THE SYSTEMATIC POSITION OF HAMILTON'S SPECIES OF GOBIOID FISHES FROM THE GANGES.

By SUNDER LAL HORA, *D.Sc., F.R.S.E., F.A.S.B., Assistant Superintendent, Zoological Survey of India, Calcutta.*

As is fully realised by all ichthyologists interested in the Indian fauna, the specific validity of a number of species described by Hamilton (once Buchanan) in his " Gangetic Fishes "[1] is not finally established. Hamilton published his monumental work in the absence of a great many of his drawings and several volumes of his manuscript notes, and, in consequence, the published descriptions of several species are defective while it has been a matter of considerable difficulty to identify the species that are not figured. This defect has been removed partially by the publication of Hamilton's manuscript drawings [2], but considerable work yet remains to be done for defining precisely the specific limits of several species. The difficulty is augmented by the fact that Hamilton, as pointed out by me in 1929, preserved no specimens, and in the absence of such material, his drawings are the only indications we possess of the different species described in the " Gangetic Fishes " To straighten this tangle, the only course open is to secure topotypes (specimens from type-locality), but here again it has to be taken into consideration that in places the configuration of the country has changed considerably since Hamilton's time : this was indicated [3] in the case of the type-locality of *Amblyceps mangois* (Ham. Buch.). It is fortunate, however, that Hamilton left comprehensive notes regarding the localities, local names and the dates of his original descriptions in a volume of " Original Notes concerning the Gangetic Fishes " which is now preserved in the Library of the India Office in London.

While working on the brackish water fauna of the Gangetic Delta, the Gobioid fishes attracted my special attention on account of the great structural and biological adaptations exhibited by them. During several visits to Uttarbhag, a trading village on the *Piali Nadi* in the 24-Parganas, a large collection of Gobioid fishes was made, and, when sorting out the material, it was observed that almost all the forms described by Hamilton from the estuaries of the Ganges were represented in it. As the material came from the type-locality (*vide infra*) and as in recent years two species of Hamilton had been redescribed under new names, it seemed to me desirable to publish my observations on the systematic position of Hamilton's species of Gobioid fishes from the Ganges.

Sewell[4], in his recent study of the fauna of the Salt Lakes, Calcutta, has pointed out that " for several years past there has been a steady

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[1] Hamilton, *An Account of the Fishes found in the River Ganges and its branches* (Edinburgh : 1822).

[2] For location of published drawings see Hora, *Mem. Ind. Mus.* IX, pp. 182-191 (1929).

[3] Hora, *Rec. Ind. Mus.* XXXV, p. 612 (1933).

[4] Sewell, *Rec. Ind. Mus.* XXXVI, p. 46 (1934).

change in the conditions existing in and the general character of some of the rivers in Lower Bengal, and these changes have had a profound effect on the Salt Lakes and the associated streams and thus indirectly on the general character of the fauna of certain areas." There is no doubt that since Hamilton's time considerable changes have occurred in the geography of the Gangetic Delta, especially of the area in the neighbourhood of Calcutta. It is known that though Hamilton entered the service of the Honourable East India Company as an Assistant Surgeon on the Bengal Establishment on 26th September, 1794, he actually took up residence in Bengal in the later half of 1796, when, on his return from Burma, he was posted to Luckipoor (Lakhipur or Lakshmipur), 23 miles from the headquarters of the present district of Noakhali in South-Eastern Bengal and in the time of the East India Company a flourishing centre of the weaving industry. He lived at Puttahaut, not far from the Padma River (The Meghna) and about six miles north of Luckipoor, from the later half of 1796 to a considerable part of 1798. Buchanan began to take interest in fishes at Puttahaut and had actually made a few observations, when he was transferred in the beginning of October 1798 to Baruipur in the 24-Parganas about 18 miles from Calcutta. Till the commencement of 1800, Buchanan, while stationed at Baruipur, drew up the descriptions and had drawings made of the fishes of the area, mostly estuarine. The result of his studies up to the beginning of 1800 are embodied in the manuscript entitled " Piscicum Bengalae inferioris Delineationes septuaginta octo ",[1] which is now preserved in the library of the Asiatic Society of Bengal. Buchanan's investigation of brackish water fishes was interrupted from the beginning of 1800 to the middle of 1814, but in 1814, when he was posted as Superintendent of the Royal Botanical Garden, he resumed his interest and described several estuarine fishes from the Hooghly River and connected pools below Calcutta and from the Calcutta Salt Water Lakes. With the possible exception of one species of Gobioid fishes, the remaining were obtained by Buchanan during his residence at Puttahaut, Baruipur or Calcutta. The table on the opposite page shows the provenance and dates of the original descriptions, the local names, up-to-date scientific names, etc., of Gobioid fishes described in his " Gangetic Fishes " The species marked with an asterisk (*) in the table are described in the 1800-manuscript and, therefore, must have been obtained by Buchanan during his stay at Puttahaut and Baruipur.

