NOTES ON FISHES IN THE INDIAN MUSEUM.

V.—On the composite genus *Glyptosternon* McClelland.

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(Plates I—IV.)

Contents.

The following notes are based on the named and unnamed collection of the genera *Glyptothorax*, *Glyptosternum* and *Pseudecheneis* in the Indian Museum. A valuable series of specimens was recently added to our collection from the Kashmir Valley and I have been able to elucidate several facts concerning these genera from fishes collected by myself in the Khasi Hills. To Dr. N. Annandale and to Dr. S. W Kemp I am greatly indebted for going through the manuscript and proofs with me and for making numerous valuable suggestions.

Introduction

In 1842 McClelland[1] proposed the genus *Glyptosternon* and included five new species in it, viz. *G. reticulatus*, *G. sulcatus*, *G. striatus*, *G. pectinopterus* and *G. labiatus*. The genus was very insufficiently characterized and Blyth[2] in 1860 recognized in it as many as four distinct generic types. He retained McClelland's designation *Glyptosternon* for the first species, *G. reticulatus*, from Afghanistan. The second species (*G. sulcatus*) was made the type of a new genus, *Pseudecheneis*; the next two, along with a new species from Tenasserim, were included under the generic denomination *Glyptothorax*. The last species, *G. labiatus* from the "Mishmee Mountains" was referred to the genus *Exostoma*, which he distinguished by "the form of the mouth" and "the remarkably small gill-openings." He described a species, *Exostoma berdmorei*, from Tenasserim as the type of his last genus.

The genus "*Glyptosternon*" as recognized by Blyth (*loc. cit.*)

[1] McClelland, *Calcutta Journ. Nat. Hist.* II, p. 584 (1842).
[2] Blyth, *Journ. As. Soc. Bengal* XXIX, p. 153 (1860).

remained undetermined and doubts were expressed both by Günther[1] and by Day[2] as to the specific validity of McClelland's *G. reticulatus*. Both these authorities therefore, adopted McClelland's genus and considered Blyth's *Glyptothorax* synonymous with it. Günther (*loc. cit.*) pointed out that "M'Clelland, in describing his *Glyptosternon reticulatus* from Afghanistan (Calc. Journ. Nat. Hist. ii, p. 584), appears to have had a species very similar to *Gl. striatum*," while Day remarked that "*Glyptosternum reticulatus*, McClelland, from Afghanistan (Calc Journ. Nat. Hist.) is said to be closely allied to this species[3] but to be *without spines*; and is probably an *Exostoma*." The remaining two genera of Blyth, *Pseudecheneis* and *Exostoma*, were adopted without any comment. It may be pointed out that Bleeker[4] recognized the genus *Glyptothorax* for the two then known species of the Malay Archipelago, viz. *G. platypogon* and *G. platypogonoides*.

The lead given by such eminent ichthyologists as Günther and Day was followed by all later workers till 1889, when Vinciguerra[5] upheld Blyth's genus *Glyptothorax* and distinguished it from *Glyptosternum* thus:—"Il genere *Glyptosternon* descritto da McClelland nel 2.° vol. del suo 'Calcutta Journal of Natural History' (p. 584) e poi da Günther ortograficamente corretto in *Glyptosternum*, comprendeva cinque specie, riferibili, secondo Blyth, a quattro differenti generi, *Glyptosternon*, *Pseudecheneis*, *Glyptothorax* ed *Exostoma*. La differenza tra i generi *Glyptosternon* e *Glyptothorax* consisterebbe nella spina dorsale, mancanta nel primo, presente nell'altro. Per tale ragione non mi pare che possa ritenersi per queste specie e le affini il nome generico proposto da McClelland e che di quelli del Blyth debba accettarsi quello che meglio corrisponde ad esse."

No notice appears to have been taken of Vinciguerra's significant statement and, with the exception of Fowler,[6] who employed "*Glyptothorax*" in recording *G. platypogon*, all others followed Günther's nomenclature. In a paper recently published dealing with the adaptations of hill-stream fishes I[7] have adduced some facts to show that both Günther's and Day's nomenclature is faulty. In my opinion McClelland's genus *Glyptosternum* should comprise all the species which are at present included under *Exostoma*, with the exception of *E. berdmorei*, while the genus *Glyptothorax* should include all the species which are now-a-days referred to *Glyptosternum*. My reasons for proposing these changes are given more fully below.

In the first instance it is desirable to scrutinize carefully in the light of our present knowledge McClelland's definition of the genus

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[1] Günther, *Cat. Brit. Mus. Fish.* V, p. 185 (1864).

[2] Day, *Fish. India* II, p. 498 (1878).

[3] Day's reference to *G. reticulatus* is included under "*Glyptosternum striatum*" (*Fish. India* II, p. 498).

[4] Bleeker, *Atl. Ichth.* II, p. 63 (1862).

[5] Vinciguerra, *Ann. Mus. Nat. Genova* XXIX, p. 245 (1889–90).

[6] Fowler, *Proc. Acad Nat. Sci. Philadelphia* LVII (2), p. 470 (1905).

[7] Hora, *Rec. Ind. Mus.* XXIV, p. 33 (1922).

Glyptosternon. It runs as follows: "Teeth like velvet, mouth situated in the lower surface of the head, which is broad and flat; eyes small and directed upwards, spines when present, are concealed within the membranes of the fins; the pectoral and ventral fins are broad, falcate, and situated in a plane with the lower surface of the head and body, which is more or less covered with mammilated and striated cuppers, for the purpose of adhering to stones. Without osseous plates on the body. The stomach is a blind sack, the intestine being given off near the anterior orifice. It usually contains the remains of insects. They inhabit the mountains of India and Central Asia."

I have examined good series of all the species McClelland referred to the genus with the exception of *G. reticulatus* from Afghanistan and have myself collected *Pseudecheneis sulcatus* and *Glyptothorax striatus* in the Khasi Hills, the type-locality of the species. All the four agree very closely with McClelland's definition, which is of a generalized nature. The only point that requires consideration is the nature of the spines which, when present, are said to be "concealed within the membranes of the fins." This is true of all the species described by McClelland. In *G. labiatus* and *Pseudecheneis sulcatus* the spines may be described as totally absent or very poorly developed, whereas in the remaining two species, *G. striatus* and *G. pectinopterus*, the spines of the paired fins are concealed by the plicated skin-folds of the adhesive apparatus, while that of the dorsal fin is weak and slender as compared with that of most of the other members of the genus *Glyptothorax*.

In the next place we must make a careful examination of Blyth's subdivisions of McClelland's genus. Of the four genera recognized by him no one doubts the validity of *Pseudecheneis*, but the remaining three require scrutiny.

Glyptosternon was restricted by Blyth to *G. reticulatus*, which is said to be "without spines; the first ray of the pectoral and ventral fins soft and pinnate, giving off soft pointed cartilaginous rays along the anterior margin, which are enveloped in the membrane of the fin. The under surface of the head and of the anterior portion of the body forms a flat corrugated surface." Thus restricted, all the species now referred to the genus *Exostoma*, except *E. berdmorei*, should be included under this genus, for all of them are devoid of spines and possess the first ray of the pectoral and ventral fins similar to that described by McClelland for *G. reticulatus*. *Exostoma berdmorei* is the type of the genus *Exostoma* and is represented in our collection by a single specimen from Tenasserim, probably the type of the species. The unique specimen, as noted by Day[1] in 1869, is broken into pieces and is not fit for detailed morphological investigation. It is provided with strong spines both on the dorsal and on the pectoral fins and in this respect is generically distinct from "*Glyptosternon labiatus*," the

[1] Day, *Proc. Zool. Soc. London*, p. 526 (1869).

second species included by Blyth in his genus *Exostoma*. To me it appears that "*Exostoma berdmorei*" is probably a species of the genus *Glyptothorax*, for Blyth's *Exostoma* differs from his *Glyptothorax* only in the following points:—

Glyptothorax.	*Exostoma.*
"Gill-openings large, and nearly meeting below."	"Small gill-openings which are visible only from above."
"A pectoral adhesive disk grooved longitudinally."	"No pectoral disk."

In the specimen of *Exostoma berdmorei* that I have examined the gill-openings appear to be just as wide as described for the genus *Glyptothorax* and it is well known that in specimens which are old or badly preserved the pectoral disc may become indistinct. It is also possible on account of bad preservation that the gill-membranes were so closely pressed to the head that the gill-openings appeared to be restricted to the sides and absent on the under surface.

As regards the genus *Glyptothorax* little remains to be said; I include in it all the species to which Blyth originally assigned the name and all those subsequently described under the names *Glyptosternum* and *Glyptothorax*.

The whole matter may now be summed up as follows:—

1. *Glyptosternon*, McClelland, as restricted by Blyth with *G. reticulatus* as its type, includes all the species at present referred to the genus *Exostoma* Blyth with the exception of *E. berdmorei*.

2. *Pseudecheneis* Blyth is a valid genus.

3. *Glyptothorax* Blyth includes all the species known at present to belong to the genus *Glyptosternum*. It also includes *Exostoma berdmorei* Blyth.

4. The genus *Exostoma* disappears from nomenclature, for its type-species, *E. berdmorei*, belongs to the genus *Glyptothorax*, while the second species included by Blyth is without doubt to be referred to *Glyptosternum* McClelland.

BIOLOGICAL.

A very interesting set of biological phenomena is illustrated by the fishes of the three genera dealt with in this paper. Their structure is adapted for life in rapid-running mountain streams subject to sudden floods and they are provided with special apparatus with which to contend against the swift currents of waters in such streams. In other words they possess special organs for adhering to rocks and stones.

In a paper recently published I have dealt with the structural modifications exhibited by hill-stream fishes and here I need only mention those facts which have recently come to my notice regarding these forms. Of the three genera *Glyptothorax* is a generalized genus, whereas the remaining two, *Glyptosternum* and *Pseudecheneis*, are highly specialized.

Following Günther, I have divided the genus *Glyptothorax* into

two groups, one in which the adhesive apparatus is only present on the chest, while in the other it is equally well-developed on the outer rays of the paired fins. The members of the former group inhabit mountain streams but some of them descend into sluggish waters and are thus capable of existence under both sets of conditions. Their paired fins are probably capable of movement and help them in keeping equilibrium in deep waters. I have collected specimens of *Glyptothorax dorsalis* and *G. minutus* in the sluggish streams of the Manipur Valley, but it was always noticed and pointed out to me by local fishermen that these fishes lived at the bottom and never came to the surface. Their very name, *Ngapang*, the innocent fish, denotes the habit of a fish which when disturbed remains quietly at the same spot and does not dart away. It may also be pointed out that not a single specimen of this genus was obtained in the rapids of the valley. The individuals of the second group are only found in rapid-running waters and are probably not capable of existence in sluggish and muddy streams.

In the first group, that in which the adhesive apparatus is only present on the thorax, the head and body are not greatly depressed and the spines of the dorsal and the pectoral fins are very strong and osseous. The thoracic adhesive apparatus is well-developed and is usually much longer than broad. The mouth and the tooth-bands are fairly large; the former is situated slightly behind the tip of the snout and the latter are placed almost inside the mouth cavity.

The members of the second group are more highly specialized and in them the head and body are greatly flattened so that they come to resemble the Homalopterid genus *Balitora* in appearance. The dorsal spine is comparatively much weaker and the broad pectoral spines, when the skin is stripped from them, show indentations along the outer border. The outer rays of the ventral fins are still more fully utilized in adhesion ; in them the indentations are so deeply cut that the rays are divided up into secondary rays given off from their outer margin. With the use of the fins for the purposes of adhesion, the thoracic apparatus is considerably reduced. It reaches its least development and the apparatus on the fin rays its greatest development in *G. pectinopterus* (plate iv, fig. 3). In this species the thoracic apparatus is very small and is slightly broader than long. The mouth in all species of the group is small and is situated considerably behind the tip of the snout; the tooth-bands are small and the anterior one is almost outside the mouth cavity.

A specimen of *Glyptothorax striatus* observed alive at Cherrapunji, remained quietly at the bottom of the bowl in which it was put for a considerable time, with its pectoral fins greatly stretched out and the chest pressed against the bottom. When lightly disturbed it did not move and when an attempt was made to dislodge it from its position, it pressed itself all the harder against the dish. When violently disturbed it darted away to fix itself quietly in another place. The paired fins were neither

folded nor oscillated in this movement, which was initiated and continued by the muscular tail and the tail-fin. The fish was next transferred to a bucket of water, to see if it was capable of making vertical movements. It was often brought to the surface and let go but every time it either went to the sides of the bucket or to the bottom. The pectoral fins always remained stretched out. Under magnesium light it became restive. The fish was found to be very tenaceous of life, as some specimens that were kept out of water for four or five hours were found to be alive when placed in water.

Following the line of evolution of the adhesive apparatus, we next come to the genus *Glyptosternum*. Here the thoracic adhesive apparatus is totally absent and only the outer rays of the paired fins perform the function of adhesion. The head and body are greatly depressed and the gill-openings are restricted to the side. I have not observed fishes of this genus in a living condition, but from the nature of their paired fins it appears that the inner rays, which are vertical, help the fish in respiration. In other genera, such as *Balitora*, in which the fin-rays are divided into a horizontal and a vertical half, it is observed that the vertical half is held in constant motion while the horizontal half acts as an organ of fixation. In most of the species the mouth is small and the teeth lie outside the mouth cavity. In an old specimen it has been observed that the teeth lie flat along the palate in special muscular sheaths when not in use. This is distinctly advantageous to fish in which the teeth are outside the mouth cavity and which use their lips for the purposes of adhesion. In *Glyptothorax* the lips are sometimes covered with tubercles suggesting an adhesive property, but in *Glyptosternum* the broad bases of the maxillary barbels and the lips have become definite organs of adhesion.

