam and Burma. |
| *Barbus ticto* (Hamilton). *Bhuri* or *Poto.* | × | .. | Throughout India, Burma, Siam and Ceylon. |
| *Barbus chagunio* (Hamilton). *Pathali.* | × | × | Dehra Dun Hills, Eastern Himalayas, Assam and Burma. |
| *Barbus tor* (Hamilton). *Makhni.* | × | × | Throughout India, Burma and Ceylon. |
| *Barbus putitora* (Hamilton). *Mahseer.* | × | × | Along the Himalayas to Assam and Burma. |
| *Labeo dero* (Hamilton). *Moili* or *Kalabans.* | × | × | Sind Hills and along the Himalayas to Assam Burma and Ceylon. |
| *Crossochilus latius* (Hamilton). | .. | × | Gangetic watershed of the Himalayas. |
| *Garra gotyla* (Gray). *Dhanaura.* | × | × | Southern slopes of the Himalayas. |
| *Lepidocephalichthys guntea* (Hamilton). *Nauni.* | .. | × | Throughout Northern India. |
| *Nemachilus botia* (Hamilton). *Nauni* or *Ghiwa.* | × | × | Throughout Northern India and Burma. |
| *Nemachilus rupecola* (McClell.).* | .. | .. | Simla Hills, along the Himalayas to the Naga Hills. |
| *Nemachilus scaturigina* (McClell.). | × | .. | Dehra Dun Hills, Eastern Himalayas and Assam. |
| *Nemachilus savona.* (Hamilton). | × | .. | Dehra Dun Hills, Kosi River, Eastern Himalayas. |
| *Mastacembelus armatus* (Lacépède). *Bam* or *Guj.* | × | × | Throughout the plains and hills of India, Ceylon and Burma to China. |
| *Xenentodon cancila* (Hamilton). *Sua.* | × | × | Throughout India, Burma and Ceylon. |
| *Ophicephalus gachua* Hamilton. *Dawla.* | | | Oriental region. |

* Specimens of the species were collected from Bhatta Falls, Mussooric,

It will be seen from the above that there is no endemic species in these waters, but the records of *Amblyceps mangois* (Ham.), *Barbus chagunio* (Ham.), *Garra gotyla* (Gray), *Nemachilus scaturigina* (McClell.) and *N. savona* (Ham.) from this area are of exceptional interest. With the help of this collection and observations made in the field, it has been possible to establish the identity of the 3 species of large-scaled Barbels described by Hamilton from the sub-Himalayan region. The specific limits of *Barbus tor* are defined and it is shown that the correct scientific name for true *Mahseer* is *B. putitora* (Ham.). Reasons are adduced for the adoption of the name *Raiamas bola* (Ham.) for the " Trout " of these parts. Ecological, biological and taxonomic notes on 14 species are added.

Though all fish found in these parts are relished as food, 5 species, *viz.*, *Barbus putitora*, *B. tor*, *B. chagunio*, *Labeo dero* and *Raiamas bola*, are of special economic importance. The anglers are, however, mainly interested in *Mahseers* (*B. putitora* with yellow fins and *B. tor* with red fins) and " Trout " (*R. bola*). Our investigations have shown that these species, though living in a more or less similar environment, do not compete with one another for food. *Labeo dero* feeds on slimy growth convering rocks and stones, and, probably on account of meagre nourishment in this substance, its alimentary canal is 14 to 15 times as long as the total length of the fish. *B. tor* is primarily a vegetable feeder but its menu also consists of insect larvae and young gastropod molluscs ; its alimentary canal is 4 to 5 times as long as the total length of the fish. The feeding habits of *B. putitora* are more or less similar to those of *B. tor* but the relative length of its alimentary canal—2·6 times as long as the length of the fish—indicates that more animal food is taken by this species than *B. tor*. *B. chagunio* is primarily carnivorous as its alimentary canal is less than twice the length of the fish. *Raiamas bola* appears to be entirely carnivorous ; its alimentary canal is shorter than its length.