Of the 16 species enumerated in the table, descriptions of 8 species are to be found in the 1800-manuscript ; while five of the species were obtained by Buchanan during his tenure as Superintendent of the Royal Botanical Garden. One species—*Gobius gutum*—was described during his survey of the Rungpur and Purnea districts, but regarding this he remarks in the " Gangetic Fishes " that " this fish I found in the lower parts of the Padda or Padma River, which Major Rennell calls the Great Ganges " Presumably the specimens on which he based his description were sent to him from the lower part of the Padma River.

Since Hamilton's discovery of *Gobius gutum*, it has never been found again and, therefore, regarded as a doubtful species by ichthyologists.

[1] Hora, *Journ. As. Soc. Bengal* (N. S.), XXVII, pp. 123-135, 1931 (1933).

Scientific Name in "Gangetic Fishes".	Habitat in "Gangetic Fishes".	Local Names in "Original Notes".	Date and place of original description.	Up-to-date Scientific Name.
**Gobioides rubicundus*, p. 37, pl. v, fig. 9.	Estuaries of the Ganges	*Laal Chaangooaa; Lal Ghagra*, Calcutta.	?	*Taenioides rubicundus* (H. B.).
Gobioides ruber, p. 38. (Hora 1929, pl. xviii, fig. 2).	Estuary below Calcutta	*Lal Chenggo*	Calcutta, 4th November, 1814.	*Trypauchen vagina* (Bl. & Schn.).
**Gobius bato*, p. 40, pl. xxxvii, fig. 10.	Estuaries of the Ganges	*Bhato*, Luckipore; *Goole* and *Chaungooaa*, Calcutta.	?	*Apocryptes bato* (H. B.).
**Gobius, changua*, p. 41, pl. v, fig. 11.	Estuaries of the Ganges	*Chaungooaa*	?	*Pseudapocryptes lanceolatus* (Bl. & Schn.).
**Gobius viridis*, p. 42, pl. xxxii, fig. 12.	Estuaries of the Ganges	*Chaungooaa*	?	*Scartelaos viridis* (H. B.).
**Gobius plinianus*, p. 45, pl. xxxv, fig. 13.	(Described as the most common species.)	*Dāns* and *Hona Meno*, Calcutta.	?	*Boleopthalmus boddaerti* (Pall.).
Gobius septemradiatus, p. 46	?	*Doag Dans* and *Dawis*	?	*Periophthalmus schlosseri* (Pall.)
**Gobius novemradiatus*, p. 47, pl. ii, fig. 14.	?	*Daans*	?	*Periophthalmus schlosseri* (Pall.).
Gobius tredecemradiatus, p. 48	?	*Doag Dans* and *Dawis*	?	*Periophthalmus schlosseri* (Pall.).
Gobius gutum, p. 50. (Hora 1929, pl. xiv, fig. 7).	Lower parts of the Padda or Padma river.	*Gutum baliya*	Padma river, 4th September, 1809.	*Glossogobius giuris* (H. B.) (Pug-headed and abnormal form).
**Gobius giuris*, p. 51, pl. xxxiii, fig. 15.	Ponds and fresh water rivers of the Gangetic provinces.	*Pookhoreeaa Baaleeaa, Pukhoriya baliya* and *ghiyuri.*	?	*Glossogobius giuris* (H. B.).
Gobius sadanundio, p. 52 (Hora 1929, pl. xviii, fig. 3).	Estuaries near Calcutta	*Sadanundi bele*	Botanical Garden, 13th January 1815.	*Stigmatogobius sadanundio* (H. B.).
Gobius chuno, p. 53. (Hora 1929, pl. xiv, fig. 6).	Estuary below Calcutta	*Chănō*	Botanical Garden, 18th January, 1815.	*Gobiopterus chuno* (H. B.) (=*Micrapocrytes fragilis* Hora).
Gobius nunus, p. 54 (Hora 1929, xiv, fig. 5).	River below Calcutta	*Thutkuri bēlē* and *Nūnī bele.*	Botanical Garden, 18th January, 1815.	*Ctenogobius nunus* (H. B.) (=*Gobius alcockii* Annandale).
**Cheilodipterus culius*, p. 55, pl. v, fig. 16.	Ponds and ditches of Bengal	*Nucli, Kuli Beliya*	?	*Eleotris fusca* (Bl. & Schn.).
Cheilodipterus butis, p. 57 (Gray 1838, II, pl. xciii, fig. 3).	River below Calcutta	*Bhutī bēlē*	Botanical Garden, 13th January, 1815.	*Butis butis* (H. B.).

