CATFISHES OF THE GENUS *HELICOPHAGUS* BLEEKER.

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It is generally recognised that the freshwater fish-fauna of India is very closely allied to that of south-eastern Asia, and, I[1] recently put forward the suggestion that it is in the main derived from that source. To elucidate the genetic affinities of some of the Indian forms it has, therefore, been necessary to study the morphological features of the related Far Eastern genera. For instance, in my work on the Siluroid fishes of India, Burma and Ceylon I found that though the accounts of the genus *Helicophagus* Bleeker clearly show its relationships to *Pangasius* Cuvier and Valenciennes, there are certain features in the anatomy of the latter by which it can be separated from the other Schilbeid fishes of south-eastern Asia and Africa; certain authorities[2] as a result regard it as a member of a separate, monotypic family Pangasiidae. The modern classification of Siluroid fishes is, in the main, based on Bridge and Haddon's[3] critical morphological studies of these fishes, especially of their air-bladder and the associated skeletal structures. Unfortunately these authors were for want of material not able to deal with all the forms of the family, and in most cases it was not possible for them to study the changes undergone during growth in various species. *Helicophagus* was one of the genera, of which they had no specimen for study, but they reported upon 5 species of *Pangasius*. Through the kindness of Mr. Luang Choola, Officer-in-charge, Bureau of Fisheries, Bangkok, I was able to obtain on loan a fine example of *H. waandersi* Bleeker for study. I have availed myself of this opportunity to examine as much of its anatomy as possible without impairing the utility of the specimen for museum purposes. I am very grateful to Mr. Luang Choola and the Bureau of Fisheries, Bangkok, for the loan of the specimen.

According to Weber and de Beaufort,[4] *Helicophagus* and *Pangasius* can be distinguished from each other with the help of the following key :—

" *a.* Posterior nostril between anterior one and eye; eye behind and totally above corner of mouth. No palatine teeth	*Helicophagus.*
b. Posterior nostril at short distance from anterior and above a line between anterior nostril and eye. Eye partly below a horizontal through the corner of mouth	*Pangasius.*"

[1] Hora, S. L.—Geographical Distribution of Indian Freshwater Fishes and its bearing on the probable land connections between India and the adjacent Countries. *Curr. Sci.*, V, pp. 351-356 (1937).

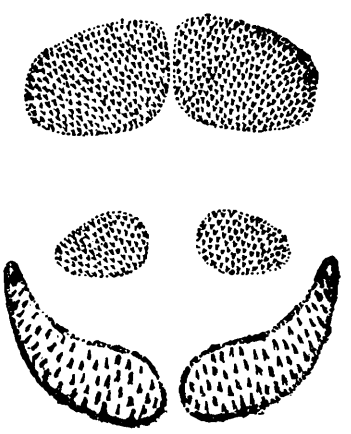
[2] Regan, C. Tate.—The classification of the teleostean fishes of the Order Ostariophysi. II. Siluroidea. *Ann. Mag. Nat. Hist.*, (8) VIII, pp. 553-557 (1911).

[3] Bridge, T. W. & Haddon, A. C.—Contribution to the anatomy of Fishes.—II. The Air-bladder and Weberian Ossicles in the Siluroid Fishes. *Phil. Trans. Roy. Soc. London*, (B) CLXXXIV, pp. 214-221 (1893).

[4] Weber, M. and de Beaufort, L. F.—*The Fishes of the Indo-Australian Archipelago.* II, p. 247 (Leiden, 1913).