In the course of the tour it was brought to our notice by the Secretary of the Dehra Dun Fishing Association that the supply of *Mahseer* in the Association waters is steadily decreasing. This decrease is attributed by the Association to two main causes : (i) " the Canal works on the Ganges and Jumna. Fish run down but cannot get up to the smaller streams again. It is true ' fish ladders ' have been provided at places like Bhimgoda and Myapur where the Northern Ganges canals take off but no one believes that fish of any size can come up these ladders." (ii) *Mahseer* " are now crowded out by fish like the *Kalabanse* (*Labeo dero*) and that there is now insufficient food for the *Mahseer* in our rivers." We have indicated above that there is absolutely no competition for food between *Barbus putitora* or *B. tor* and *Labeo dero*. The decrease in the *Mahseer* supply cannot, therefore, be attributed to the preponderance of *L. dero*. Irrigation works, on the other hand, are known to have affected fisheries all over India and in the case of migratory fishes, such as *Mahseer*, their influence would be particularly pronounced. For details reference may be made to Day's " Report on the Fresh Water Fish and Fisheries of India and Burma " (pp. 7-14, 32-33, Calcutta : 1873). We have received a similar complaint from the

Laldacca Fishing and Shooting Association. The decrease in the number of *Mahseer* in the area under this Association is attributed to " the practice of placing semi-permanent weirs across the lower reaches of hill rivers when these fall to their cold weather level, whereby no fish can run down-stream without first evading the traps and nets which are placed in the gaps left for that purpose in the weirs by the khas mahal fishermen, who erect them." Such 'fixed engines' do incalculable harm to fisheries in general, but are particularly harmful in the case of migratory forms such as the *Mahseer.*

In collecting fish we employed the following methods: (i) A small bag-net fixed to a bamboo pole was used for collecting fish from small channels and from the shallower parts of larger streams. (ii) Portions of small streams were dammed both above and below a small area selected for fishing and the bed between the dams was allowed to run dry. From the small pools thus formed and by turning over stones in the dry bed a large number of fish, mostly of small size, were collected. (iii) Cast net was used along the sides of streams and the majority of our specimens over 6 inches in length were collected in this way. We had no appliances to collect fish either from the deeper parts of the streams or from the middle of the streams where the current was flowing very fast. This explains the absence from our collection of the adults of typical hill-stream fishes and the preponderance of young and half-grown specimens.

Judging from our collection as a whole and subject to the limitations stated above, it seems clear that these streams provide suitable nurseries for *Mahseer*, for we found all small channels and sides of larger streams teeming with the young of *Barbus putitora* and *B. tor.* Half-grown specimens of both the species, mostly under one foot in length, were also plentiful at the sides of the streams but anglers, who are interested in larger fish, report that the supply of such fish has decreased considerably during recent years. These apparently contradictory statements may be explained as follows: The *Mahseers*, as is well known, breed in the streams of the sub-Himalayan range to which they ascend during the south-west monsoon period when these streams are flooded. After breeding the parent fishes return to the main rivers but the young apparently spend the first year in the mountainous streams. As a result of obstruction by the irrigation works only very few individuals probably can ascend to their breeding grounds but even these seem to produce sufficient ova for populating the streams with young and half-grown forms. When the adults begin to descend with the fall of water, weirs obstructing the courses of the streams divert them into irrigation canals and here, having descended over one of the vertical falls, they are, in the majority of cases, unable to return to their breeding-grounds. Such effects of the irrigation works, if continued over a period of several years, are sure to impoverish the fisheries. In the Eastern Doons, though the *Mahseers* have admittedly decreased in number, the damage does not appear to be very great, for the number of young ones in the upper streams is fairly large, while the River Ganges at Hardwar, Rishikesh and Lachmanjhula is full of large *Mahseers*, which probably help year after year in the restocking of the upper smaller streams. If, however, the proper

conservation of this fisheries is desired, early steps should be taken to allow a free passage up and down the main river, at certain periods, of the migrating individuals.

We take this opportunity to record our sincere thanks to Mr. J. E. C. Turner, I.F.S., Divisional Forest Officer, Mr. I. N. Sewal, Extra-Assistant Conservator of Forests and Mr. P. S. Quarry, Honorary Secretary, Dehra Dun Fishing Association, for their kind help and invaluable suggestions in the course of our investigations.

## Systematic Account and Bionomics.

### **Amblyceps mangois** (Ham.).

1933. *Amblyceps mangois*, Hora, *Rec. Ind. Mus.*, XXXV, p. 617.