The genus *Pseudecheneis* appears to be one of the genera most highly specialized for hill-stream life. In it all available parts of the body have been pressed into service for the function of adhesion. The chest is provided with a broad oval disc composed of transverse skin-folds, the outer ray of the pelvic fin is broad and provided with a plicated adhesive apparatus, the pectoral spine is also to a certain extent provided with a similar structure, the lips and the barbels are covered with papillae. The gill-openings are narrow and restricted to the side. The mouth-opening is small. The outer rays of the paired fins are not spines and have a structure like that of those of the genus *Glyptosternum* but not so well developed. The ventrals possess long curved bases and there is an indication of a membranous fold between the two anteriorly. The fins have not yet united as in the Bornean genus *Gastromyzon* to form a suctorial disc, but no doubt of a similar tendency is left after an examination of a large number of specimens in our collection. The dorsal spine is weak. I observed *Pseudecheneis sulcatus* in a living condition at Cherrapunji. I found that the fish lay quietly at the bottom of the bowl in which it was put for a considerable time and behaved to touch and light just as *Glyptothorax*

striatus did. The pectorals were fully stretched out and were not folded even once during all the time the fish remained under observation. It was observed that it sometimes made a to-and-fro movement by the help of the pectorals. First the fin of one side was advanced and then that of the other, contact with the bottom being maintained by the two fins. In other words the fish walked with the help of its pectoral fins.

There are two more points to which I wish to allude: firstly the advantage which the fish may obtain by using the paired fins for the purpose of adhesion and secondly the reasons why the pectorals are used for respiration.

In my paper referred to above I have indicated the line along which the evolution of the adhesive apparatus might have taken place. Let us suppose that a fish from sluggish waters begins to move upstream and for life in rapid waters finds its advantageous to develop adhesive organs. The tendency in rapids will be for the fish to fasten itself to a rock. The bulging chest or the whole of the under surface of the body will be the first part to come in contact with the rock and as the body becomes flatter in the course of evolution a tendency for the skin of the lower surface to become corrugated might naturally be manifested. This is exactly what has happened in *Erethistes elongata* and *Laguvia shawi*. The next phase is the concentration of the adhesive surface to the chest region, as is found in most species of the genus *Glyptothorax*. Along with these changes the depressed condition of the head and body is brought about and consequently the paired fins adopt a lateral position. When the under surface of the body becomes so much depressed that the paired fins come in contact with the rock when the fish rests on it, then it is found more advantageous to grip the rock with the extremities than with the center. If the head and body are smooth and firmly pressed against the rock and the outer extremity of the paired fins is adhesive, it becomes difficult to dislodge the fish, as no water can flow beneath it. In the final form, the paired fins will be brought closer to the body and we will find in extreme cases the horizontal portion of the fins acting as an adhesive organ while the vertical portion of the fin is used for respiration.

With the increased flattening of the body and the employment of paired fins for adhesion, the gill-openings become more and more restricted to the sides and disappear from the under surface of the head. The head being also greatly depressed and the lips and mouth being used for adhesion, normal respiration must become extremely difficult. In *Glyptothorax* and *Pseudechencis* they remain constantly stretched out and a considerable area of their surface is exposed to currents of water. In extreme cases, where the fin is divided into two portions, the inner vertical portion remains constantly in motion, as I have myself observed at least in three genera, viz. *Psilorhynchus*, *Garra* and *Balitora*. A specimen of the last genus was kept under observation for a considerable time at Cherrapunji. The fish did not object to its head,

gill-openings and a part of the adhesive portion of the pectoral fin remaining out of water against the side of the bowl for a couple of minutes, but as soon as the whole of the pectoral fin was out of water it immediately became restive. Microtome sections of the paired fins show that blood vessels are scarce in them. It is probable, therefore, that their directions and movements are of secondary importance in respiration.

Taxonomic.

The genera dealt with in this paper may be distinguished by the following key:—

A. Gill-openings wide, almost meeting each other on under surface; pectoral provided with a strong spine which is denticulated internally ... ... *Glyptothorax.*

B. Gill-openings narrow, almost restricted to side or extending to the under surface for a short distance; pectoral spine weak and smooth or finely serrated internally.

1. Chest smooth or papillated but devoid of an adhesive apparatus ... ... *Glyptosternum.*
2. A broad oval adhesive apparatus present on chest ... *Pseudecheneis.*

These genera belong to the purely Asiatic family Sisoridae.[1]

Genus **Glyptothorax** Blyth.

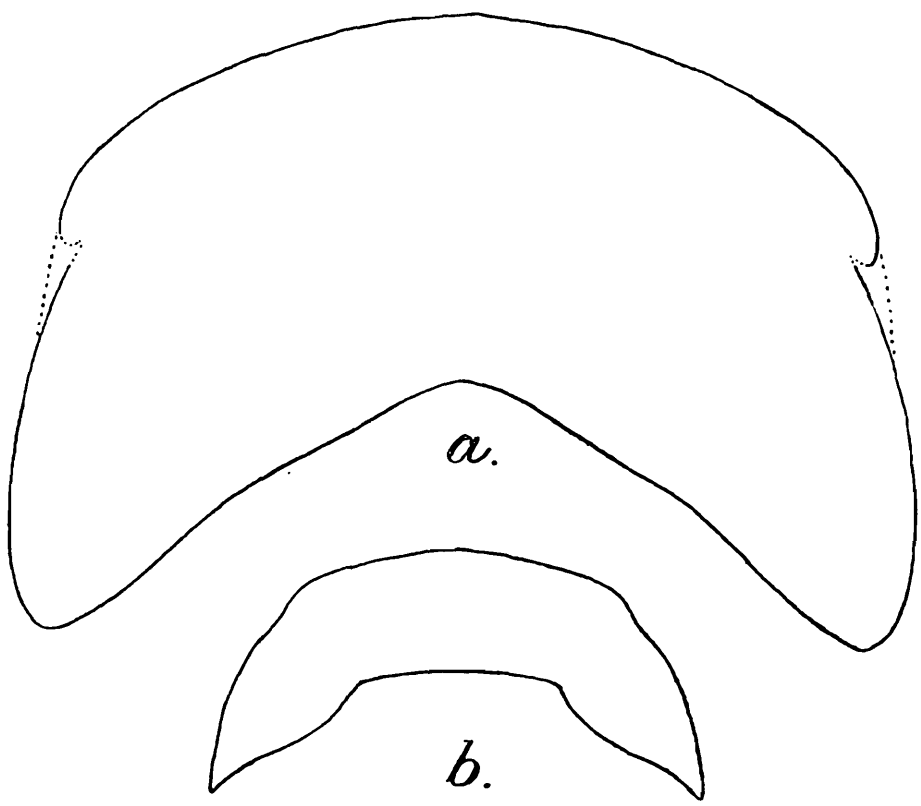
1860. *Glyptothorax*, Blyth, *Journ. As. Soc. Bengal* XXIX, p. 154.
1860. *Exostoma*, Blyth (in part: only the type-species, *E. berdmorei*), *ibid.*, p. 155.
1864. *Glyptosternum*, Günther, *Cat. Brit. Mus. Fish.* V, p. 185.
1878. *Glyptosternum*, Day, *Fish. India* II, p. 496.
1878. *Euglyptosternum*, Day (*nec Aclyptosternum* Bleeker and *Euclyptosternum* Günther), *ibid.*, p. 499.
1889. *Glyptosternum*, *Euglyptosternum*, Day, *Faun. Brit. Ind. Fish.* I, pp. 195, 202.
1913. *Glyptosternum*, Weber and Beaufort, *Fish. Indo-Austral. Archipel.* II, p. 263.

The genus may be defined as follows:—

The head and body are moderately or greatly depressed, the former in most cases is slightly longer than broad. The chest is always provided with a thoracic adhesive apparatus which is either U-shaped or V-shaped in form. It is composed of longitudinal plaits of skin. The pectoral fin is always provided with a strong, broad spine which is sharply denticulated internally. In certain species it is provided on its ventral aspect with plicated skin. In some species one or more outer rays of the ventral fin are similarly provided. The rays of the paired fins bearing adhesive skin on their under surface are cut up into secondary rays of which there is only a faint indication. The dorsal fin is usually provided with a strong spine but in some cases it is weak. The ventrals are situated considerably behind the commencement of the dorsal. The adipose dorsal is short and high. The caudal fin is deeply

[1] Regan, *Ann. Mag. Nat. Hist.* (8) VIII, p. 563 (1911)

forked. The eyes are small and greatly approximated on the dorsal surface; they are covered by a skin membrane. The nostrils are situated close together and are separated by a flap bearing the nasal barbel. There are eight barbels, four mandibular, two maxillary and two nasal; the maxillary barbels are provided with broad bases. The mouth is a transverse opening on the under surface behind the tip of the snout and is provided with thick lips which are sometimes papillated for adhesion. The teeth on the upper jaw are arranged in a crescentic band, the palate is edentulous or covered with minute horny structures resembling teeth but not fixed to any bony element. The gill-openings are wide and the gill-membranes are confluent with the skin of the



TEXT-FIG. 1.—Types of tooth-band in *Glyptothorax*.
a. Premaxillary tooth-band of *G. lineatus* (Day).
b. Premaxillary tooth-band of *G. dorsalis* Vinciguerra.

isthmus. The air-bladder is divided into two lateral chambers which are partially or wholly enclosed in a bony capsule.

The fishes of this genus are usually of a small size but some of them grow to a foot or more in length. They are primarily hill-stream forms but some are also found in sluggish stream not very far from the base of the hills. They prefer to live at the bottom.

Day (*loc. cit.*) distinguished *Euglyptosternum* from "*Glyptosternum*" by the presence of the palatine teeth in the former. In describing *Euglyptosternum lineatum* he writes that the teeth are "villiform in the jaws, and in one large patch extending across the palate, and so closely approximating to the premaxillary teeth that they appear like a single large band." Day's description

agrees with the type-specimen in our collection, but I am convinced that the broad band is not formed by the coalescence of the premaxillary and the palatine teeth as Day supposed it to be, but is a premaxillary band somewhat enlarged. The genus *Aclyptosternum* Bleeker,[1] which was changed into *Euclyptosternum* by Günther[2] and *Euglyptosternum* by Day, possesses villiform teeth on the palate "in two separate patches" as has been described by Günther from the type-specimen. In a synoptic table of the genera of the family Sisoridae, Regan[3] distinguishes the two genera "*Glyptosternum*" and "*Euclyptosternum*" by the absence or presence of palatine teeth. From the above description it will be clear that Day's *Euglyptosternum* cannot be synonymous with *Aclyptosternum* of Bleeker or *Euclyptosternum* of Günther. I am of opinion that Day's genus is synonymous with *Glyptothorax* Blyth, and that the broad tooth-band may at present be considered as a specific character for separating *G. lineatus* from the remaining species included under the genus *Glyptothorax*.

Pietschmann[4] has described a species of the genus *Glyptothorax* from the waters of the Tigris River. Unfortunately the journal in which the account of this new species is published is not available in Calcutta. *Aclyptosternum coium* is known from an adjacent locality (River Coic in Syria) and it thus appears that the range of the two genera coincides with each other. No species of the genus *Glyptothorax* is at present known from the intermediate region between India and Syria and, therefore, I suggest a re-examination of the two Syrian forms.

Annandale[5] quite recently referred a specimen from the Satara District to the genus *Euglyptosternum*. He remarks: "In general facies the species resembles *Euglyptosternum* rather than *Glyptosternum* and I find that both in Dr. Jenkin's specimens and in my own microscopic horny teeth are scattered on the palate. They are, however, attached to the skin and not to the bone and are not arranged in any definite manner. The tooth band in the upper jaw is narrow as in *Glyptosternum*. I have examined the palate of *E. lineatum* and of several species of *Glyptosternum* and cannot discover any trace of scattered teeth." I have found similar scattered teeth on the palate of *G. dorsalis* and *G. striatus* but am of opinion that they should not be considered of generic importance. If the palatine tooth-bands of *Aclyptosternum* turn out to be of a similar nature, I would consider *Aclyptosternum* synonymous with *Glyptothorax*.

Day,[6] when writing on *G. striatus* in 1871, observed "I have obtained this species with from nine to eleven anal rays, and

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[1] Bleeker, *Nederl. Tydschr. Dierk.*, p. 103 (1863).
[2] Günther, *Cat. Brit. Mus. Fish.* V, p. 183 (1864).
[3] Regan, *Ann. Mag. Nat. Hist.* (8) VIII, p. 564 (1911).
[4] *Pietschmann, Anz. Akad. Wiss. Wien, math.-nat. Kl.*, I. Jahrg., p. 93-95 (1913).
[5] Annandale, *Rec. Ind. Mus.* XVI, 126 (1919).
[6] Day, *Proc. Zool. Soc. London*, p. 714 (1871).

I suspect *G. reticulatus* and *G. pectinopterum*, M'Clell., to be synonyms. It is found in the rivers of the lower plateau of the Himalayas, down to those of the plains; and a most remarkable difference is perceptible in specimens from these two situations. Only small ones are taken on the hills, and these have the pectoral and ventral rays plaited inferiorly, more especially in the young, evidently to enable them to adhere to the rocks, and by these means, with the assistance of the adhesive sucker on the chest, to withstand the impetuosity of the mountain-torrents. I took larger ones in the Beas near the plains, and in them this plaiting was either very indistinct or entirely absent, whilst there cannot be a doubt as to the identity of the species" The above statement is wholly incorrect and entirely misleading. During my recent visit to the Khasi Hills I obtained several specimens of *G. striatus* varying in length from two inches to a little more than a foot in length. All were captured in rapid running streams and all were provided with adhesive apparatus on the thorax and on the outer rays of the paired fin, the spine of the latter showing characteristic deep indentations. As has been pointed out in the preceding biological section of the paper the ray is divided into a number of secondary rays corresponding in number and position to the striations on it. Günther and myself have found that these striations on the paired fins afford a useful character for grouping the species of the genus, but Day appears to have disregarded them.

The genus is found in the Tigris River (*G. steindachneri*), throughout India and Lower Burma (*G. trilineatus*) whence it extends to Indo-Australian Archipelago. Its range has recently been extended by Regan [1] to China (*G. sinense*). With the exception of a few species, all are endemic in the Indian Empire. It is strange that though the ichthyology of Persia and the neighbouring countries is moderately well known on the one hand and of Yunnan on the other, not a single species of the genus has been recorded from these places. At any rate there is no doubt that the genus is a generalised one; future researches may be expected to reveal interesting facts bearing on the evolution of the other two genera with which this paper is concerned.