In the above key no reference is made to the nature of the teeth in *Pangasius*, but in the description of the genus the authors state that the vomerine and the palatine teeth are " in 4 patches, or united into one, or only the vomerine patches united " I have examined the dentition of several species of *Pangasius* and find it to be very variable. In species like *P. hypophthalmus* (Sauvage), the dentition is feebly developed or altogether absent. In the development of *Pangasius pangasius* (Ham.) it has been found that the dentition of the species undergoes considerable changes. In the case of *Pangasius*, therefore, dentition is not a very safe diagnostic character. Presumably on the basis of dentition alone Sauvage[1] referred *P. hypophthalmus* to the genus *Helicophagus* and the same feature appears to have influenced Suvatti[2] in supporting Sauvage's view. It has, however, been shown by me[3] that in this species the posterior nostril is situated only slightly behind the anterior and above the line joining the middle of the eye to the anterior nostril. According to this character there is no doubt regarding its position in the genus *Pangasius*. Its broad head and snout also point to the same conclusion, for in *Helicophagus* the head is conical with a prominent, bluntly-pointed snout. Moreover, a part of its eye is situated below a horizontal line passing through the corner of the mouth.

After the elimination of *P. hypophthalmus* from *Helicophagus* there only remain 2 species of this interesting genus : *H. typus* Bleeker, known from Palembang in Sumatra and *H. waandersi* Bleeker, known from Palembang, river Batang Hari and Djambi in Sumatra, Siam and Indo-China. Thus this genus has a somewhat restricted distribution, whereas *Pangasius* is found throughout south-eastern Asia (including India), except Southern China and Ceylon.



TEXT-FIG. 1.—Dentition of *Helicophagus waandersi* Bleeker. × 7. Length of specimen 143 mm. without caudal.

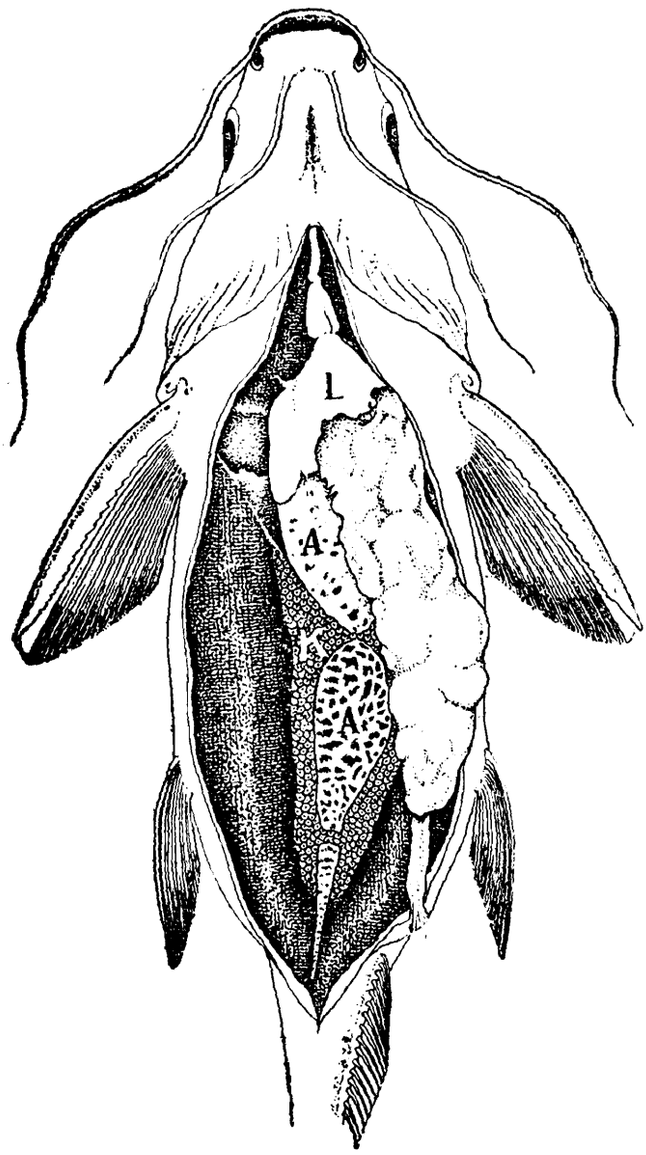
Comparing *Helicophagus waandersi* with several species of *Pangasius* that I have studied I find that the former possesses much longer barbels

[1] Sauvage, H. E.—Recherches sur la faune ichthyologique de l'Asie et description d' especes nouvelles de l'Indo-Chine. *Nouv. Arch. Mus. Hist. Nat. Paris*, (2), IV, p. 170 (1881).