In the description of the fish, Hamilton referred to its close similarity with *G. giurus*. A careful study of the figures[1] and descriptions of the two species has shown that the former may be an abnormal form of the latter, which is a very widely distributed species of India and is adapted to live under varying conditions of salinity, etc. According to Hamilton, the principal features in which *G. gutum* differs from *G. giurus* are (*i*) 13 rays in the pectoral fin of *G. gutum* as against 22 rays in that of *G. giurus*, (*ii*) head small and narrower than the body in *G. gutum*, while it is wider than the body in *G. giurus* and (*iii*) the lower jaw shorter than the upper in *G. gutum* and *vice versâ* in *G. giurus*. A comparison of the figures also shows that the chief differences lie in the form and structure of the head which, in my opinion, are due to the pug-headed condition of *G. gutum*. The smaller number of rays in the pectoral fin is probably another abnormal feature. It seems likely, therefore, that *G. gutum* was described from an abnormal pug-headed specimen of *G. giurus*.

To verify this surmise a photographic copy of the original drawing of *G. gutum* was sent to the Collector of the Noakhali district with a request that any information and specimens of *Gutum baliya*, if available, may kindly be obtained. In reply the Collector sent seven specimens and remarked that a fish locally known as *Gutum Baliya* " is available in this district in abundance " All the seven specimens sent by the Collector are *Glossogobius giurus*, and now there seems no doubt that *G. gutum* and *G. giurus* should be regarded as conspecific.

There are two species, *G. septemradiatus* and *G. tredecemradiatus*, about which no definite information exists, but there can be hardly any doubt that Buchanan obtained them while stationed at Calcutta, as the forms are abundant in the estuaries. Moreover, these forms are conspecific with *G. novemradiatus* and all the three names are synonymous with *Periophthamodon schlosseri*, a species very variable in regard to the number of spines in the first dorsal fin (0—15). I have obtained specimens of all the species referred to above from the neighbourhood of Calcutta and especially from Uttarbhag, which is situated about 5 miles to the south-east of Baruipur. In the " Original Notes ", the Luckipore name of only one species is mentioned and in the " Gangetic Fishes ", *G. gutum* is definitely stated to have been collected from the Padma River, so it may be reasonable to presume that at Puttahaut Buchanan became familiar with only two species of Gobioid fishes.

I include here a short summary of the changes in the configuration of the areas near Puttahaut and Baruipur. Rennell's map (1780-1790) shows " the Meghnā flowing past Lakhipur, then an important factory of the East India Company, sweeping in a steady curve round the south-west of the district and passing some five miles south of the present station of Naokhali, and then inclining slightly northward on to the mouth of the Feni where it flowed some two miles south of Companyganj"[2]. Hooker found in 1850 that Meghnā was moving gradually to the west, and the tide rose about 14 feet. With regard to the configuration of the area near Lakshmipur, the Collector of Noakhali informs me that

[1] For a figure of *G. gutum* see Hora, *Mem. Ind. Mus.* IX, pl. xiv, fig. 7 (1929).
[2] Webster, Eastern Bengal and Assam District Gazetteers. Noakhali, p. 7 (1911).

" an area of about 4 or 5 miles to the south of Lakshmipur has, of late, been diluviated and new chars, *viz.*, Char Ramani Mohan and Char Martin, etc., have been formed, thus diverting the course of the Meghnā River near Lakshmipur to flow by the south side of Char Ramani Mohan."

In the old days, Baruipur used to be a big trading centre and was situated on the banks of the Adiganga, a tidal creek. Now the bed of Adiganga is represented by a series of freshwater tanks and there is no brackish water in the immediate neighbourhood of the place, but it is likely that 136 years ago, when Buchanan was living at Baruipur, there were brackish water pools in the bed of the Adiganga near Baruipur. Uttarbhag is now a big fishing centre and lot of fish from this place are sold daily in the Baruipur market and it is likely that Buchanan may have also obtained his specimens from neighbouring places. Under these circumstances, the specimens from Uttarbhag can be regarded without any hesitation as topotypes of the species described by Buchanan during his stay at Baruipur.