The only species dealt with in this paper are those of which material was available in the collection of the Zoological Survey of India or those Indian forms which were fairly well characterized. It is impossible to recognise *G. botia* and *G. telchitta* from Buchanan's [2] original descriptions. I use these names in the sense in which Day applied them and have had the advantage of examining the specimens on which Day based his descriptions. *Pimelodes cavia* has been considered by Day [3] to belong to this genus but I am not sure about this form and have not, therefore, included it in the paper.

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[1] Regan, *Ann. Mag. Nat. Hist.* (8) I, p. 110 (1908).
[2] Buchanan, *Fish. Ganges*, pp. 192, 378; 185, 378 (1822).
[3] Day, *Fish. India* II, p. 499 (1878).

In order to bring the literature on the subject up to date a note on the extra-Indian species may also be included here. Mention has already been made of the species described by Pietschmann and Regan from the Tigris and from China. Besides these there are only four other species that are found in the Indo-Australian Archipelago; these are fully dealt with by Weber and Beaufort [1] and all references to them are included in their valuable book.

The members of the genus *Glyptothorax* are still in process of adaptation to life in hill-streams, and the specific characters in them are not yet properly fixed. The taxonomy of the genus is in a state of great confusion and I agree with Day [2] that some of the species may ultimately prove to be mere varieties. I have been obliged, as were also Weber and Beaufort, to employ characters which in the case of most other Silurid genera would not be regarded as specific.

Glyptothorax lineatun (*Euglyptosternum lineatum*, Day) is readily distinguished by its broad band of teeth, and is not, therefore, included in the synopsis.

Key to the Indian species of the genus *Glyptothorax*.

Pectoral spine and one or more outer ventral rays plaited below.

1. Longest ray of dorsal fin as long as or shorter than depth of body.	
A. Longest ray of dorsal fin almost as long as depth of body; commencement of dorsal almost equidistant from tip of snout and base of adipose fin; head longer than broad; thoracic apparatus longer than broad	*G. annandalei*, sp. nov.
B. Longest ray of dorsal considerably shorter than depth of body; commencement of dorsal considerably nearer tip of snout than base of adipose fin; head almost as long as broad; thoracic apparatus as long as broad	*G. brevipinnis*, sp. nov.
1. Longest ray of dorsal considerably longer than depth of body.	
A. Dorsal spine strong; anal-opening midway between base of ventral and that of anal fins; pectorals separated from ventrals by half their length; maxillary barbels extending to middle of pectoral spine	*G. stoliczkae* (Steind.).
B. Dorsal spine weak; anal-opening much nearer base of anal than that of ventral fins; pectorals separated from ventrals by a short distance; maxillary barbels not extending beyond middle of base of pectoral fin.	
1. Shortest middle ray of caudal more than half length of caudal fin; nasal barbels reaching anterior margin of orbit [Adhesive apparatus on chest small, almost as long as broad and semicircular anteriorly]	*G. pectinopterus* (McClell.).
2. Shortest middle ray of caudal less than half length of caudal fin.	
a. Base of adipose fin equal to length of snout and shorter than length of tail behind it...	*G. saisii* (Jenkins).

[1] Weber and Beaufort *Fish. Indo-Austral. Archipel.* II, pp. 263–288 (1913).
[2] Day, *Fish. India*, II, p. 496 (1878).

b. Base of adipose fin greater than length of snout and equal to length of tail behind it (Young individuals) ... ... *G. striatus* (McClell.).

Pectoral spine and ventral rays not plaited below.

I. Longest ray of dorsal fin as long as or shorter than depth of body.
  A. Pectorals as long as or slightly longer than length of head; thoracic adhesive apparatus slightly longer than broad and provided with a depression in its centre [Bony portion of dorsal spine more than half length of head] ... ... *G. kashmirensis*, sp. nov., ♀
  B. Pectorals shorter than length of head; thoracic adhesive apparatus considerably longer than broad and devoid of a depression in its centre.
    1. Longest ray of dorsal almost as long as depth of body [Maxillary barbels extending considerably beyond posterior margin of orbit] *G. dekkanensis* (Günth.).
    2. Longest ray of dorsal considerably shorter than depth of body.
      a. Maxillary barbels not extending beyond posterior margin of orbit ... ... *G.* sp.
      b. Maxillary barbels considerably extending beyond posterior margin of orbit ... *G. minutus*, Hora.

II. Longest ray of dorsal fin considerably longer than depth of body.
  A. Anal opening considerably nearer origin of pectoral spine than base of caudal fin [Origin of ventrals considerably nearer tip of snout than base of caudal].
    1. Occipital process twice as long as broad; base of adipose fin half as long as distance between dorsal and adipose fins; pectorals almost reaching base of ventrals [Pectorals slightly longer than head; head and body covered with minute tubercles] ... *G. gracilis* (Günth.).
    2. Occipital process much more than twice as long as broad; base of adipose fin less than half as long as distance between dorsal and adipose fins; pectorals separated from ventrals by a considerable distance.
      a. Pectorals considerably shorter than length of head; maxillary barbels not reaching base of pectoral spine [Body marked with numerous longitudinal elevations forming regular lines] ... ... *G. botia* (Ham. Buch.) Day.
      b. Pectorals as long as head; maxillary barbels extending to or beyond base of pectoral spine.
        i. Body marked with numerous longitudinal elevations forming regular lines; maxillary barbels reaching posterior margin of head ... ... *G. dorsalis* Vinci.
        ii. Body devoid of prominent elevations; maxillary barbels not reaching posterior margin of head ... ... *G. telchitta* (Ham. Buch.) Day.
  B. Anal opening nearer base of caudal than origin of pectoral spine.
    1. Pectorals considerably longer than head and almost reaching base of ventrals; nasal barbel reaching anterior margin of orbit [Head and body tuberculate] ... .. *G. kashmirensis*, sp. nov., ♂

2. Pectorals as long as or shorter than head and separate from ventrals by some distance.
   a. Head one and a half time as long as broad; maxillary barbels extending beyond base of pectoral fin [Body smooth] ... *G. conirostris* (Steind.).
   b. Head slightly longer than broad but not as long as one and a half times its breadth; maxillary barbels not extending beyond base of pectoral fin.
      i. Body marked with three pale longitudinal lines, one along back and one along each lateral line; surface of head and body smooth ... ... *G. trilineatus* Blyth
      ii. Body and fins marked with short black bands; skin roughened with tubercles and ridges ... ... *G. madraspatanus* (Day).

Glyptothorax annandalei, sp. nov.

(Plate I, fig. 3.)

1867. *Glyptosternum lonah*, Day (*nec* Sykes), *Proc. Zool. Soc. London*, p. 285.

D 1/6. P. 1/9. V 1/5. A. 10.

I refer four specimens collected by Dr. N. Annandale in the Nierolay stream, Bhavani River at the base of the Nilgiri Hills to this species. It closely resembles *Glyptothorax madraspatanus*, from which it can be readily distinguished by the presence of an adhesive apparatus on its paired fins, by the nature of its dorsal spine and the position of the dorsal fin in relation to the tip of the snout and the base of the caudal fin.

The dorsal profile rises considerably from the tip of the snout to the base of the dorsal fin, beyond which it is almost straight and horizontal. The head and a part of the body in front of the ventrals is greatly depressed. Beyond the anal fin the ventral profile rises to the base of the caudal fin. The head is slightly longer than broad; its length is contained about four and a half times in the total length without the caudal; the greatest body height is contained 5·5 to 6 times in the same standard. The eyes are small and are situated in the posterior half of the head. The nostrils are much nearer to the tip of the snout than to the anterior margin of the orbit. The nasal barbels are small and do not extend to the anterior margin of the orbit. The maxillary barbels reach to the base of the 3rd or 4th pectoral ray. The inner mandibular are as long as the interorbital width and the outer are separated from the commencement of the pectoral fin by a short distance. The thoracic adhesive apparatus is well developed; it is longer than broad. The lips and the under surface of the head are papillated.

The dorsal fin commences in the beginning of the second-third of the distance between the tip of the snout and the base of the caudal fin, it is somewhat nearer to the tip of the snout than to the commencement of the adipose fin. In the young the dorsal

fin is higher than the body but with the growth of the fish its height becomes equal to the depth of the body; the dorsal spine is weak. The pectoral fins are broad and their posterior margin is almost circular; they are shorter than the head. The pectoral spine is broad and strong; it is smooth externally but strongly pectinated internally. The pectorals are separated from the ventrals, which extend considerably beyond the anal opening and almost reach the base of the anal fin. The least height of the caudal peduncle is slightly less than one-third of its length. The caudal fin is deeply forked; its lower lobe is slightly longer than the upper

The colour in spirit is greyish all over with a lighter streak along the dorsal surface and also along the lateral line. Some of the outer rays of the fins are black and usually the bases of the pectoral and the adipose fins are black. The under surface is whitish and the adhesive apparatus yellow.

Type-specimen.—F 10135/1 *Zoological Survey of India* (*Ind. Mus.*).

Locality :—Bhavani River at the base of the Nilgiri Hills

Measurements in millimetres.

Total length including caudal	99·5	72·3
Length of caudal	16·0	13·7
Length of head	18·5	13·6
Greatest width of head	15·7	11·5
Height of head near occiput	12·6	8·4
Length of snout	10·0	7·1
Interorbital width	5·5	4·2
Depth of body	15·1	9·7
Height of dorsal fin	14·7	12·0
Length of pectoral fin	17·3	13·4
Length of ventral fin	15·3	12·0
Longest ray of anal fin	12·1	10·0
Length of caudal peduncle	18·6	13·0
Least height of caudal peduncle	6·7	4·9
Distance between tip of snout and commencement of dorsal fin	27·8	20·3
Distance between commencement of dorsal fin and that of adipose fin	29·0	22·2
Distance between tip of snout and commencement of adipose fin	56·0	41·1
Distance between commencement of dorsal fin and base of caudal fin	57·6	40·2
Distance between base of dorsal fin and commencement of adipose fin	20·9	14·1
Length of base of adipose fin	11·9	5·9

Glyptothorax brevipinnis, sp. nov.

(Plate I, fig. 4.)

D. 1/6. A. 8. P 1/7. V 6.

This characteristic species is distinguished from the remaining species by the position and the nature of its dorsal fin, which is situated considerably nearer to the tip of the snout than to the origin of the adipose fin. It is not as high as the body immediately below it. The dorsal spine is short and strong and is enclosed in a thick membrane. The adhesive apparatus on the chest is broader than long and is not well-developed. The under surface of the pectoral spine and that of the outer ray of the ventral fin is plaited to form an adhesive surface.

The dorsal profile rises from the tip of the snout to the base of the dorsal fin beyond which it is almost straight and horizontal. The ventral profile is somewhat arched and the body is but slightly depressed in the anterior region. The head is slightly depressed and is as long as broad; its length is contained about 4·2 times in the total length without caudal. The height of the body is slightly less than the length of the head. The eyes are minute and are situated in the posterior half of the head. The nostrils are placed much nearer to the tip of the snout than to the anterior margin of the orbit. The nasal barbels are slightly flattened and, when adpressed, do not reach the eyes. The maxillary barbels extend to the base of the pectoral spine. The outer mandibulars reach the gill-openings and the inner to the anterior margin of the thoracic adhesive apparatus.

The dorsal fin commences anterior to the middle of the pectoral fin and its anterior origin is considerably nearer to the tip of the snout than to the base of the caudal fin, it is three-fourth as high as the depth of the body; the dorsal spine is half the length of the head. The adipose fin is as long as the base of the spiny dorsal and is contained twice in the distance between the dorsal and the adipose fins. The commencement of the adipose fin is equidistant between the base of the dorsal and that of the caudal fins. The pectorals are shorter than the head and are separated from the ventrals by a considerable distance. The ventrals just reach the anal opening. The caudal fin is forked, the lower lobe is slightly longer than the upper.

The sides and the dorsal surface of the body are light reddish-brown. The under surface of the body, the head and the fins are of a lighter colour. The eyes are black with a white pupil.

Type-specimen :—F 10134/1 *Zoological Survey of India* (*Ind. Mus.*).

There are four specimens in the unnamed collection which I refer to this species. They were found without any label and I have not been able to trace their history.

Locality :—Unknown.

Measurements in millimetres.

Total length including caudal	97·0	55·0
Length of caudal	14·5	8·7
Length of head	20·0	11·2
Greatest width of head	19·5	10·3
Height of head near occiput	14·5	7·6
Length of snout	9·8	5·6
Interorbital width	5·8	4·0
Depth of body	17·0	8·7
Height of dorsal fin	13·5	7·7
Length of pectoral fin	16·0	10·5
Length of ventral fin	12·5	8·0
Longest ray of anal fin	13·4	8·4
Length of caudal peduncle	17·1	10·5
Least height of caudal peduncle	8·3	4·1
Distance between tip of snout and commencement of dorsal fin	27·4	16·8
Distance between commencement of dorsal fin and that of adipose fin	35·5	20·0
Distance between tip of snout and commencement of adipose fin	59·1	34·3
Distance between commencement of dorsal fin and base of caudal fin	56·8	32·1
Distance between base of dorsal fin and commencement of adipose fin	24·0	13·8
Length of base of adipose fin	12·2	5·8

Glyptothorax stoliczkae (Steind.).

1867. *Glyptosternum Stoliczkae*, Steindachner, *Sitzungsb. K. Acad. Wiss. Wien* LV, pt. 1, p. 533, pl. v, fig. 1; pl. vi, fig. 1.
1878. *Glyptosternum pectinopterum*, Day, *Fish. India* II, p. 499, pl. cxvi, fig. 6.
1889. *Glyptosternum pectinopterum*, Day, *Faun. Brit. Ind. Fish.* I, p. 201.

I refer to this species two specimens which had been identified as *Glyptosternum pectinopterum* by Day. One of these is the original of his figure in the fishes of India.

In *G. stoliczkae* the head is almost as long as broad and the body is almost smooth. The under surface of the pectoral spine is plaited. The thoracic adhesive apparatus is well developed. The dorsal spine is strong and sharp at the end. The maxillary barbels are very long and reach to about the middle of the pectoral fin. The ventral fins begin entirely behind the base of the dorsal and extend to slightly beyond the anal opening. The pectorals are separated from the ventrals by a considerable distance. The eyes are situated in the posterior half of the head.

Locality:—Simla, probably in the headwaters of the Jumna River.