[2] Suvatti, C.—*Index to Fishes of Siam*, p. 81 (Bangkok, 1936).

[3] Hora, S. L.—On a collection of fish from Siam. *Journ. Nat. Hist. Soc. Siam*, VI, p. 166 (1923).

and a very peculiar type of dentition. The teeth (text-fig. 1) of the upper jaw form two almost quadratic patches and those of the vomer are disposed in two small patches widely separated from one another. In the lower jaw the teeth are somewhat larger and fewer in number ; they form two pear-shaped patches with the points directed outwards and backwards. In *H. typus*, however, the teeth in the jaws are stated to form broad, curved bands ; while those on the vomer are arranged in two distinct, narrow, curved bands. There would thus appear to be considerable variation in the dentition of this genus.



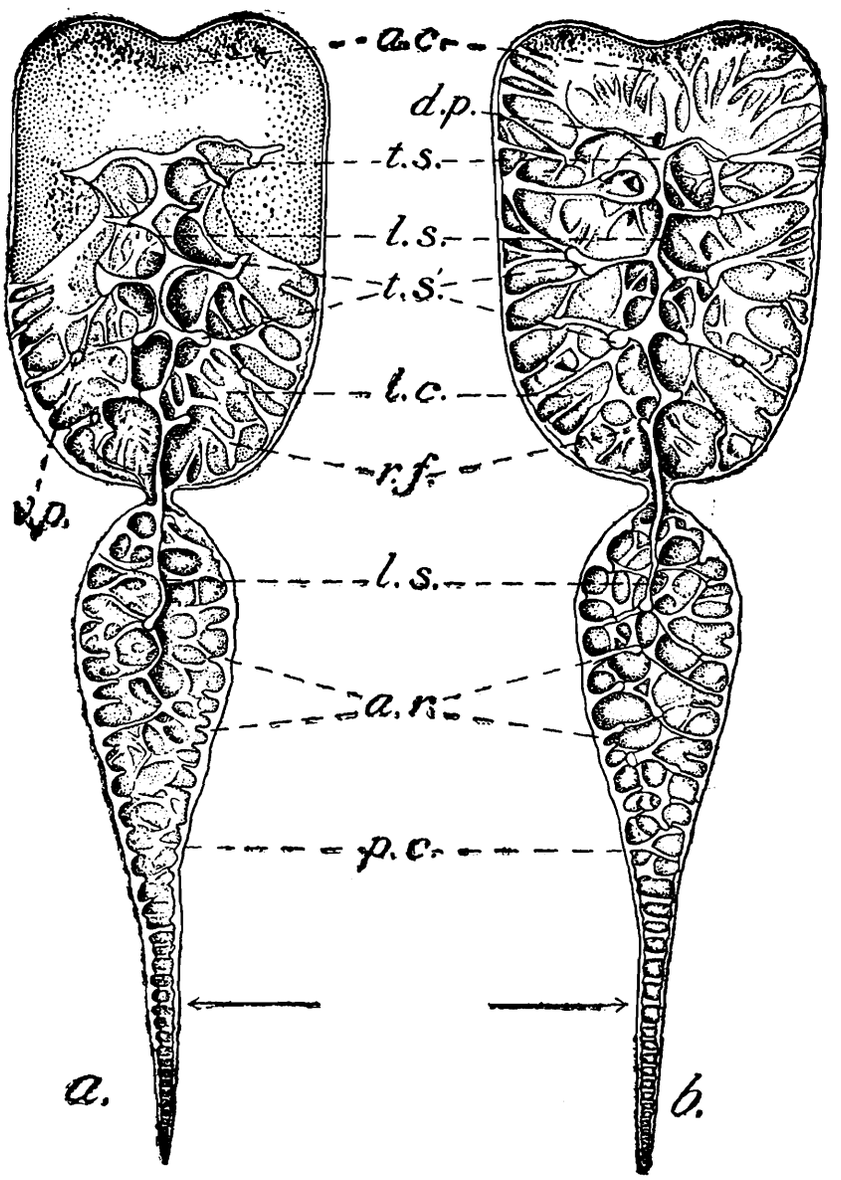
Text-fig. 2.—Dissection of the visceral organs of a specimen of *Helicophagus waandersi* Bleeker. ×1½.