There are 11 young specimens of *Amblyceps mangois* in our collection, the largest being 73 mm. in total length. They were collected from the Song and Suswa rivers by damming streamlets in their beds. The remarkable feature of these specimens is that the caudal fin is deeply forked and the upper lobe is considerably longer than the lower ; this form of the fin corresponds with that figured by Hamilton in his manuscript drawing of the species[1].

*A. mangois* is found along the Himalayas and its range extends to Burma and Siam.

### **Glyptothorax pectinopterus** (McClell.).

1923. *Glyptothorax pectinopterus*, Hora, *Rec. Ind. Mus.*, XXV, p. 18.

Of the 13 young specimens of *Glyptothorax pectinopterus* in our collection, 3 were obtained from a small canal below the Forest Rest House at Lachhiwala, while the others were collected from the Song river. The largest specimen is about 30 mm. in length. It seems probable that the adults live in stronger and deeper currents whence collections could not be made with the appliances available to us.

In the young specimens the outer rays of the paired fins are not striated and the adhesive disc on the chest is more extensive. The specimens from the canal are somewhat lighter in colour, otherwise the colour marks are the same as those of the adult (Hora, *op. cit.*).

*G. pectinopterus* has hitherto been known from the Simla Hills and the Kangra Valley.

### **Barilius bendelisis** var. **chedra** (Ham.).

1921. *Barilius bendelisis* var. *chedra*, Hora, *Rec. Ind. Mus.*, XXII, p. 189.

*Barilius bendelisis* var. *chedra* is a very common fish in the larger streams of the Eastern Doons ; we collected a large number of young,

[1] Reproduced by Hora in *Mem. Ind. Mus.*, IX, p. 188, fig. 4, pl. xxii, (1929).

half-grown and adult specimens of the species. It prefers a sandy bed. Its paired fins, especially the pectorals, are fan-like and horizontal and are never folded even when the fish moves from place to place. Some of the rays are especially strengthened and it seems likely that they are used either for digging in sand or for holding on to rocks in somewhat rapid waters.

*B. chedra* feeds on algae and the insects that are found among them. It is used by anglers as a bait for *Raiamas bola* and *Barbus putitora*. It is common in all large streams at the base of the Himalayas and in Assam.

**Raiamas bola** (Ham.).

1878. *Barilius bola*, Day, *Fish. India*, p. 594, pl. cxlix, fig. 4.

*Raiamas bola* is the species that is known as " Trout " by anglers in the Dehra Dun District and is very much sought for. It is, however, not so abundant as *Barbus tor*, *B. putitora*, *B. chagunio* and *Labeo dero*. We obtained only 4 specimens from the Song river, the largest being 28·5 cm. in total length.

The colouration varies with age. In young specimens about 13 cm. in length there is a series of 15-17 short bars between the superior angle of the gill-opening and the base of the caudal fin. In between these bars there are indications of a second row alternating with the first. The posterior border and the middle of the lower lobe of the caudal fin is gray. With the growth of the fish the marks become rounded and are distributed in several rows on the body and in our two large specimens they are found on the head also. Judging from the descriptions of colour markings, it seems probable that *Cyprinus bola* of Hamilton[1] is in reality a juvenile form of his *C. goha*.

The alimentary canal is short and the walls of the stomach are greatly folded. The stomach was empty in most of the specimens but remains of a dragon-fly were found in one.

Though Hamilton included his *C. bola* in the *Barilius* group, it has been rightly assigned to a separate genus by Günther[2] and recent workers. Günther unfortunately proposed for it the generic name *Bola* which had already been used by Hamilton for a group of marine and estuarine fishes with *Bola coitor* Hamilton as the type of the genus. To correct Günther's error, Jordan[3] proposed the name *Raiamas* but Chaudhuri,[4] without looking properly into the contention of Jordan, revived the generic name *Bola* for this species and erroneously considered *C. bola* and *C. goha* as distinct species.

*Raiamas bola* is confined to the hilly parts of the Punjab, United Provinces, Orissa, Bengal, Assam and Burma.

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[1] Hamilton, *Fish Ganges*, pp. 274, 275 (1822).
[2] Günther, *Cat. Fish. Brit Mus.*, VII, p. 263 (1868).
[3] Jordan, *Proc. Acad. Nat. Sci. Philadelphia*, LXX, p. 344 (1919).
[4] Chaudhuri, *Rec. Ind. Mus.*, XIX, p. 29 (1920).