Glyptothorax pectinopterus (McClelland).

(Plate I, fig. 1; Plate IV, fig. 3.)

1842. *Glyptosternon pectinopterus*, McClelland, *Calcutta Journ. Nat. Hist.* II, p. 587.

McClelland defined the species thus: "Mouth wide, cirri eight; striated on the breast, but *the first ray of the dorsal which is pinnate and soft*, affords along its anterior margin a row of sharp points; in other respects this species differs but little from the last.

B. 9. D. 9. V 6. A. 7. C. 17."

The italics are mine. I believe that the description of the dorsal spine as having "a row of sharp points along its anterior margin" is incorrect and misleading, while its soft and pinnate nature has helped me to a great extent in arriving at a correct estimation of the species.

I have examined two specimens from Simla, which Day referred to this species. One of these is quite young, 43 mm. in length without the caudal, and is not well preserved; the other is 9·8 cm. in length without the caudal and is the original of his figure in the *Fishes of India* (pl. cxvi, fig. 6). The latter is in fairly good condition. In both the dorsal spine is well developed and is in the form of a strong prickle. I believe that these specimens belong to *Glyptothorax stoliczkae* (Steindachner).

There are two specimens in our unnamed collection, which I can definitely refer to *G. pectinopterus*. They were procured by Mr. G. C. L. Howell, late of the Punjab Fisheries in Badhmana Khad, Sutluj River, Punjab, in May 1912. Both these specimens are well preserved. Besides these there is an old specimen of Day's from the Jumna River, which I refer to this species with some doubt.

Quite recently I have received several specimens from the Kangra Valley, sent to me by the Punjab Fisheries.

The species may now be redescribed as follows:—

In *Glyptothorax pectinopterus* the head and body in front of the ventral fins are greatly depressed and the under surface is highly muscular. The dorsal profile rises considerably from the tip of the snout to the origin of the dorsal fin beyond which it is almost straight and horizontal. The ventral profile is straight in front but gradually rises to the base of the caudal fin posteriorly. The head is slightly longer than broad; its length is contained 4 to 4·5 times in the length of the fish without the caudal. The greatest body height is about two thirds the length of the head and is contained from 6 to 6·3 times in the total length without the caudal. The eyes are minute and are situated in the middle or somewhat in the posterior half of the head; they are placed on the dorsal surface of the head and are separated by a distance which is about one-third the length of the head. The nostrils are well developed and are situated much

nearer to the tip of the snout than to the anterior margin of the orbit. The mouth is on the under surface considerably behind the tip of the snout; the gape of the mouth is about half the width of the head. The lips are well developed and are studded with numerous papillae. There is a flap of the skin between the anterior and the posterior lips. The teeth are small and pointed and form a single band on the anterior as well as on the posterior jaw. The thoracic adhesive apparatus is small, but similar structures on the under surface of the pectoral spine and on some of the outer rays of the ventral fins are well developed. The head and body are covered over with small tubercles. There are eight barbels, the nasal barbels reach the anterior margin of the orbit, the maxillary barbels slightly beyond the base of the pectoral fin, the outer mandibulars to the base of the third pectoral fin ray and the inner mandibulars are shorter than the gape of the mouth.

The dorsal fin commences almost in the beginning of the second third of the distance between the tip of the snout and the base of the caudal fin, it is higher than the depth of the body below it. The spine is weak and slender and besides the spine there are five branched rays, the last of which is divided to the base. The pectoral is separated from the ventrals by a considerable distance; it contains 8 branched rays besides a strong, broad pectoral spine which is strongly denticulated internally and smooth externally. The ventrals extend to the anal opening and two of their outer rays are plaited on the ventral aspect. The anal fin is situated just below the base of the adipose fin and contains 7 rays. The caudal fin is deeply forked; the lower lobe is somewhat longer than the upper. The caudal peduncle is more than 2 times as long as high.

The colour in spirit is uniformly dark brown on the dorsal surface and sides of the head and body with the exception of a light orange streak along the dorsal edge of the body and tail. The under surface is pale white. The paired fins are lighter in colour. The dorsal and the caudal fins are greyish, tipped with light yellow.

Locality:—Simla and Kangra Valley, Punjab.

Measurements in millimetres.

Total length including caudal	74·5	68·6
Length of caudal	12·8	11·3
Length of head	15·2	12·7
Greatest width of head	13·2	12·1
Height of head near occiput	8·3	7·3
Length of snout	7·6	6·7
Interorbital width	4·9	4·3
Depth of body	10 2	9·0
Height of dorsal fin	11·7	10·5
Length of pectoral fin	13·7	12·1

Length of ventral fin . ..	12·1	10·0
Longest ray of anal fin	11·0	9·5
Length of caudal peduncle	13·4	12·3
Least height of caudal peduncle	6·1	5·4
Distance between tip of snout and origin of dorsal fin	22·5	21·0
Distance between tip of snout and origin of adipose fin	42·5	39·2
Distance between origin of dorsal fin and that of adipose fin	22·4	21·4
Distance between origin of dorsal fin and base of caudal fin	43·3	39·3
Distance between base of dorsal and origin of adipose fin	15·8	14·0
Length of base of adipose fin	8·7	7·0

Glyptothorax saisii (Jenkins).

1910. *Glyptosternum saisii*, Jenkins, *Rec. Ind. Mus.* V p. 128, text-fig., pl. vi, fig. 6.

The species is apparently endemic on Paresnath Hill, Bihar, whence three specimens were obtained by Dr. J T. Jenkins and Dr. N. Annandale. The under surface of the pectoral spine and of the two outer rays of the ventral fin is plicated. The thoracic adhesive apparatus is well developed. The largest specimen in our collection is 70 mm. in length including the caudal.

Glyptothorax striatus (McClelland).

1842. *Glyptosternon Striatus*, McClelland, *Calcutta Journ. Nat. Hist.* II, p. 587, pl. vi, figs. 1 and 2.
1860. *Glyptothorax striatus*, Blyth, *Journ. As. Soc. Bengal* XXIX, p. 154.
1864. *Glyptosternum striatum*, Günther, *Cat. Brit. Mus. Fish.* V, p. 188.
1878. *Glyptosternum striatum*, Day, *Fish India* II, p. 498.
1889. *Glyptosternum striatum*, Day, *Faun. Brit. Ind. Fish* I, p. 200.

During my recent visit to the Khasi Hills I obtained a good series of specimens of this species in the Nong-priang and the Tang-siang streams near Cherrapunji. The fish attains a length of at least nine inches. The type-specimen is now preserved in the British Museum and is only three and a half inches in length. Günther's description from these young specimens does not agree with the adult in my collection; and the differences in proportions and in the position of the fins due to growth can be determined from the table of measurements over leaf. The colour also undergoes considerable variation. In individuals up to 8 cm. in length the upper surface and sides of the head and body are uniformly dark brown, while the under surface is pale white. The fins are somewhat lighter in colour. The upper and the lower surfaces of the paired fins correspond in colour to the dorsal and the ventral surfaces of the body

respectively. With growth dark vertical bands begin to appear on the body till ultimately the fish is dark above and dirty white below. The adhesive apparatus on the thorax and on the outer rays of the paired fins is flesh-red when the fish is alive but turns yellowish brown in spirit.

The head and the anterior part of the body in front of the ventral fins are greatly depressed. The dorsal profile is only slightly arched but it slopes down considerably from the base of the dorsal fin to the tip of the snout. The lower lobe of the caudal fin is somewhat longer than the upper; this condition is more marked in the young than in the adult specimens. The greatest breadth of the thoracic adhesive apparatus equals its length. The spine of the pectoral fin and the four outer rays of the ventral are provided on their ventral aspect with an adhesive apparatus of the same type as is present on the chest. The dorsal fin is higher than the body. There are six branched rays in the dorsal and nine in the anal fin. The ventrals begin considerably behind the base of the dorsal. The anterior origin of the adipose fin is almost above that of the anal. The ventrals extend slightly beyond the anal opening. The maxillary barbels, when adpressed, reach beyond the posterior margin of the operculum and the eyes are situated almost in the beginning of the posterior half of the head. The least height of the caudal peduncle is about one-third its length. The distance between the basal bone of the dorsal fin and the occipital process almost equals the diameter of the eye.

I refer to *G. striatus* a young specimen recently collected by Dr. Kemp and Mr. Chopra in the Garo Hills, Assam. It agrees very closely with the young specimens obtained by myself from the Khasi Hills, but differs from them in having all the fins tipped with white. The lower lobe of the caudal fin is considerably longer than the upper.

Locality :—Assam, Khasi and Garo Hills.

Measurements in millimetres.

Total length including caudal	71·7	102·0	156·5	225·0
Length of caudal	13·0	18·0	26·2	39·0
Length of head	13·1	18·9	31·1	42·8
Greatest width of head	11·1	17·0	26·5	37·0
Height of head near occiput	7·1	11·5	14·6	11·5
Length of snout	7·2	10·0	16·7	24·5
Interorbital width	4·5	5·1	8·2	12·0
Depth of body	8·7	12·8	19·0	27·0
Height of dorsal fin .	10·5	16·8	23·0	34·2
Length of pectoral fin	13·0	17·5	24·0	37·5
Length of ventral fin .	11·7	15·9	23·1	31·4
Longest ray of anal fin	10·3	13·8	20·4	30·0

Length of caudal peduncle	13·5	19·0	26·5	41·0
Least height of caudal peduncle	4·3	6·0	9·5	12·2
Distance between tip of snout and commencement of dorsal fin	19·5	27·7	45·0	61·0
Distance between tip of snout and commencement of adipose fin	40·0	54·5	89·3	128·5
Distance between base of dorsal fin and that of adipose fin	22·0	29·0	46·0	69·2
Distance between commencement of dorsal fin and base of caudal fin	41·2	59·0	85·0	128·0
Distance between base of dorsal and commencement of adipose fin	15·0	19·0	13·1	50·4
Length of base of adipose fin	8·7	14·3	17·2	20·0

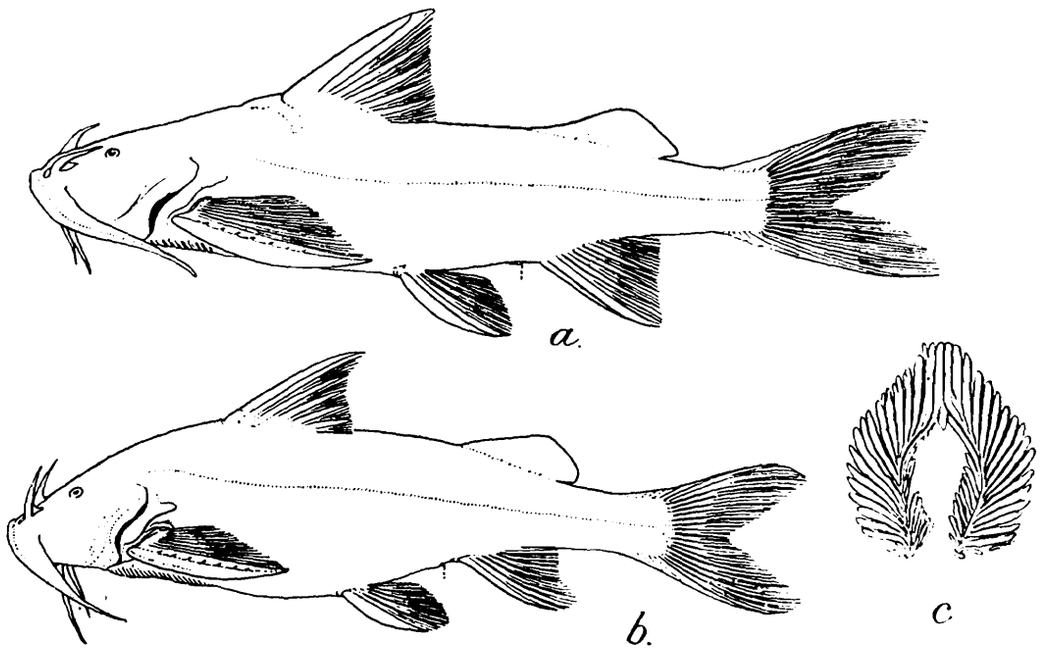
Glyptothorax kashmirensis, sp. nov.

D. 1/5. V 6. P. 1/8–9. A. 2/6.

Glyptothorax kashmirensis is represented by a large series of specimens from the Kashmir Valley. Most of the specimens were recently collected by the members of the Zoological Survey of India but there are two well preserved examples obtained by Col. H. T. Pease. Both the sexes are present in the collection and differ from each other in several important respects. The female possesses shorter fins and a deeper body as compared with the male. The differences in proportions and the position of the fins are indicated in the table of measurements.

The dorsal profile rises from the tip of the snout to the base of the dorsal fin beyond which it is almost straight and horizontal in the male or slopes down considerably to the base of the caudal fin in the female. The head and a part of the body in front of the ventrals are somewhat depressed and the profile in this region is almost straight. The head is slightly longer than broad; in the male its length is contained 4·3 times and in the female 3·9 times in the total length without the caudal. The eyes are small and are situated in the posterior half of the head. The nostrils are placed nearer to the tip of the snout than to the anterior margin of the orbit. The barbels are thick and stout; the nasal barbels when adpressed reach the orbit, the maxillary to the end of the base of the pectoral fin and the outer mandibular to the base of the pectoral spine. The inner mandibular are slightly shorter than the gape of the mouth. The head and body are covered with minute tubercles all over.

The dorsal fin is provided with a very strong spine; its bony portion is at least as long as the head behind the nostrils. The fin is higher than the body in the male whereas in the female it is lower than the body. In the female the pectorals are as long as the head and are separated from the ventrals by a considerable distance; in the male the pectorals are longer than the head and also reach the base of the ventrals. The adipose fin is comparatively longer; the length of its base is more than half the distance between the base of the dorsal and the commencement of the adipose fins. The caudal fin is deeply forked and in some specimens its upper lobe is longer than the lower.



TEXT-FIG. 2.—*Glyptothorax kashmirensis*, sp. nov.
a. Lateral view of male specimen.
b. Lateral view of female specimen.
c. Thoracic adhesive disc.

The adhesive apparatus is present on the chest only. It is slightly longer than broad and its plaits enclose a circular depression in the middle. The anterior lip near the bases of the maxillary barbels is provided with papillae.