In view of the above remarks, the forms listed above are referable to 13 species, all of which are well-known though two of these—*Gobiopterus chuno* and *Ctenogobius nunus*—have become familiar in literature under taxonomically unsound names. The remaining eleven species are known to be widely distributed in the seas and estuaries of India, Burma, Malay Archipelago and of countries further east.

In the following pages, therefore, the systematic position of Hamilton's two little know species is discussed.

Gobiopterus chuno (Ham. Buch.).

1822. *Gobius chuno*, Hamilton, *Gangetic Fishes*, p. 53.
1923. *Micrapocryptes fragilis*, Hora, *Mem. Ind. Mus.* V, p. 751.
1929. *Gobius chuno*, Hora, *Mem. Ind. Mus.* IX, pl. xiv, fig. 6 (Ms. drawing of Hamilton-Buchanan reproduced).
1931. *Gobiopterus fragilis*, Koumans, *Pre. Rev. Genera Gobioid Fish.*, p. 32.

Gobiopterus chuno was described by Hamilton-Buchanan from " the estuary below Calcutta ", and a reference to the " Original Notes " shows that the species was discovered by him in January 1815 while stationed at the Royal Botanical Garden. *Chuno* is a name collectively employed for small species of fish and prawns in Calcutta and there is no doubt that in the specific name reference is made to the small size of the fish and to its diaphonous colouration. Judging according to the present day standard, Hamilton's description of the species is inadequate and it is greatly to be regretted that he had not access to the figure of the species when he published its description in the " Gangetic Fishes " In these circumstances, it is not surprising that no notice has been taken of this species by any ichthyologist; even Day omitted to refer to it in his monumental work on the "Fishes of India "

In 1923, I described a small, transparent Goby from the Chilka Lake and the Baliaghata Canal near Calcutta. It was so remarkable that a new genus was proposed for its accommodation, and its close affinity to *Gobius brachypterus* Bleeker was indicated. Unfortunately, I missed to note at the time that Bleeker had already proposed a separate genus

Gobiopterus for his *G. brachypterus*. Kouman has now directed attention to this omission and after an examination of a cotype of my species—*Micrapocryptes fragilis*—has referred it to *Gobiopterus*.

A careful study of the description and figure of Buchanan's *Gobius chuno* shows that, in all the points noted by Buchanan in his short description, it agrees very closely with the transparent Goby described by me, and I have no doubt that the two are conspecific. The most salient feature, however, is the character of the teeth, but, with the appliances available to Buchanan, he was unable to determine their nature and remarked that "The structure of the *teeth* in such a minute animal cannot be readily ascertained, although these organs evidently exist." The principal features in which the two descriptions agree are :—

i. Small size.
ii. Diaphonous colouration with black dots.
iii. Oblique and upturned mouth with the lower jaw longer than the upper.
iv. Forward position of the eyes.
v. Five short rays in the first dorsal fin, and seven to eight rays in the second dorsal.
vi. Occurrence in the estuaries near Calcutta.

Besides these, there are several other minor points of agreement also.

Gobiopterus consists of small pelagic species which correspond in habits with the European transparent Gobies of the genera *Aphia* and *Crystallogobius*. So far as I am aware, *Gobiopterus* is represented by three forms, *G. brachypterus* Bleeker[1] from the Grati Lake in Java. *G. chuno* from the Chilka Lake and the Salt Lakes, Calcutta, and *G. sp.*[2] from the Talé Sap, Siam. It is significant that all the three forms are known from brackish water lakes and in the Chilka Lake *G. chuno* was found in the main area where the specific gravity of the water varied from 1·0020 to 1·0080. The salinity of the other pieces of water in which *Gobiopterus* lives is not known.

The alimentary canal of *G. chuno* is a broad simple tube ; it is somewhat dilated in the region of the stomach and is about one-third the total length of the fish. An examination of the stomach contents has shown that the fish feeds on Copepods and other planktonic crustacea. Thus from its structure, colouration and feeding habits, the fish seems to be a true pelagic species. The structure of the pelvic fins, as a long funnel-like tube, also shows that these fins are not used for adhesion as is the case in a majority of the other Gobioid fishes.

Ctenogobius nunus (Ham. Buch.).