## **Barbus chagunio** (Ham.).

1878. *Barbus chagunio*, Day, *Fish. India*, p. 559, pl. cxxxvi, fig. 1.
1933. *Barbus chagunio* Hora & Mukerji, *Journ. & Proc. As. Soc. Bengal* (N. S.), XXVII, pp. 137-139.

We have already indicated that *Cyprinus chagunio* Ham.[1] and *Barbus spilopholus* McClelland[2] are conspecific and that their distinguishing features are in reality secondary sexual characters. The male specimens of the species (*spilopholus*-type) had hitherto been collected from Assam and the Eastern Himalayas, while the females (*chagunio*-type) were recorded by Day " From Orissa, throughout Bengal, Assam, Behar and N. W. Provinces to the Punjab" In the Eastern Doons this species is very common and both the sexes are represented in our collection. The local fishermen, who are aware of these sex differences, use the same vernacular name for both the sexes. We preserved only 16 specimens, 12 females and 4 males, and did not keep the large number of female specimens that were collected from the Song and Suswa rivers. We have already remarked on the rarity of the male examples in museum collections, and our field experience clearly shows that females predominate in nature.

From an examination of its stomach contents, it appears that the fish feeds on Trichopterous and Chironomid larvae that live in tubes made of sand or gravel particles. Small gastropods are also scraped off the rocks. In two cases the stomach was found to be empty showing that the fish probably feeds intermittently. The length of the intestine is about 1·7 times the total length of the fish ; this also shows that the fish is not herbivorous.

According to a local belief, *B. chagunio* does not migrate over long distances ; its movements are confined within a narrow limit depending upon the quantity of water in the rivers at different seasons.

## **Barbus tor** (Ham.).

1822. *Cyprinus tor*, Hamilton, *Fish. Ganges*, pp. 305, 388.
1839. *Barbus hexastichus*, McClelland, *As. Res.*, XIX, pp. 269, 333, pl. xxxix, fig. 2.
1878. *Barbus hexastichus*, Day, *Fish. India*, p. 565, pl. cxxxvi, fig. 4.

Great confusion prevails regarding the large-scaled Barbels of India and the specific name *tor* appears to have been indiscriminately used for several forms with 4 barbels, large scales and a strong and smooth last undivided ray in the dorsal fin. The vernacular name *Mahseer*, which is commonly applied to these large fishes, has also been responsible for a certain amount of confusion. While the systematic treatment of this group of fishes will form the subject matter of a separate monograph, sufficient material from along the southern slopes of the Himalayas and Assam is now available to discuss the specific limits of Hamilton's

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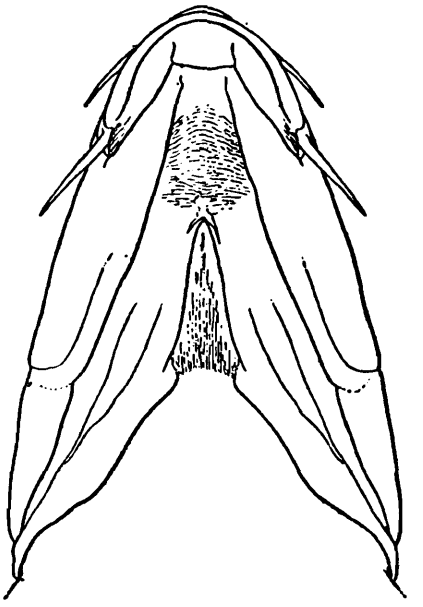
[1] Hamilton, *Fish. Ganges*, p. 295 (1822).

[2] McClelland, *As. Res.*, XIX, pp. 272, 341, pl. xxxix, fig. 4 (1839). It is worthy of remark that McClelland was aware of the close association of his *spilopholus* with *chagunio*, for he regarded the latter as a synonym of the former.

three species with " squamis maximis ", *viz.*, *Cyprinus putitora*, *C. tor* and *C. mosal*, which are usually regarded as conspecific.



TEXT-FIG. 1.—*Barbus tor* (Ham.) from Eastern Doons. Ventral surface of head showing nature of lower lip and jaws. Nat. size.