The colour in spirit is uniformly dark brown, with the under surface of the head, body and fins lighter in colour. In some specimens the body is marked with a number of black dots.

Type-specimen:—F 10270/1 *Zoological Survey of India* (*Ind. Mus.*).

Locality:—Kashmir Valley.

Measurements in millimetres.

	♂	♀
Total length including caudal	117·0	85·4
Length of caudal	20·4	14·2
Length of head	22·3	18·1

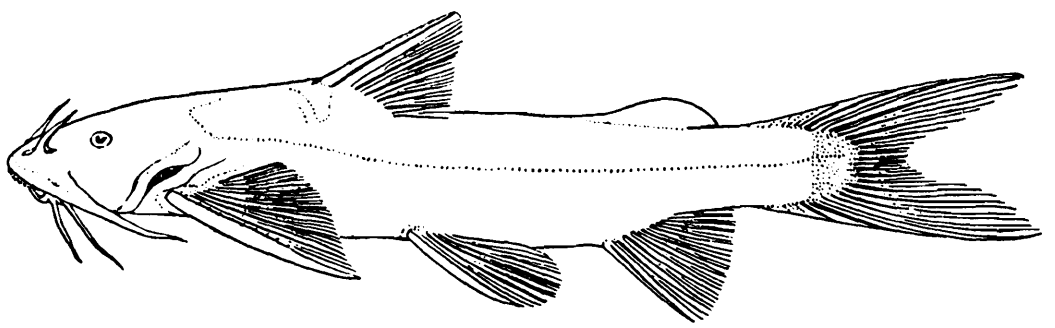
Greatest width of head	19·7	16·3
Height of head near occiput	15·5	14·0
Length of snout	11·0	8·8
Interorbital width	5·9	5·0
Depth of body	20·3	18·2
Height of dorsal fin	22·4	15·7
Length of pectoral fin	26·0	17·6
Length of ventral fin	16·2	11·3
Longest ray of anal fin	18·1	14·0
Length of caudal peduncle	20·7	15·6
Least height of caudal peduncle	9·3	5·9
Distance between tip of snout and commencement of dorsal fin	34·0	26·7
Distance between commencement of dorsal fin and that of adipose fin	30·7	25·5
Distance between commencement of dorsal fin and base of caudal fin	65·8	48·8
Distance between base of dorsal fin and commencement of adipose fin	19·4	15·7
Length of base of adipose fin	16·8	10·4

Glyptothorax dekkanensis (Günther).

1864. *Glyptosternum dekkanense*, Günther, *Cat. Brit. Mus. Fish.* V, p. 187.

1919. *Euglyptosternum saisii*, Annandale (*nec* Jenkins), *Rec. Ind. Mus.* XVI, p. 126.

To this species I refer a single specimen collected by Dr. N. Annandale in the Yenna (Vena) River at Medha in the Satara District of the Bombay Presidency. It closely agrees with Günther's description of the species and is about 12 cm. in length.



Text-fig. 3.—Lateral view of a young specimen of *Glyptothorax dekkanensis* (Günther).

Day[1] recorded *G. dekkanense* from the Jumna River, "near where it emerges from the Sewalik Hills," but I look upon this record with suspicion. In his later and more comprehensive work, Day[2] considered *G. dekkanensis* to be synonymous with *G. lonah*, but on reading Günther's descriptions of the two species based on the

[1] Day, *Proc. Zool. Soc. London*, p. 714 (1871).
[2] Day, *Fish. India* II, p. 496 (1878).

type-specimens I think myself justified in regarding them as specifically distinct. The two species differ in the following points:—

G. lonah.	*G. dekkanensis.*
Head as long as broad."	" Head rather longer than broad."
' The free portion of the tail is twice as long as high.''	" The free portion of the tail is two-third as high as long "
' Dorsal fin higher than the body.''	" Dorsal fin as high as the body."
The pectoral spine is provided " with a fine outer and with a strong inner serration."	The pectoral spine is " strongly serrated interiorly."

The colouration is rather characteristic of the species. It is uniformly light grey with the bases of the pectoral, dorsal, adipose and caudal fins dark. Portions of certain rays in the dorsal, anal and ventral fins are infuscated with black. The posterior portion of the caudal fin is black but it is tipped with a lighter colour.

The dorsal profile in this species is almost straight and horizontal and shows only a slight rise from the tip of the snout to the base of the dorsal fin. The ventral surface is greatly depressed in front of the ventral fins and the profile of this region is almost straight. The dorsal fin is as high as the body and is situated in the beginning of the second third of the distance between the posterior margin of the nostrils and the base of the caudal fins. The pectorals are shorter than the head and are separated from the ventrals by a considerable distance. The ventrals extend to the anal opening and do not reach to the base of the anal fin. The thoracic adhesive apparatus is much longer than broad and is fairly well developed.

Locality:—Deccan, the Yenna River in the Satara District, Bombay Presidency.

Glyptothorax gracilis (Günther).

1864. *Glyptosternum gracile*, Günther, *Cat. Brit. Mus. fish.* V p. 186.

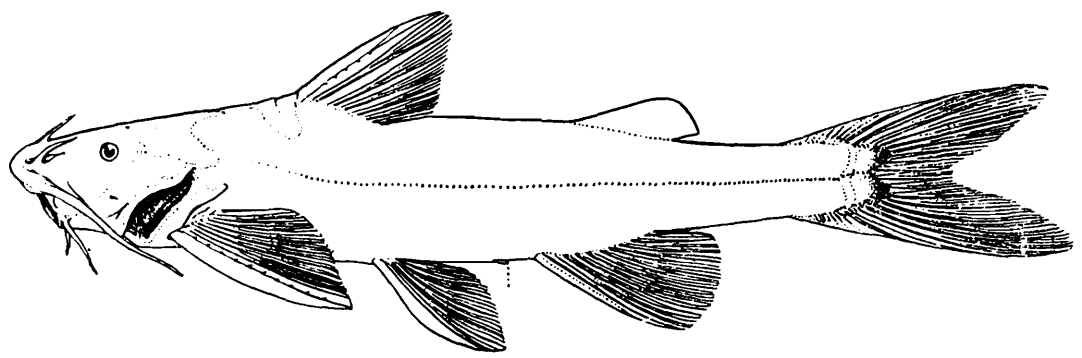
Day[1] did not recognise this species as valid; under *G. trilineatum* he remarks, " *G. gracile*, Günther, V, p. 186, from Nepaul differs in having one more anal ray: occipital process a little narrower; maxillary barbels longer, while the pectoral fin reaches the base of the ventral."

There is a specimen in the collection about 10 cm. in length including the caudal, which I can refer to Günther's species. It was procured by Dr. B. L. Chaudhuri in the Rangit River, Manjhitar, Sikkim. It agrees so closely with Günther's description that I need add only a few short notes on the species. It differs from *G. trilineatus* in a number of important points which Day has disregarded.

The thoracic adhesive apparatus is much longer than broad and the pectoral spine is devoid of plaits on its under surface. The pectoral fin is slightly longer than the head and reaches almost

[1] Day. *Fish. India* II, p. 497 (1878).

to the base of the ventral fin. The latter extends considerably beyond the anal opening and just reaches the origin of the anal fin. The origin of the ventral fin is slightly behind the base of the dorsal. The maxillary barbels are considerably longer than



TEXT-FIG. 4.—Lateral view of *Glyptothorax gracilis* (Günther).

the head; the eyes are placed in the posterior half of the head. The lower lobe of the caudal fin is longer than the upper and the dorsal fin is higher than the body.

Locality:—Nepal and Sikkim.

Glyptothorax, sp.

(Plate IV, fig. 2.)

The collection contains a mature female specimen from the Saran District, Bihar, obtained by Mr. M. Mackenzie, which I have not been able to refer to any known species of the genus. It is interesting in several respects, but I do not propose to give it a new name as Buchanan's forms from the adjacent localities are not properly known. The following are some of its salient features:—

i. The gill-openings of the two sides are as widely apart as the interorbital width and the thoracic adhesive apparatus is continued forward between the openings.

ii. The thoracic adhesive apparatus is twice as long as broad and is greatly pointed anteriorly.

iii. The dorsal fin is considerably shorter than the body height; the bony portion of its spine is almost as long as the length of the head excluding the snout.

iv. The pectoral fins are small; they are almost as long as the head behind the nares.

v. The barbels are small, none of them extending beyond the hinder margin of the eye.

vi. The mouth is small and the lips are provided with well-marked papillae.

vii. The body is covered with small elevations which are arranged in longitudinal rows.

viii. The adipose fin commences slightly behind the commencement of the anal fin.

One of the inner mandibular barbels is bifurcate, an abnormality which I have also observed in certain specimens of *Nemachilus* and *Garra*.

Measurement in millimetres.

Total length including caudal	71·2
Length of caudal	11·3
Length of head	14·2
Greatest width of head	10·8
Height of head near occiput	10·8
Length of snout	7·0
Interorbital width	3·4
Depth of body	14·2
Height of dorsal fin	9·6
Length of pectoral fin	9·8
Length of ventral fin	7·7
Longest ray of anal	6·8
Length of caudal peduncle	13·4
Least height of caudal peduncle	3·8
Distance between tip of snout and commencement of dorsal fin	21·3
Distance between commencement of dorsal fin and that of adipose fin	21·7
Distance between commencement of dorsal fin and base of caudal fin	41·6
Distance between base of dorsal fin and commencement of adipose fin	15·9
Length of base of adipose fin	6·0

Glyptothorax minutus, Hora.

1921. *Glyptothorax minutus*, Hora, *Rec. Ind. Mus.* XXII, p. 180, fig. 1.

Unfortunately the specimens of this species were lost. I have utilized the characters mentioned in my description for including the species in the synoptic table. As regards the number of rays in the anal fin the figure is inaccurate.

Locality :—Imphal Stream in the Manipur Valley, Assam.

Glyptothorax botia (Ham. Buch.) Day.

1878. *Glyptosternum botia*, Day, *Fish. India* II, 497, pl. cxiii, fig. 4.
1889. *Glyptosternum botium*, Day, *Faun. Brit. Ind. Fish.* I, p. 198.

The form to which I give this name is certainly the *G. botia* of Day but I am not sure that it is the same as that to which Buchanan [1] applied the name.

I have examined Day's original of his figures in the *Fishes of India* and also refer to the species three young specimens from Mawai, Bara-Banki.

Locality :—Delhi and Bara-Banki (Northern India).

[1] Buchanan, *Fish. Ganges*, pp. 192, 378 (1822).

Glyptothorax dorsalis Vinciguerra.

1889. *Glyptothorax dorsalis*, Vinciguerra, *Ann. Mus. Stor. Nat. Genova* XXIX, p. 246, pl. vii, fig. 4.
1921. *Glyptothorax dorsalis*, Hora, *Rec. Ind. Mus.* XXII, p. 180.

In describing the dorsal spine of this species I made a mistake. It is finely serrated along its posterior border but is smooth anteriorly. The occipital process and the basal bone of the dorsal spine are almost continuous. The paired fins are devoid of an adhesive apparatus on the ventral aspect of some of their outer fin rays: the apparatus on the chest is well developed and is much longer than broad.

I hesitatingly refer to this species a young specimen from Pegu obtained by Mr. J P. Cook. Its colouration is different from that of the Manipur examples. There is a yellowish line running from the occiput to the base of the caudal fin and the fins are not marked with black dots. The body is covered with prominent tubercles, which are arranged in regular longitudinal rows.

Locality:—The head-waters of the Irrawaddy River, Burma and the Manipur Valley.

Glyptothorax telchitta (Ham. Buch.) Day.

1871. *Glyptosternum telchitta*, Day, *Proc. Zool. Soc. London*, p. 228.
1878. *Glyptosternum telchitta*, Day, *Fish. India* II, p. 498, pl. cxvi, fig. 2.
1889. *Glyptosternum telchitta*, Day, *Faun. Brit. Ind. Fish.* I, p. 199.

I use this name in the sense in which Day applied it as Buchanan's [1] description is insufficient for exact determination.

Day's original of his figure in the *Fishes of India*, which is now in our collection, is without any history. There are, however, several other specimens of considerable age in the collection, which I refer to this species. They are labelled "Burrabhum," by which Birbhum in Bengal is probably intended.

Locality:—Northern Bengal and probably some portions of Bihar.

Glyptothorax conirostris (Steindachner).

1867. *Glyptosternum conirostre*, Steindachner, *Sitzungsb. K. Acad. Wiss. Wien.* LV, pt. 1, p. 532, pl. v, fig. 2; pl. vi, fig. 2.
?1871. *Glyptosternum modestum*, Day, *Proc. Zool. Soc. London*, p. 714 (young individuals).
1878. *Glyptosternum lonah*, Day (in part), *Fish. India* II, p. 496.
1878. *Glyptosternum conirostre, id., ibid.*, p. 497, pl. cxvi, fig. 5.
1889. *Glyptosternum lonah*, Day, *Faun. Brit. Ind. Fish.* I, p. 196.
1889. *Glyptosternum conirostre, id., ibid.*, p. 198.

In *Glyptothorax conirostris* the head is much longer than broad. It is narrow and broadly pointed anteriorly. The dorsal fin is higher than the body and the pectorals are as long as the head. The adhesive apparatus is much longer than broad; the outer rays of the paired fins are not plaited below.

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[1] Buchanan, *Fish. Ganges*, pp. 185, 378 (1822).

In Day's *G. modestum*, which I consider to be a doubtful synonym of *G. conirostris*, the head is as long as broad, the thoracic adhesive apparatus is small and the dorsal is nearly as high as the body. In these respects *G. modestum* is closely related to *G. pectinopterus* but differs from it in the absence of an adhesive apparatus on the under surface of the outer rays of the paired fins.

Locality :—Simla, the head-waters of the Jumna River.

Glyptothorax trilineatus, Blyth.

1860. *Glyptothorax trilineatus* Blyth, *Journ As. Soc. Bengal* XXIX, p. 154.
1878. *Glyptosternum trilineatum*, Day, *Fish. India* II, p. 497 pl. cxvi, fig. 3.
1889. *Glyptosternum trilineatum*, Day, *Faun. Brit. Ind. Fish.* I, p. 197.
1889. *Glyptothorax trilineatus*, Vinciguerra, *Ann. Mus. Stor. Nat. Genova* XXIX. p. 252.