A. Air-bladder ; **K.** Kidney ; **L.** Liver.

To examine the disposition of the visceral organs of *H. waandersi* (text-fig. 2) an incision was made along the mid-ventral line. The positions of the liver, the kidneys and the air-bladder respectively were almost similar to those of *Pangasius pangasius*.[1] The lateral lobes of the liver

[1] Hora, S. L.—Correlation between the disposition of the Liver and the Kidney and the form of the Air-bladder in Certain Siluroid Fishes of India. *Proc. Nat. Inst. Sci. India*, III, p. 34 (1937).

are lodged in small cul-de-sacs above the pectoral fins, so that the liver lies very close to the skin. The air-bladder is divided into two portions, a large anterior portion corresponding to the normal air-bladder and a posterior portion which is drawn out in the form of a caecum. A small portion of the caecum extends into the muscles of the tail on the right



TEXT-FIG. 3.—Air-bladder of a specimen of *Helicophagus waandersi* Bleeker, 143 mm. in length without the caudal, showing the internal structure. ×2⅔.

a. Dorsal half; *b*. Ventral half.

a. c. Anterior chamber; *a. r.* Annular ridges; *d. p.* Pneumatic duct; *l. c.* Lateral chamber; *l. s.* Longitudinal septum; *p. c.* Posterior chamber or caecum; *r. f.* Root-like fibres; *t. s.* Primary transverse septum; *t. s.'* Secondary transverse septa; *v. p.* Vertical pillar.

The part of the air-bladder below the arrows is enclosed in the muscles of the tail region.

side. In several respects the bladder is similar to that of a specimen of *Pangasius pangasius* of the same size (143 mm. in length without caudal).

The internal structure of the air-bladder (text-fig. 3) is, in the main, similar to that of a specimen of *P. pangasius*[1] of the same size. The anterior portion of the bladder is divided internally by a primary transverse septum (*t. s.*) into a short and broad anterior chamber (*a. c.*) and a pair of lateral chambers (*l. c.*), separated from each other by a longitudinal septum (*l. s.*). The dorso-lateral walls of the anterior chamber bulge out dorsally so as to form pocket-like cavities which are lodged inside the recesses provided by the vertebral elements, one on either side of the vertebral column. The remaining portion of this chamber is invaded by fibrous growths of the primary transverse septum. The cavities of the lateral chambers are subdivided and broken up by the formation of numerous secondary transverse septa (*t. s'.*), which grow out from the sides of the longitudinal septum ; they do not, however, extend to the outer wall of the chambers. In the transverse cavities thus enclosed, the walls become greatly thickened and sacculated by the development of fibrous tissue (*r. f.*) so that the free space inside the bladder is greatly reduced. In addition to these fibrous growths, there are a few vertical pillars (*v. p.*) which make the air-bladder more compact.

The pneumatic duct (*d. p.*) opens into the bladder on its ventral wall in the middle line just in front of the transverse septum.

The posterior portion of the bladder (*p. c.*) communicates anteriorly with both the lateral chambers of the anterior portion, but terminates blindly behind. It is fairly broad anteriorly but from the middle of its length becomes very narrow and tube-like. The longitudinal septum noted above, extends into the caecum for a short distance. The walls of the caecum are greatly thickened throughout by the formation of annular ridges (*a. r.*).