Judging by modern standards Hamilton's descriptions are inadequate and though his figures are usually reliable, apparently he made no drawing of *C. putitora*, the largest of the carps described by him. The drawings of the other two species were published by Gray[1] from Hamilton's collection of manuscript drawings. If all the characters in the descriptions of the three species are tabulated, it is found that *C. putitora* and *C. mosal* have much in common and are abundantly distinct from *C. tor* (text-fig. 1). In *C. putitora* and *C. mosal* the dorsal surface in front of the dorsal fin slopes and forms a sharp ridge, whereas in *C. tor* the surface in front of the dorsal fin has a blunt or convex edge. While examining fresh specimens we could very easily separate the yellow-finned form and the red-finned form, and these colour groups could be further distinguished by certain well marked taxonomic characters. In the specimens with red fins, the length of the head is contained more than 4 times and the depth of the body less than 4 times in the total length without the caudal, whereas in the examples with yellow fins the length of the head is less than 4 times in the total length without the caudal. Among the yellow-finned form there are two types: (i) The lips are fleshy and the lower one is produced backwards into a long fleshy appendage ; the snout is blunt. (ii) The lips are of the normal type and the lower lip does not form an appendage ; the snout is rather pointed. We believe that these differences are correlated with sex ; the former type represents the male and the latter the female (text-fig. 2). As these are the differences on which Hamilton separated *C. putitora* from *C. mosal*, we regard them as conspecific and on account of page priority adopt the former name for the species. This fish is popularly known as *Mahseer* in the Eastern Doons whereas *B. tor* is known as *Makhni*. It is stated by Hamilton that his *C. putitora* grows to about 9 feet while the female

[1] Gray, *Ill. Ind. Zool.* I, pl. xciii, fig. I, & II, pl. xcvi, fig. 1. (1832).

of the same (=*C. mosal*) grows to about 5 feet. *B. tor* is a smaller species attaining 3 to 4 feet in length.

*B. tor* is a common food fish and by the local people it is believed to be more powerful than *Mahseer*, *B. putitora*. The intestine is moderately long and convoluted; its length is equal to about 4·5 times the total length of the fish. It feeds preferably on filamentous algae and water plants, but in some cases young Gastropod molluscs, sand and gravel were found among the stomach contents. The young specimens were found to feed on slimy matter encrusting rocks and stones.

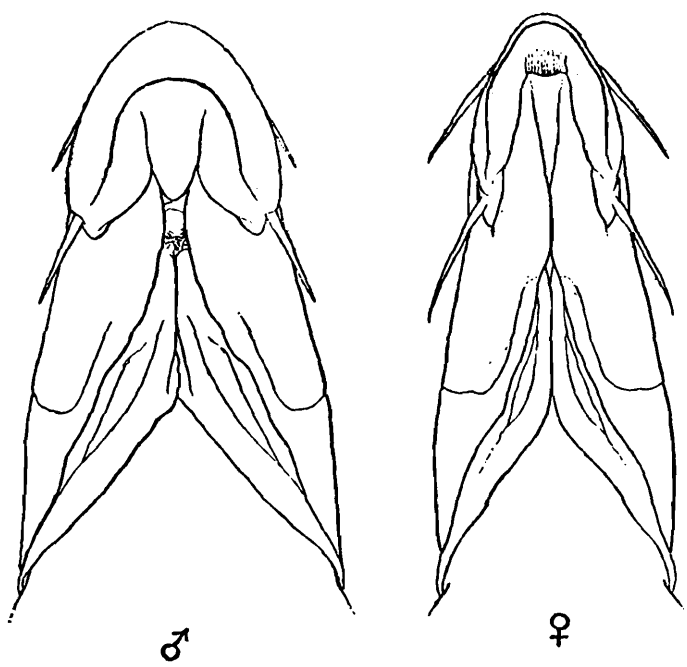
From the presence of a large number of young specimens in our collection, it would appear that the fish breeds in August-September. The fry is characterised by a black spot before the base of the caudal fin.

According to Day, this species is found in " Rivers on and around Himalayas, Cashmere, Sikkim and Assam"

### **Barbus putitora** (Ham.).

1822. *Cyprinus putitora*, Hamilton, *Fish. Ganges*, pp. 303, 388.
1822. *Cyprinus mosal*, Hamilton, *Fish. Ganges*, pp. 306, 388.
1878. *Barbus tor*, Day (in part), *Fish. India*, p. 564, pl. cxxxvi, fig. 5 & pl. cxl, fig. 1.