In the old collection of the Indian Museum I have found three specimens belonging to this species, erroneously labelled "*Glyptosternum telchitta* (Ham. Buch.)." Two of these were collected by Major Berdmore in Tenasserim and are probably the type-specimens of *G. trilineatus*. The third is from Rangoon and appears to be the original of Day's figure in the *Fishes of India*. I need not add anything to Day's description which is lucid and clear, but it may be pointed out that his interpretation of the three white streaks along the body is different from that of Blyth, who observed the fish as "of a blackish colour, with three longitudinal yellow lines, one along the entire ridge of the back from occiput to base of tail, the others along each lateral line." This type of colouration is met with among some of the other members of this genus and it is probably this fact which led Günther [1] to refer his Nepalese examples to this species. The two forms may, however, be distinguished as shown in the table given below :—

"*Glyptosternum trilineatum*" Günther.	*Glyptothorax trilineatus*, Blyth.
"The free portion of the tail is nearly thrice as long as high."	The free portion of the tail is nearly twice as long as high.
Dorsal spine rather slender, the length of its bony portion being one half, or less than one-half, that of head.	Dorsal spine moderately strong the length of its bony portion being more than half the length of the head.

The skin is devoid of any tubercles.

Locality :—Tenasserim and Rangoon.

Glyptothorax madraspatanus (Day).

1873. *Glyptosternum madraspatanum*, Day, *Journ. Linn. Soc. London* XI, p. 526.
1878. *Glyptosternum madraspatanum*, Day, *Fish. India* II, p. 498, pl. cxvi, fig. 4.

[1] Günther, *Cat. Brit. Mus. Fish.* V p. 185 (1864)

1889. *Glyptosternum madraspatanum*, Day, *Faun. Brit. Ind. Fish* I, p. 200.

The species appears to be closely allied to *Glyptothorax lonah* and *G. dekkanensis*, from which it differs in having a few serrations along the upper half of the posterior border of the dorsal spine. Day was unable to find an air-vessel in this species, but on dissecting a specimen I have found it to have the form of two lateral chamber connected by a transverse canal. The bladder is covered by a thick fibrous coat and is not even partially enclosed in a bony capsule.

In *G. madraspatatum* the dorsal fin is higher than the body and the pectorals are as long as or slightly longer than the head. The ventrals extend beyond the anal opening and almost reach the base of the anal fin. The pectoral and the ventral fins are devoid of an adhesive apparatus and one on the thorax is rather longer than broad and is well developed.

Locality :—Day obtained his specimens in the Bhavani River at the foot of the Nilgiris. Of the five specimens recently collected by Dr. N. Annandale three are from the same locality, while the remaining two were obtained a little lower down stream at Mettupalaiyam in the Coimbatore District, Madras. Day's original of his figure in the *Fishes of India* and another of his specimens are preserved in the collection of the Zoological Survey of India.

Glyptothorax lonah (Sykes).

1841. *Bagrus Lonah*, Sykes, *Trans. Zool. Soc. London* II, p. 371.
1864. *Glyptosternum lonah*, Günther, *Cat. Brit Mus. Fish.* V, p. 187.
1878. *Glyptosternum lonah*, Day (in part), *Fish. India* II, p. 496, pl. cxiii, fig. 5.
1889. *Glyptosternum lonah*, Day (in part), *Faun. Brit. Ind. Fish.* I, p. 196, fig. 72.

I have not examined any specimen of this species and have entirely relied on Günther's description. I have examined an old specimen from the head-waters of the Jumna River, which Day had referred to this species, but believe that it belongs to *Glyptothorax conirostris* and not to *G. lonah*. The extension of the range of the species into the head-waters of the Jumna River thus requires confirmation. Syke's example was obtained in "Dekkan" and it is probable that Day's specimens from Poona were correctly identified.

Günther has not mentioned the presence of an adhesive apparatus on the ventral aspect of the outer rays of the paired fins. The two chief characters of the species are, firstly, that the head is as long as broad and secondly, that the pectoral spine is finely serrated internally.

Locality :—Deccan, South India.

Genus Glyptosternum McClelland.

1842. *Glyptosternon*, McClelland, *Calcutta Journ. Nat. Hist.* II, p. 584.
1860. *Glyptosternon*, Blyth, *Journ. As. Soc. Bengal* XXIX, p. 153.

1860. *Exostoma*, Blyth (in part: all known species except the type, *E. berdmorei*), *ibid.*, p. 155.
1864. *Exostoma*, Günther (in part), *Cat. Brit. Mus. Fish.* V, p. 264.
1874. *Chimarrhichthys*, Sauvage, *Rev. et Mag. Zool.* XXV, p. 332.
1878. *Exostoma*, Day (in part: except *E. berdmorei*), *Fish. India* II, p. 501.
1889. *Exostoma*, Day (in part: except *E. berdmorei*), *Faun. Brit. Ind. Fish.* I, p. 108.
1905. *Parexostoma*, *Chimarrhichthys*, Regan, *Ann. Mag. Nat. Hist.* (7) XV, p. 182.
1905. *Exostoma*, Regan (in part: all except *E. berdmorei*), *ibid.*, p. 182.
1907. *Euchiloglanis*, Regan, *Rec Ind. Mus.* I, p. 158.
1911. *Parexostoma*, *Euchiloglanis*, *Exostoma*, Regan, *Ann. Mag. Nat. Hist.* (8) VIII, p. 564 (1911).

The genus may be defined as follows:—

The head and body are greatly depressed; the former is almost as broad as long. The under surface is smooth or minutely tuberculate but always devoid of a plaited adhesive apparatus on the chest or any part of abdomen. The paired fins are greatly expanded; they are "vertical in their upper and horizontal in their lower half"; the outer ray of the paired fins is weak and ensheathed in thick skin, which is striated on the ventral aspect to form an adhesive apparatus; it gives "off soft pointed cartilaginous rays along the anterior margin, which are enveloped in the membrane of the skin." The dorsal fin is devoid of a spine and commences considerably in advance of the ventrals; the adipose fin is long and low; the caudal fin is truncate or emarginate but never forked. The eyes are small and greatly approximated on the dorsal surface; they are covered by a skin membrane. The nostrils are situated close together and are separated by a flap which bears the nasal barbel. There are eight barbels, four mandibular, two nasal and two maxillary; the maxillary barbels possess broad bases which are sometimes corrugated on the ventral aspect to serve as adhesive organs. The mouth is situated on the under surface considerably behind the tip of the snout; the lips are broad and usually spread continuously round the mouth; they are papillated, suggesting adhesive properties; the lower labial fold may be continuous or widely interrupted. The palate is edentulous; the jaws are provided with small conical or flattened teeth which are variously disposed to form several types of bands. The gill-openings are narrow and usually restricted to the sides and in some cases extend to the under surface only for a short distance. The air-bladder is divided into two lateral chambers which are enclosed in a bony capsule.

The fishes of this genus are usually of a small size but some grow to a foot or more in length. They are always found in rapids at fairly high altitudes and have not so far been recorded from deep and sluggish streams.

Regan in 1905 (*loc. cit.*) subdivided the fishes of this genus into three groups, which he considered as distinct genera. His synoptic table is faulty in several respects as it is probably built upon the meagre descriptions of most of the species included in

it. For instance of *G. blythi* he says, "fold of the lower lip not continuous," whereas in the type-specimen and in Day's figure it is continuous. The reverse is the case with *G. andersoni*, which according to Regan's synopsis should have the "fold of the lower lip continuous," while in the specimens I have examined it is widely interrupted. I have already pointed out that "*Exostoma berdmorei*" of Blyth does not belong to this genus at all.

Apart from these errors which, owing to the inadequacy of many of the descriptions, were probably unavoidable, I am of opinion that Regan's subdivisions are not of generic importance. He depends for the separation of his genera mainly on the character of the teeth, on the nature of the gill-openings, on the continuity or discontinuity of the fold of the lower lip and on the number of branched rays in the pectoral fin. These characters are discussed below.

According to the arrangement and the nature of the teeth the members of the genus *Glyptosternum* may be divided into four groups as follows :—

Group I. The teeth on the upper jaw form a continuous band, which is produced backwards at the sides. The teeth are pointed and are not to be seen when the mouth is closed. To this group I refer *G. maculatum* (Regan) and *G. stoliczkae* (Day). In both the species the gill-openings are wide and the fold of the lower lip broadly interrupted. *G. andersoni*, which possesses a totally different kind of teeth, shares the last two important characters with the species included in this group. In *G. feae* the fold of the lower lip is discontinuous and the gill-openings are narrow, while the teeth are described by Vinciguerra as :—"dentibus maxillaribus conicis, interdum apice truncatis, vomero-palatinis nullis."

Group II. The teeth on the upper jaw form a continuous band which is not produced backwards at the sides. The teeth are greatly compressed in their free portion and the apex is either truncate or is so notched as to possess two or more processes on the crown. The lower portion of a tooth is also compressed but the plane of this compression is at right angles to that of the upper portion. The outermost row of teeth is distinctly visible when the mouth is closed. This group comprises a single species, *G. andersoni*, which in the nature of the gill-openings and in the discontinuous fold of the lower lip greatly resembles the members of the first group.

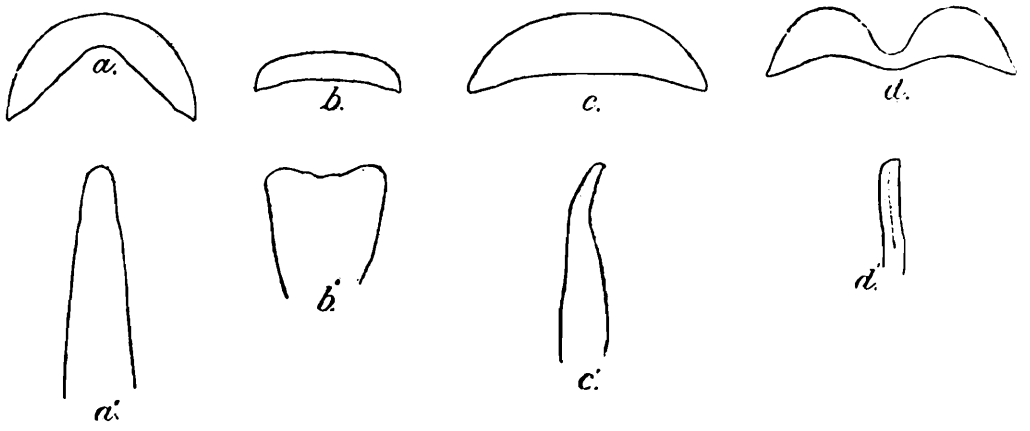
Group III. The teeth on the upper jaw form a continuous band which is not produced backwards at the sides. The teeth are pointed and, when the mouth is closed, a portion of the band is distinctly visible. To this group I assign *G. blythi*, *G. feae* and *G hodgarti*. In *G. blythi* the fold of the lower lip is continuous, whereas in the remaining two species it is broadly interrupted. The gill-openings are narrow in all the three forms.

Group IV This is the largest group numerically and comprises all the remaining species with the possible exception of

G. davidi, which I have not examined. The teeth on the upper jaw form two characteristic patches which remain exposed even when the mouth is closed. The labial fold of the lower lip is continuous. With the exception of *G. macropterum* and *G. sp.* all others possess rather wide gill-openings extending to the base of the pectoral spine. In *G. macropterum* and *G. sp.* they are narrow and do not extend below the middle of the base of the pectoral fin.

The teeth in *G. macropterum* are somewhat different from the others. They form a continuous band on the upper jaw and are not visible when the mouth is closed. The teeth of the lower jaw are, however, pushed outside the mouth cavity, they are somewhat compressed and possess truncate apices.

It is clear from what has been said above that, by relying only on the arrangement and the nature of the teeth, the genus



TEXT-FIG. 5.—Nature of tooth-bands and teeth in *Glyptosternum*.
a, *a'*, *G. maculatum* (Regan); *b*, *b'*, *G. andersoni* (Day); *c*, *c'*, *G. hodgarti*, sp. nov.; *d*, *d'*, *G. vinciguerrae* (Regan).

Glyptosternum can be split up into four groups, but there are equally important characters such as the nature of the gill-opening and the labial fold, which do not permit of such a division. The number of pectoral rays is only a specific character and therefore needs little consideration.

The name *Euchiloglanis* was proposed by Regan for *Chimmarhichthys* Sauvage, which was preoccupied. Sauvage's species and his genus are provisionally included in this paper, but nothing is known about them beyond their original descriptions.

Besides "*Exostoma berdmorei*", which I have referred to the genus *Glyptothorax*, there are two extra-Indian species the names of which I have not been able to include in my synoptic key. One is *Glyptosternum reticulatum* from Afghanistan and the other "*Exostoma oschanini*" from Tschirtschik, Taschkent and Amu-Darja (Russia). I have dealt with the former species in my general introductory note. Herzenstein[1] characterized "*Exostoma*

[1] Herzenstein, *Bull. Acad. St. Pétersbourg.* XXXIII, p. 120 (1890).

oschanini" as follows: "E. capite valde depresso, labio inferiore ad oris angulos modo evoluto, dentibus aciculatis, spatio pinnam dorsalem et adiposam inter $1\frac{4}{5}$–$2\frac{1}{10}$ pinnae dorsalis basin superante; pinna adiposa a caudali, recte truncata, plane sejuncta; pinnae analis initio ventralium quam caudalis basi multo propiore; pectoralibus ventralium basis haud attingentibus." He alludes to the close relationship between his species and *G. stoliczkae* (Day) and distinguishes the two by the position of the adipose dorsal in relation to the caudal fin. In *G. oschanini* the adipose is separated from the caudal by a considerable distance, whereas in *G. stoliczkae* it is continued to the base of the caudal. I regard this as a valid specific distinction and, therefore, do not agree with Regan (*loc. cit.* p. 183) who considers the two names as synonyms. Moreover Regan gives the habitat of *G. stoliczkae* as "Eastern Turkestan" which is not correct.