1822. *Gobius nunus*, Hamilton, *Gangetic Fishes*, p. 54.
1876. *Gobius nunus*, Day, *Fish. India*, p. 297.
1906. *Gobius alcockii*, Annandale, *Journ. As. Soc. Bengal* (N. S.), II, p. 201, 1 fig.
1923. *Ctenogobius alcockii*, Hora, *Mem. Ind. Mus.* V, p. 744.
1928. *Ctenogobius alcockii*, Hora, *Rec. Ind. Mus.* XXX, p. 37.
1929. *Gobius nunus*, Hora, *Mem. Ind. Mus.* IX, pl. xiv, fig. 5 (Ms. drawing of Hamilton-Buchanan reproduced).

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[1] Bleeker, *Nat. Tijdschr. Ned. Ind.* IX, p. 401 (1855).
[2] Hora, *Mem. As. Soc. Bengal* VI, p. 495, fig. 7 (1924).

This is the smallest of the Indian Gobies and was described by Hamilton from "the river below Calcutta" In his "Original Notes", the description of this species is dated 18th January 1815, when Buchanan was stationed at the Royal Botanical Garden. Among other characters, Hamilton noted that *C. nunus* "has six irregular black belts, one passing through the eye, a second on the gill-covers, the third at the pectoral fins, the fourth at the vent fin, the fifth behind the second back fin, and the sixth at the end of the tail" It was also noted that "the first back fin contains six undivided rays." The species remained undetermined for a long time and it appears that Cuvier and Valenciennes and Günther considered the original description inadequate for the specific recognition of the species and, therefore, did not include it in their systems of classification. Day, who had access to Buchanan's manuscript drawings in the library of the Asiatic Society of Bengal, redescribed this species from a small specimen "captured by the late Dr. Stoliczka in a freshwater stream, near Moulmein" and thus extended its range from Hooghly to Burma. The description of its colouration agrees very closely with that given by Buchanan, but its dorsal fin formula "D $5/\frac{1}{9}$" is different. Unfortunately, Day did not figure this small species nor directed attention in his description to its manuscript drawing in Buchanan's collection of drawings in the Asiatic Society of Bengal. No one seems to have taken notice of this species after Day.

In 1906, Annandale described a new species *Gobius alcockii* from a large number of specimens obtained at Port Canning in brackish water and at Calcutta in fresh water. Annandale's description of the colour of his species is identical with that given by Hamilton and Day for *G. nunus*, and in other particulars also the two species appear to be conspecific. According to Annandale, the dorsal fin formula is "D $5\ \frac{1}{6-7}$", but in the large number of specimens examined by me I have always found six undivided rays in the first dorsal. Annandale added a note on the breeding habits of the fish and remarked on the large size of the eggs in *G. nunus*.

In 1907, Annandale[1] recorded "*G. alcockii*" from a tank at Rajshahi, 150 miles north of Calcutta. In 1923, it was recorded by me from the Chilka Lake where it is very common all over the lake. It was also pointed out that the first dorsal fin contains 6 spines and not 5 as described by Annandale. In 1928, the range of the species was extended both towards the east and the west by recording it from Rangoon and Puri on the Ganjam Coast. In 1929, when I published the manuscript drawing of Buchanan's *Gobius nunus*, the great similarity between it and Annandale's *G. alcockii* struck me and later researches have confirmed the view then formed. It is abundantly clear to me now that the two species are identical.

Ctenogobius nunus is very common in brackish water ponds and pools in the neighbourhood of Calcutta and it is always found among vegetation where its banded colouration and absolutely transparent caudal fin makes it inconspicuous. So far as I have been able to ascertain, it feeds on planktonic crustacea or animal and vegetable growths on the

[1] Annandale, *Rec. Ind. Mus.* I, pp. 41-42 (1907).

stems of water plants. Its alimentary canal is a broad simple tube with the stomach portion dilated and slightly bent in its posterior half. The alimentary canal is less than one-third the length of the fish. The specimens collected late in December and early in January were found to be fully ripe. The species does not seem to grow to more than 18 mm. in total length, and is thus one of the smallest living vertebrates.

C. nunus is found among vegetation both in fresh and brackish waters, but usually it does not live far from tidal influence. Its occurrence at Rajshahi and in Calcutta tanks, however, shows that it is fully acclimatised to fresh water existence. In the Chilka Lake the species was obtained from the main area as well as the outer channel and from waters the specific gravity of which varied from 1·0075 to 1·028250.

C. nunus has not been found so far in flowing water.