Under *Barbus tor* we have referred to the systematic position of *B. putitora*, but it may be mentioned here that this species is the celebrated *Mahseer* of India. In its habits it corresponds with *B. tor* and it is probable that these two species compete for food in the same environment. Both the species were equally abundant in the streams at




Text-fig. 2.—*Barbus putitora* (Ham.) from the Eastern Doons. Ventral surface of head of ♂ and ♀ showing sexual dimorphism in nature of both upper and lower lips and jaws. ×*ca* ⅔.

Lachhiwala and Satnarain, but in the deeper waters of the Ganges *B. putitora* seemed to predominate.

In most of the specimens dissected, the stomach was found to be empty showing that the feeding is probably intermittent in this species. The alimentary canal is considerably shorter than that of *B. tor*, being 2·6 times as long as the length of the fish. The fish feeds on green filamentous algae, insect larvae, water plants, slimy matter from rocks, etc. Judged by the length of its intestine, it would appear to be more carnivorous than *B. tor*.

*B. putitora* is represented by a large number of young specimens in our collection. This species also seems to breed in August-September. The fry is provided with a black spot in front of the base of the caudal fin.

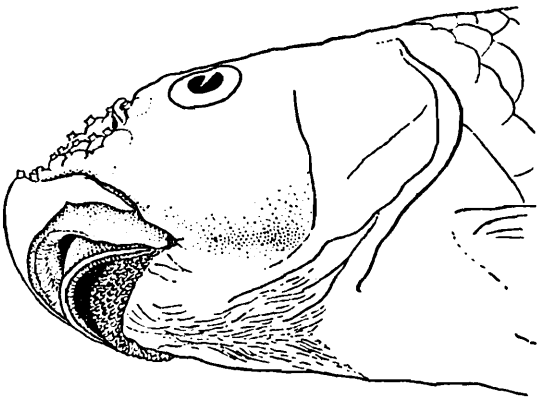
The species is said to be widely distributed in India and Burma, but till the large-scaled Barbels are revised it is difficult to form an exact idea of its range.

### **Labeo dero** (Ham.).

1822. *Cyprinus dero*, Hamilton, *Fish. Ganges*, pp. 277, 331, 385.
1878. *Labeo diplostomus*, Day, *Fish. India*, p. 540, pl. cxxix, fig. 2.

*Labeo dero* is a common fish of the Eastern Doons and is highly esteemed as food. We preserved 18 young, half-grown and adult specimens of the species from the Suswa and Song rivers. Day had some hesitation in regarding *L. dero* and *L. diplostomus* as conspecific, but an examination of a large number of specimens from the Tista Valley and the Dehra Dun Hills makes it abundantly clear that the two forms are identical and that the differences between them are probably due to the age of the specimens on which the original descriptions were based.

*L. dero* usually lives along the sides of streams and feeds by " licking " off slippery growth from the rocks. Fishes were noticed to settle on rocks and apply their mouths closely to them ; then they moved round and round the rocks till the slimy growth was polished off from them. The intestines of several specimens examined were found to be full of this slimy stuff. The alimentary canal is very long and convoluted ; its length being 14 to 15 times as much as the total length of the fish.



TEXT-FIG. 3.—*Labeo dero* (Ham.) from the Eastern Doons. Ventro-lateral view of head showing sharpness of lower jaw and papillated nature of inner surface of lower lip (deflected). Nat. size.

The lower jaw is sharp and blade-like (text-fig. 3) and the lip is free from the jaw. The dorsal surface of the lower lip is covered with large,

spinate papillae. When the fish begins to feed, it seems probable that, during the forward movements of the fish, the lower lip is turned over and the papillae come in contact with the rock. In all probability they enable the fish to keep its mouth closely applied to the rock.

*L. dero* can be readily caught with cast nets and is commonly used by anglers as bait for *Barbus putitora* and *Raiamas bola.* It is the well-known *Kalabans* of the sportsmen of this area.