The genus is at present found in the Darja River of the Oxus system that flows in the Aral Lake (*G. oschanini*); at the source of the Kabul River (*G. reticulatus*), in the head-waters of the Indus River (*G. stoliczkae*), in Eastern Tibet (*G. maculatum*) and the neighbouring parts of China (*G. davidi*) and Yunnan (*G. andersoni*), in Nepal and the Darjiling Himalayas (*G. hodgarti*) and in the Abor Hills, the Mishmi Hills and the north-eastern frontier of Burma (many species).

The genus has not been found hitherto in the Himalayas between Nepal and the Indus watershed, but will probably be found there in course of time. It appears to have originated in the plateaus of Central Asia, where the less specialized members of the genus such as *G. stoliczkae* and *G. maculatum* are now found. These generalized forms are met with mostly on the northern slopes of the Himalayas and their range extends from the Aral Lake to Eastern Tibet, Yunnan and the neighbouring parts of China. Great diversity of form and specialization are found in the members of the genus that inhabit the hill-tracts of Assam and of the north-eastern border of Burma.

The genus affords an interesting example of progressive specialization, which is shown in the form of the tooth-band, the degree of compression of the teeth, in the position of the teeth in the mouth-cavity, in the restriction of the gill-openings and the character of the labial fold. In the course of evolution the various characters are indiscriminately blended together and we find that members of the genus can be grouped in several ways as has already been shown in the case of the tooth-bands. This is exactly what is to be expected of a genus which is still in course of adaptation to its proper habitat—the mountain rapids. In the synoptic table I have arranged the species according to the degree of specialization they exhibit. For instance *G. maculatum* and *G. stoliczkae* are less specialized than the remaining species, while *G. labiatum* and *G. vinciguerrae* are more specialized than *G. stuarti* and *G. coggini* and less specialized than *G. blythi* and *G. sp.* which are the most highly specialized of the lot.

According to the rules of nomenclature *Glyptosternum reticulatus* should be considered the type of the genus, being the first mentioned by McClelland under his genus *Glyptosternum*. The same species is the logotype as well, because Blyth, who first revised this genus, adopted *G. reticulatum* as the type of the genus. But as has already been pointed out this species is insufficiently characterized. I therefore, regard McClelland's other species *G. labiatum* as the type of the genus.

In the following pages notes and descriptions are given only in the case of those species which are not sufficiently known, while all available references are included under the synonomy of each. An asterisk denotes that the type-specimen of the species is in the collection of the Zoological Survey of India, while a dagger indicates that the species is represented in the collection.

A key to the Indian and some of the extra-Indian species of *Glyptosternum*.

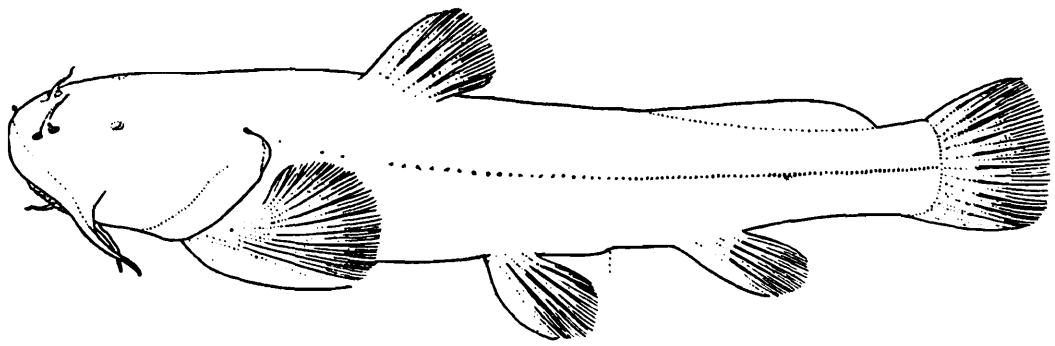
A. Fold of lower lip broadly interrupted.
- I. Pectoral fin separated from ventral fin by a considerable distance.
  - *a*. Gill-opening wide, extending to origin of base of pectoral fin or to under surface for short distance.
    - 1. Teeth all pointed, those of upper jaw forming a band, which is produced backwards at the sides.
      - *α*. "Pectoral extending $\frac{1}{2}$–$\frac{3}{5}$ of the distance from its base to the base of the ventral; caudal peduncle twice as long as deep." Adipose fin separated from base of caudal by a considerable distance ... *G. maculatum*† (Regan).
      - *β*. "Pectoral extending $\frac{2}{3}$–$\frac{3}{4}$ of the distance from its base to the base of the ventral; caudal peduncle 3 times as long as deep." Adipose fin extending to base of caudal fin ... ... *G. stoliczkae** (Day).
    - 2. Teeth compressed with broad truncate apices, those of upper jaw forming a band, which is not produced at the sides; adipose fin extending to base of caudal fin ... *G. andersoni** (Day).
  - *b*. Gill-opening narrow, not extending to origin of base of pectoral fin [I denti mascellari sono, piccoli e conici, alcuni coll'apice smusso.] .. *G. feae*† (Vinciguerra).
- II. Pectoral fin reaching origin of ventral fin.
  - *a*. Maxillary barbels not reaching origin of base of pectoral fin; gill-opening wide ... *G. davidi* (Sauvage).
  - *b*. Maxillary barbels reaching beyond origin of base of pectoral fin; gill-opening narrow, not extending below middle of base of pectoral fin [Teeth pointed, those on upper jaw forming a band, which is not produced at the sides] ... ... *G. hodgarti*,* sp. nov.

B. Fold of lower lip continuous.
- I. Pectoral fin extending considerably beyond commencement of ventral fin. [Gill-opening narrow, not extending below middle of base of pectoral fin; inner mandibular barbels not situated on fold of lower lip; teeth somewhat flattened, those on upper jaw forming a band which is not produced at the sides] ... ... *G. macropteram*† (Vinci.).

II. Pectoral fin not extending beyond commencement of base of ventral fin.
  a. Gill-opening wide, extending to origin of base of pectoral fin [Inner mandibular barbels situated on fold of lower lip; teeth somewhat compressed and possessing truncate apices; those on upper jaw forming two semicircular patches.]
    1. Beginning of anal fin distinctly nearer base of caudal than commencement of ventral fin.
      α. Longest ray of dorsal fin much shorter than depth of body below it ... *G. stuarti*,* sp. nov.
      β. Longest ray of dorsal fin much longer than depth of body below it ... *G. vinciguerrae*† (Regan).
    2. Beginning of anal fin slightly nearer commencement of ventral fin than base of caudal fin.
      α. Caudal fin deeply emarginate; adipose fin not reaching base of caudal fin .... *G. labiatum*† McClelland.
      β. Caudal fin very slightly emarginate; adipose fin extending to base of caudal fin ... ... *G. chaudhurii*,* sp. nov.
  b. Gill-opening narrow, extending to middle of base of pectoral fin.
    1. Distance between anus and beginning of anal fin twice that between anus and commencement of ventral; inner mandibular barbels not situated on fold of lower lip; teeth pointed, those on upper jaw forming a band, which is not produced at the sides *G. blythi** (Day).
    2. Distance between anus and beginning of anal fin is less than half that between anus and commencement of ventral; inner mandibular barbels situated on fold of lower lip; teeth somewhat compressed with truncate apices, those on the upper jaw forming two semicircular patches ... *G. sp.*†

Glyptosternum maculatum (Regan).

1905. *Parexostoma maculatum*, Regan, *Ann. Mag. Nat. Hist.* (7) XV, p. 183.
1908. *Parexostoma stoliczkae*, Lloyd (*nec* Day), *Rec. Ind. Mus.* II, p. 342.
1911. *Parexostoma stoliczkae*, Stewart, (*nec* Day), *Rec. Ind. Mus.* VI, p. 70.



TEXT-FIG. 6.—Lateral view of *Glyptosternum maculatum* (Regan).

To this species I refer two specimens collected by Capt. F.

H. Stewart, I.M.S. in Gyang-tse, Tibet, and also a specimen presented to the Indian Museum by Lord Carmichael from Sikkim.

The species is closely related to *Glyptosternum stoliczkae* from which it differs in its relatively broader head and shorter caudal peduncle.

Habitat:—Lhasa and Gyang-tse in Tibet; Sikkim.

Glyptosternum stoliczkae (Day).

1876. *Exostoma stoliczkae*, Day, *Proc. Zool. Soc. London*, p. 782.
1878. *Exostoma stoliczkae*, Day, *Fish. India*, II, p. 502, pl. cxvii, fig. 3.
1889. *Exostoma stoliczkae*, Day, *Faun. Brit. Ind. Fish.* I, p. 110, fig. 45.

Habitat:—This species is known from "Basgo, Sneema, and Leh or Ladak on the head-waters of the Indus." Two specimens of this species have recently been obtained by the members of the Zoological Survey of India from a small stream flowing from the water-works reservoir to the trout-farm at Harwan, Kashmir.

Glyptosternum andersoni (Day).

1869. *Exostoma andersonii*, Day, *Proc. Zool. Soc. London*, p. 524.
1876. *Exostoma andersonii*, Day, *Proc. Zool. Soc. London*, p. 783.
1878. *Exostoma andersonii*, Day, *Fish. India* II, p. 501 (footnote).
1878. *Exostoma andersonii*, Anderson, *Anat. Zool. Res. Yunnan Expd.* I, p. 866.

I have examined all the four specimens collected by Dr. Anderson. Two of them are dessicated and have fallen to pieces; the remaining two are in a better condition. The teeth of this species are totally different from those of any other known form.

Habitat:—Hotha, Yunnan, and Ponsee, China.

Glyptosternum feae (Vinciguerra).

1889. *Exostoma Feae*, Vinciguerra, *Ann. Mus. Stor. Nat. Genova* XXIX, p. 256, pl. viii, fig. 6.
1905. *Chimarrhichthys Feae*, Regan, *Ann. Mag. Nat. Hist.* (7) XV, p. 184.

I have examined a specimen of this species from Taó, kindly sent to me by Dr. Vinciguerra of the Genoa Museum.

Habitat:—Karen-ni Hills, Upper Burma.

Glyptosternum davidi (Sauvage).

1874. *Chimarrichthys Davidi*, Sauvage, *Rev. et Mag. Zool.* XXV p. 333.
1892. *Exostoma Davidi*, Günther, in Pratts' *Snows of Thibet*, p. 245.
1896. *Exostoma davidi*, Günther, *Ann. Mus. Zool. Acad. Sci. St. Petersbourgh* I, p. 210.
1905. *Chimarrhichthys Davidi*, Regan, *Ann. Mag. Nat. Hist.* (7) XV, p. 183.

No reliable description of this species exists at present and it is after great hesitation and not without reserve that I have included it in the key given above. Sauvage (*op. cit.*) does not make any mention of the lower labial fold; but Regan in his

synoptic table states that it is not continuous. An adequate description with figures of this species is badly needed.

Habitat :—Eastern Tibet and adjoining parts of China.

Glyptosternum hodgarti, sp. nov.

(Plate II, figs. 1, 2, 3.)

1871. *Exostoma blythii*, Day, *Proc. Zool. Soc. London*, p. 715.
1878. *Exostoma blythii*, Day (in part), *Fish. India* II, p. 501.
1889. *Exostoma blythii*, Day (in part), *Faun. Brit. Ind. Fish.* I, p. 109.
1907. *Euchiloglanis blythii*, Regan, *Rec. Ind. Mus.* I, p. 158.

This species is represented by a large number of specimens in our collection and is readily distinguished from all others that I have examined by the absence of any labial fold to the lower lip.

In *Glyptosternum hodgarti* the head and body are greatly depressed and the dorsal profile is but slightly arched ; the ventra is straight and almost horizontal. The head is slightly longer than broad ; the length of head is contained 4·1 times in the total length without the caudal fin. The depth of body is two-thirds the length of head. The snout is almost as long as the postorbital part of the head ; the interorbital width is two-thirds the length of the snout. The gill-openings are restricted to the sides of the head and extend to about the middle of the base of the pectoral fin. The mouth opening is crescentic and is bordered by thick lips which are somewhat papillated. The labial fold of the lower lip is widely interrupted and appears to be almost absent in wrinkled specimens. The nasal barbels extend beyond the posterior margin of the orbit and the maxillary barbels are separated from the gill-openings by a short distance. The mandibular pairs of barbels are short, the outer just reaches the base of the pectoral fin. There are flaps of skin at the corners of the mouth ; these are continuous with the upper lip and are joined to the broad bases of the maxillary barbels. The teeth are sharp. The dorsal fin commences opposite the end of the base of the pectoral fin ; it is not so high as the depth of the body below it and possesses only six rays which are enveloped in a thick membrane. The pectoral fin is much longer than the head and extends beyond the beginning of the base of the ventral fin ; it contains 17 rays but the fins become almost leathery in grown up specimens and the number of rays is difficult to count. The ventral fin contains 6 rays and the anal only 5. The posterior margin of the caudal fin is lunate, the upper corner somewhat projecting beyond the lower. The caudal peduncle is 1·2 times as long as deep. The adipose fin is long and low ; in the young specimens it ends considerably in front of the base of the caudal fin while in adults it is continued to the base of the caudal fin.

The colour of the young specimens, in spirit, is brown all over the dorsal surface and the sides of the body, while the fins and the under surface are pale. In a specimen from Nepal the fins are edged with white bands. The posterior half of the caudal fin is black while the general colour of the other fins is brown.

Type-specimen:—F 1553/1, *Zoological Survey of India* (*Ind. Mus.*).

Habitat:—Nepal (Pharping), rivers below Darjiling, and the Abor Hills (between Rotung and Renging).

Measurements in millimetres.

Total length without caudal fin	57·5
Length of head	14·0
Depth of head at occiput	6·5
Width of head	12·0
Depth of body	9·0
Length of snout	6·0
Width of interorbital space	3·8
Length of caudal peduncle	4·7
Least height of caudal peduncle	4·0
From tip of snout to commencement of dorsal fin	19·0
From tip of snout to commencement of ventral fin	20·5
From tip of snout to commencement of anal fin	49·5
From tip of snout to anal opening	48·5
Longest ray of dorsal fin	8·0
Longest ray of anal fin	7·0
Length of pectoral fin	19·0
Length of ventral fin	12·5
Length of caudal fin	7·8
Length of base of adipose dorsal fin	22·5
Greatest height of ,, ,, ,,	1·5
Gape of mouth	6·5

Glyptosternum macropterum (Vinciguerra).