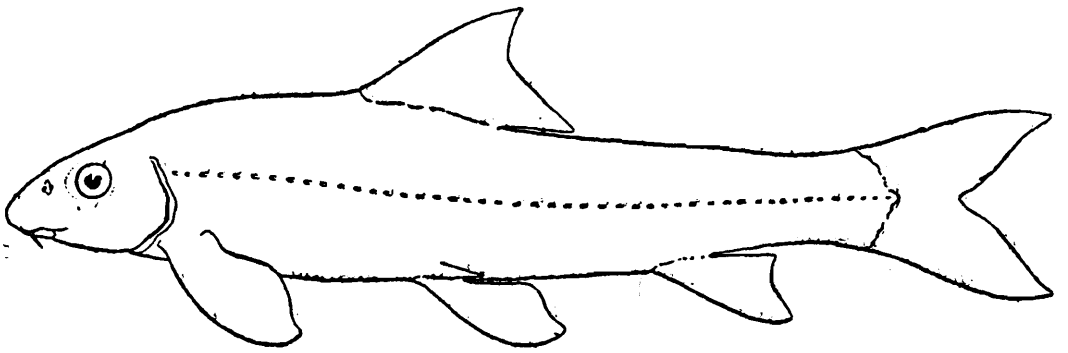
*L. dero* is found in the Sind hills, all along the Himalayas and Assam.

### **Crossochilus latius** (Ham.).

1934. *Crossochilus latius* (*forma typica*), Mukerji, *Journ. Bombay Nat. Hist. Soc.*, XXXVII, p. 50.

We obtained two fine examples of *Crossochilus latius* from the Song river at Satnarain ; the larger specimen is about 20·5 cm. in total length. These examples correspond with the typical form (text-fig. 4) of the species as recently restricted by one of us (Mukerji, *op. cit.*).

The sides and the front part of the snout are covered with small, spiny tubercles. The body is irregularly marked with a number of dark spots.



Text-fig. 4.—Lateral view of *Crossochilus latius* (Ham.) *forma typica* from the Eastern Doons. ×½.

The feeding habits of this species correspond with those of *Garra gotyla* (*vide infra*). The food seems to be ingested in lumps so that the alimentary canal presents a beaded appearance. The food consists of algae and algal slime which are scraped from rocks. It would thus appear that *Garra* and *Crossochilus* compete for food. *Garra* is, however, equipped for life in stronger currents where it can use its vacuum sucker for attachment ; while *Crossochilus,* as a rule, frequents less rapid currents. It was remarked by one of us[1] that *Garra* may have evolved from *Crossochilus*-like ancestors. The observations on the feeding habits of the two forms seem to lend further support to this view.

The typical *C. latius* is found in the Gangetic watershed of the Himalayas ; the Assamese and Burmese form is more allied to it than the Punjab form[2] which has quite a different facies.

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[1] Hora, *Rec. Ind. Mus.*, XXII, p. 646 (1921).
[2] Mukerji, *Journ. Bombay Nat. Hist. Soc.*, XXXVII, p. 53, fig. 7 (1934).

## **Garra gotyla** (Gray).

1921. *Garra gotyla*, Hora *Rec. Ind. Mus.*, XXII, p. 653.

In his revision of the fishes of the genus *Garra*, Hora remarked as follows concerning the validity of *G. gotyla* :—

" It is after long hesitation and not without reserve that I recognise this species as valid. Gray has not given any description of his species, but as most of his figures are made from specimens collected in Northern India, I have referred the North Indian specimens with a well-developed proboscis to this form."

24 specimens of *G. gotyla* were collected by us from the Song and Suswa rivers. The Fishing Guard at Lachhiwala, a native of Garhwal, gave us *Gotyla* as the vernacular name of the species, thus leaving no doubt that the name has been rightly applied to the Himalayan species with a well-developed proboscis. The proboscis is present in both the sexes and even in young specimens, about 53 mm. in total length, it is fairly prominent. In a specimen about 38 mm. in length a transverse groove is present but there are no tubercles on the snout.

In young specimens, besides the normal colouration of the species, there is a vertical band extending in width over two to three scales and situated slightly in front of the base of the caudal fin. The characteristic dark mark near the superior angle of the gill-opening is also much deeper in colour.

The alimentary canal presents a beaded appearance, and it seems likely that each bead represents a morsal of food taken by the fish. *Garra* feeds by scraping algal matter from rocks and it appears probable that the food is collected between the rostral hood and the posterior jaw. Probably when sufficient food had been collected, only then it is ingested. In this way lumps of food are taken in at a time and passed along the alimentary canal.

*G. gotyla* is found along the southern slopes of the Himalayas. The largest specimen in our collection is 16 cm. in total length.

## **Nemachilus rupecola** (McClell.).

1935. *Nemachilus rupecola*, Hora & Mukerji, *Rec. Ind. Mus.*, XXXVII, p. 400, figs. 4 & 5.