1889. *Exostoma macropterum*, Vinciguerra, *Ann. Mus. Stor. Nat. Genova* XXIX, p. 253, pl. viii, fig. 5.

1905. *Chimarrhichthys macropterus*, Regan, *Ann. Mag. Nat. Hist.* (7) XV, p. 184.

There are four specimens of this species in our collection, of which three were presented to the Museum by Mr. J Coggin Brown, who collected them at Pazi, Monghong Hsipai State, North Shan States (96° 30′ N., 22° 40′ E.), while the remaining one has been very kindly seat to us by Dr. Vinciguerra of the Genoa Museum.

Habitat:—Northern frontier of Burma: Kakhyen Hills and Pazi, Monghong Hsipai State.

Glyptosternum stuarti, sp. nov.

(Plate II, figs. 4, 5, 6.)

1919. *Exostoma vinciguerrae*, Chaudhuri (in part), *Rec. Ind. Mus.* XVI, p. 277.

A specimen collected by Dr. Murray Stuart, late of the Geological Survey of India, in the Nam-Yak River at Tanja on the northern frontier of Burma, is the type of this species. It is

about 45 mm. in length and was referred by Chaudhuri (*op. cit.*) to "*Exostoma vinciguerrae.*" The species can be readily distinguished from the others by its greatly arched dorsal profile and by its peculiar caudal peduncle.

The species possesses a characteristic form; the dorsal profile rises considerably from the tip of the snout to the base of the dorsal fin, beyond which it slopes down to that of the caudal fin. The head and body in front of the anal fin are greatly depressed and consequently the ventral profile in this region is almost straight and horizontal, but behind the ventral fin it rises to the base of the caudal fin. The head is almost as broad as long; its length is contained 4·6 times in the total length without the caudal fin. The body is deepest near the origin of the dorsal fin and is contained 5·5 times in its length. The eyes are small and are situated on the dorsal surface; the interorbital width is slightly less than one-third the length of head. The snout is longer than the remaining portion of the head. The gill-openings are restricted to the sides and extend to just opposite the base of the first pectoral fin ray. The mouth is a transverse slit on the under surface of the head and is slightly less than half the width of the head; it is surrounded by thick lips which are continuous at the angle. The lower lip possesses a broad continuous labial fold. The teeth are present in two small patches in each jaw; they were somewhat flattened with a rounded or truncate apex. There are eight barbels; one pair nasal, one pair maxillary and two mandibular pairs. The nasal barbel when adpressed does not reach the eyes, the maxillary barbel just extends to the base of the pectoral fin. Both the mandibular pairs are short; the outer are situated on the skin covering the under surface of the head, while the inner are situated in notches on the posterior margin of the labial fold. The dorsal fin possesses one weak undivided ray besides five others that are divided; the last ray is divided to the base. The dorsal fin is not so high as the depth of the body below it. The pectoral fin is slightly longer than the head and possesses eleven rays, which are separated from the ventrals by a considerable distance. The ventrals contain six rays and do not extend as far as the anal opening. The anal fin contains five rays. The caudal fin is truncate. The adipose fin is long and low and ends considerably in front of the base of the caudal fin. The least height of the caudal peduncle is contained about two and a half times in its length.

The colour in spirit is uniformly grey on the sides and on the dorsal surface. There is a well marked black spot at the base of the pectoral fin. Near the bases of the dorsal and the pectoral fins the skin is darker in colour. The under surface of the head and body and also of the fins is pale.

Type-specimen:—F 9742/1, *Zoological Survey of India* (*Ind. Mus.*).

Habitat:—Nam-Yak River at Tanja on the northern frontier of Burma.

Measurements in millimetres.

Total length without caudal fin ..	47·0
Length of head	10·3
Depth of head at occiput	5·5
Width of head	9·8
Depth of body	8·5
Length of snout	5·8
Width of interorbital space	3·3
Length of caudal peduncle	7·2
Least height of caudal peduncle	2·8
From tip of snout to commencement of dorsal fin	20·0
From tip of snout to commencement of ventral fin	22·0
From tip of snout to commencement of anal fin	34·0
From tip of snout to anal opening	32·2
Longest ray of dorsal fin	7·7
Longest ray of anal fin	5·0
Length of pectoral fin	11·0
Length of ventral fin	8·6
Length of caudal fin	9·0
Length of base of adipose dorsal fin	12·0
Greatest height of adipose dorsal fin	0·7
Gape of mouth	4·6

Glyptosternum vinciguerrae (Regan).

(Plate III, figs. 1, 2, 3.)

1889. *Exostoma labiatum* (*non* McClelland), Vinciguerra, *Ann. Mus. Stor. Nat. Geneva* XXIX, p. 252.

1905. *Exostoma vinciguerrae*, Regan, *Ann. Mag. Nat. Hist.* (7) XV p. 184.

This species is represented by several specimens in our collection. Most of them were collected by Dr. Coggin Brown of the Geological Survey of India at Pazi, Monghong Hsipai State in the Northern Shan States (90° 30′ N. and 22° 40′ E.) Two specimens from the collection of late Signor Fea have very kindly been sent to us by Dr. Vinciguerra of the Genoa Museum. They are labelled as "*Exostoma labiatum*" from "Catcin," and agree very closely with Regan's description of '*Exostoma vinciguerrae.*"

Habitat:—Upper Burma: Kakhyen Hills and the Northern Shan States.

Glyptosternum chaudhurii, sp. nov.

1919. *Exostoma vinciguerrae* (*non* Regan), *Chaudhuri, Rec. Ind. Mus.* XVI, p. 277.

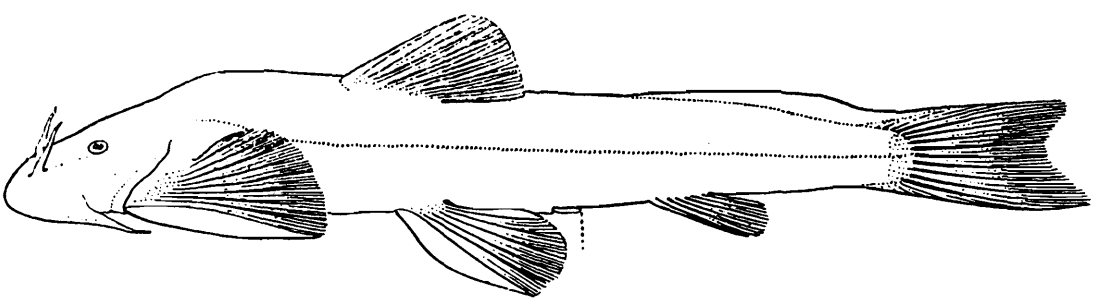
The species is represented by a single specimen from the Putao Plains, where it was collected by Dr. Murray Stewart, late of the Geological Survey of India. It agrees in several respects with Regan's description of *Glyptosternum vinciguerrae* but differs from it in having the origin of the anal fin nearer to the commencement of the ventral than to the base of the caudal. In *G. vinciguerrae*

the origin of the anal is much nearer to the base of the caudal than to the commencement of the ventral.

The length of the head is contained 5 times and the depth of the body 6·5 times in the total length without the caudal. The eyes are situated wholly in the posterior half of the head. The nasal barbels extend to the anterior margin of the orbit and the maxillary barbels just reach below the posterior limit of the base of the pectoral fin. The dorsal fin commences considerably in advance of the ventrals; the adipose dorsal is continuous with the base of the caudal. The caudal is slightly emarginate with the lower lobe slightly longer than the upper.

Type-specimen:—F 9741/1, *Zoological Survey of India* (*Ind. Mus.*)

Habitat:—Putao Plains, northern frontier of Burma.



Text-fig. 7.—Lateral view of *Glyptosternum chaudhurii*, sp. nov.

Glyptosternum labiatum McClelland.

(Plate I, fig. 2.)

1842. *Glyptosternon labiatus*, McClelland, *Calcutta Journ. Nat. Hist.* II, p. 588.
1860. *Exostoma labiatum*, Blyth, *Journ. As. Soc. Bengal* XXIX, p. 155.
1864. *Exostoma labiatum*, Günther, *Brit. Mus. Cat. Fish.* V, p. 265.
1869. *Exostoma labiatum*, Day, *Proc. Zool. Soc. London*, p. 525.
1876. *Exostoma labiatum*, Day, *Proc. Zool. Soc. London*. p. 783.
1878. *Exostoma labiatum*, Day, *Fish. India*. II, p. 502.
1889. *Exostoma labiatum*, Day, *Faun. Brit. Ind. Fish*. I, p. 108.

Habitat:—Assam: Mishmi and Abor Hills.

Glyptosternum blythi (Day).

1869. *Exostoma Blythii*, Day, *Proc. Zool. Soc. London*, p. 525.
1876. *Exostoma blythii*, Day, *Proc. Zool Soc. London*, p. 783.
1878. *Exostoma Blythii*, Day (in part), *Fish. India* II, p. 501, pl. cxvii, fig. 2.
1889. *Exostoma blythii*, Day (in part), *Faun. Brit. Ind. Fish.*, I, p. 109.

The species was originally described from two unlocalized specimens, but later on in 1871 Day referred to it certain specimens from "rivers below Darjeeling." The type-specimens are still present in our collection and on comparison I find that the Darjiling form, of which we have a large series, cannot be referred to *G. blythi*. The habitat of *G. blythi*, therefore, remains undetermined.

There is an inconsistency in Day's descriptions as regards the nature of the labial fold. In his original description he states "lips thick and reflected round the mouth," but in 1876 (*op. cit.*) he is more definite and remarks "lower labial fold uninterrupted." In 1878 having confused the Darjiling forms with this species he writes, "Lower labial fold interrupted." In the type-specimens the lower labial fold is not interrupted and the figure of the species in the *Fishes of India* is correct in this as well in many other respects.

Habitat :—?.

Glyptosternum sp.

? 1869. *Exostoma labiatum*, Day, *Proc. Zool. Soc. London*, p. 525.

Day referred two specimens in old collection of the Indian Museum to "*Exostoma labiatum.*" The specimens are now preserved in the collection of the Zoological Survey of India and are in very bad condition. Their habitat is unknown. They cannot be referred to *G. labiatum* as they are readily distinguished by the small gill-openings and the comparatively larger eyes.

These specimens along with *G. blythi* and *G. macropterum* form a group of species in which the fold of the lower lip is continuous and the gill-openings are narrow, not extending to below the middle of the base of the pectoral fin. The habitat of *G. blythi* is also unknown. The only species of this small group of which the habitat is known, *G. macropterum*, is found in streams on the north-eastern frontier of Burma. It is possible that the other species are also found in the same region.

Genus **Pseudecheneis** Blyth.

(Plate IV, fig. 1.)

1860. *Pseudecheneis*, Blyth, *Journ. As. Soc. Bengal* XXIX, p. 154.
1864. *Pseudecheneis*, Günther, *Cat. Brit. Mus. Fish.* V, p. 264.
1878. *Pseudecheneis*, Day, *Fish. India* II, p. 500.
1889. *Pseudecheneis*, Day, *Faun. Brit. Ind. Fish.* I, p. 106.

The genus may be defined as follows :—

The fishes comprising the genus *Pseudecheneis* are almost subcylindrical with the under surface of the head and the anterior part of the body somewhat flattened. The chest is always provided with a broad, oval adhesive apparatus, which is composed of a series of transverse plates. The pectoral fin is provided with a weak articulated spine, which is finely serrated internally, and is provided with a large number of short cartilaginous rays along its outer border ; it is also provided with striated skin on its ventral aspect. The pectoral fin is placed at a slightly higher level that the ventral profile of the body ; it extends considerably beyond the base of the ventrals. The ventrals are situated almost on the under surface and have very oblique bases. The outer ray is broad and is provided with striated skin on its ventral aspect ; it is provided with a large number of long, pointed cartilaginous rays along its outer border, as in the genus

Glyptosternum. The dorsal fin is provided with a moderately strong spine; the adipose dorsal is well developed; the caudal fin is deeply forked. The eyes are small and greatly approximated on the dorsal surface; they appear to be covered over by skin membrane. The nostrils are situated close together and are separated by a nasal barbel. There are eight barbels, one pair nasal, one pair maxillary and four mandibular. The maxillary barbels are provided with very broad bases. All the barbels are covered with numerous rounded papillae. In the Indian species there is a pair of button-like structures internal to the inner mandibular pair. The mouth is short and is situated on the under surface behind the tip of the snout. The lips are thick and continuously spread round the mouth; they are provided with papillae. The teeth are arranged in a small patch on the upper jaw; the palate is edentulous. The teeth are somewhat flattened and are provided with truncate apices. The gill-openings are small and are restricted to the side; the gill-membranes are united with a broad isthmus. The air-bladder is divided into two lateral chambers which are enclosed in a bony capsule.

The fishes of this genus are usually of a small size, never growing more than five or six inches in length.

The range of the genus, though restricted, is fairly continuous. It extends from the Darjiling Himalayas through the Abor Hills, the Khasi Hills, Kakhyen (Kachin) Hills, Upper Burma, to the limits between Yunnan and Tonkin. The Indian species *Pseudecheneis sulcatus* is widely distributed, while the only other known example of the genus, *P. paviei*, is found in Yunnan.

Vaillant [1] distinguished *P. sulcatus* from his species *P. paviei* thus:—"Elle diffère de l'espèce nouvelle ici décrite par son barbillon maxillaire plus court n'atteignant pas l'orifice branchial, l'espace interorbitaire un peu plus large, 2/7 de la longueur de la tête, sa nageoire adipeuse égalant en longueur la distance mésépiptérique, enfin sa coloration variée de grandes taches pâles irrégulières. On pourrait ajouter que la ventouse thoracique offre 14 plis, et, d'après la figure de Day, que l'origine de la dorsale rayonnée serait un peu moins éloignée de l'extrémité rostrale que chez le *Pseudecheneis Paviei*; la bouche sensiblement plus petite, n'occupe guère que 1/4 ou 1/3 de la largeur du museau."

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[1] Vaillant, *Bull. Soc. Philom. Paris* (8) IV, p. 126 (1891–92); *Miss. Pavie* p. 464, pl. xxii, fig. 3 (1904).