In our recent account of the fishes of the Naga Hills, we referred to the variability of *Nemachilus rupecola* originally described from the Simla Hills. The specimens recently collected by us from the Bhatta falls, Mussoorie, agree with the typical form but are provided with several series of spots on the dorsal and caudal fins. A few marks are usually present on the dorsal and caudal fins in specimens collected from the clear streams of the Western Himalayas, while the rich colouration of the Mussoorie examples is probably correlated with the thick growths of filamentous algae in the Bhatta falls. The specimens from the Eastern Himalayas and the Naga Hills, which were collected from among bare rocks, have the fins dusky in the middle but there are no spots on them.

A very large number of young specimens was collected showing that the fish breeds after the rains.

The stomachs of the larger specimens are full of filamentous algae and the Trichopterous larvae that are found among them.

The range of *N. rupecola* extends from the Simla Hills along the Himalayas to the Naga Hills. The largest specimen in our collection is about 90 mm. in total length. From field observations in the Tista Valley and the Dehra Dun Hills, it seems probable that this species is found in precipitous streams where it lives in pools and channels below waterfalls.

### **Nemachilus scaturigina** (McClell.).

1935. *Nemachilus scaturigina*, Hora, *Rec. Ind. Mus.*, XXXVII, p. 64, pl. iii, figs. 7 & 8.

The specific limits of *Nemachilus scaturigina* were recently defined by one of us and a description was given from specimens collected in the Eastern Himalayas and Assam. We have now collected 20 specimens from the Song river at Lachhiwala and it seems probable that the species is widely distributed along the base of the Himalayas.

### **Nemachilus savona** (Ham.).

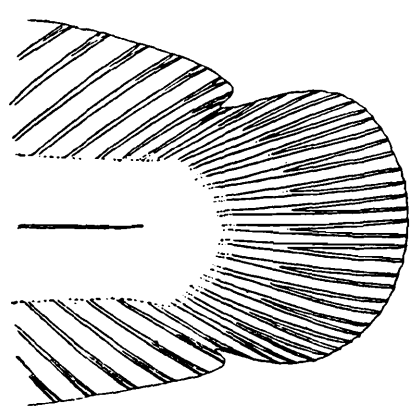
1935. *Nemachilus savona*, Hora, *Rec. Ind. Mus.*, XXXVII, p. 56, pl. iii, figs. 3 & 4.

Recently one of us defined the specific limits of *Nemachilus savona* and remarked that " It seems probable that this species has a wide range in the small, rapid and clear streams of the eastern sub-Himalayan region." There are 3 specimens in our collection from the Eastern Doons which belong to this species and it seems probable that it is widely distributed along the entire base of the Himalayas in suitable places.

### **Mastacembelus armatus** (Lacép.).

1877. *Mastacembelus armatus*, Day, *Fish. India*, p. 340, pl. lxxiii, fig. 2.

Mastacembelidae or Ditch-eels are usually found in great abundance in marshy areas, but certain species appear to be equally at home in clear waters of hill streams where they live at the bottom among stones and boulders. We collected a large number of young, half-grown and



Text-fig. 5.—*Mastacembelus armatus* (Lacép.) from the Eastern Doons. Tail region of a young specimen showing incomplete union of dorsal and anal fins with caudal fin. ×4½.

adult specimens of *Mastacembelus armatus* from the Song and Suswa rivers. As pointed out by Day the colouration varies considerably in

this species and from the material before us it appears that the young are more gaudily coloured and the colour pattern is very variable; with the growth of the fish the colour markings become restricted and in some specimens fade out altogether.

Usually the dorsal and the anal fins are continuous with the caudal but in some specimens, especially the young ones (text-fig. 5), there are shallow notches between these fins.

*M. armatus* is a predaceous fish; in the earlier stages it feeds on insect larvae and small prawns while as an adult it feeds on other fish. A specimen of *Nemachilus botia*, 60 mm. in length, was found in the stomach of a fish 375 mm. long; while another specimen, 335 long, had a *Barilius*, 50 mm. in length, in its stomach. The alimentary canal is about three-fifths of the total length of the fish.

*M. armatus* is a widely distributed species; its range extends from Sind, throughout India to Burma and China. It is found in the fresh and brackish waters of the plains and hills of India.