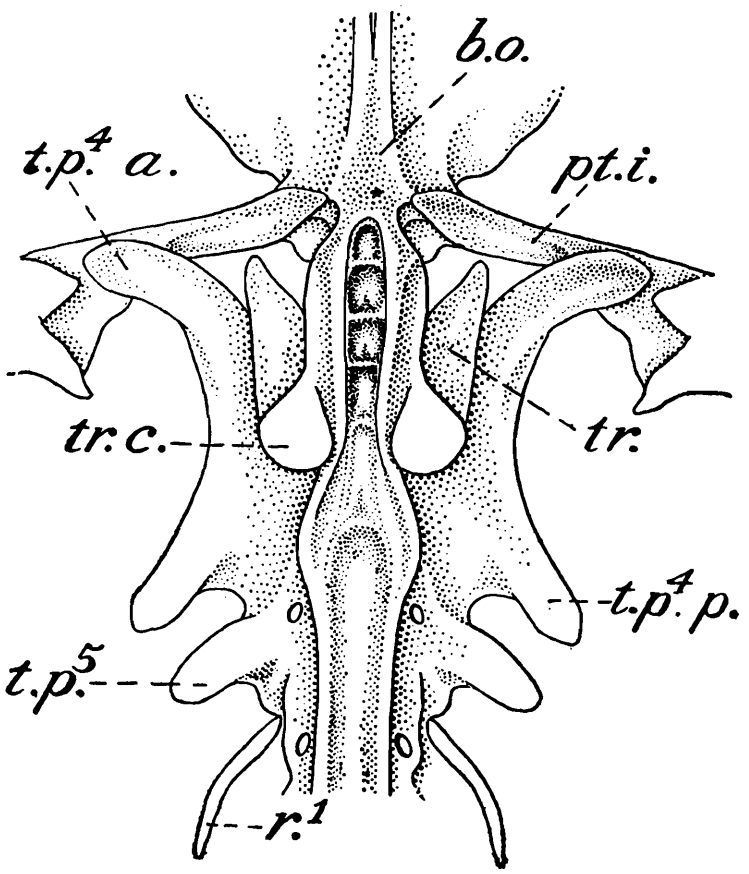
In the modification of the anterior vertebrae (text-fig. 4), *Helicophagus waandersi* differs from most of the species of *Pangasius*, but conforms to the normal condition in a great majority of the Siluroid fishes. Each of the transverse processes of the fourth vertebra has a broad flat root, which is prolonged distally into distinct anterior (*t. p*^{4}. *a.*) and posterior (*t. p*^{4}. *p.*) divisions, separated from each other by a broad, deep concavity. The anterior division is moderately thick and inflexible and does not possess any trace of the oval plate so characteristic of *Pangasius pangasius* and several other species of the genus. So in *Helicophagus* there is no " elastic-spring " mechanism ; the distal portion of the process is applied to and firmly supports the outer extremity of the inferior limb of the post-temporal (*pt. i.*). The structures described above correspond with those of *P. micronema* Bleeker, the only species of *Pangasius* in which Bridge and Haddon (*op. cit.*) did not find an " elastic-spring " mechanism, and which would in the circumstances appear to form a connecting link between the genera *Helicophagus* and *Pangasius*.

In *P. pangasius*, Nair (*op. cit.*) has shown that with the development of the fish the space inside the air-bladder is gradually reduced and in

[1] Nair, K. K.—Changes in the Internal Structure of the Air-bladder of *Pangasius pangasius* (Ham.) during Growth. *Rec. Ind. Mus.*, XXXIX, pp. 117-124 (1937).

It may, however, be noted that the air-bladder of a specimen of *Pangasius pangasius*, 143 mm. in length, does not extend into the muscles of the tail region ; the narrow portion of its caecum is devoid of annular ridges and the posterior portion is smaller than the anterior. The absence of an " elastic-spring " mechanism in *Helicophagus* is referred to later.

large specimens a fatty degeneration of its tissues, especially at the anterior end, takes place. So far as the hydrostatic function of the



TEXT-FIG. 4.—Ventral view of the anterior vertebrae and their processes in a specimen of *Helicophagus waandersi* Bleeker, showing the absence of any " elastic-spring " mechanism. ×4.

b. o. Basioccipital; *pt. i.* Inferior process or limb of post-temporal; r^1. First rib; *t.* p^4. *a.* Anterior division of the transverse process of the fourth vertebra; *t.* $p.^4p.$ Posterior division of the transverse process of the fourth vertebra; *t.* $p.^5$ Transverse process of the fifth vertebra; *tr.* Tripus; *tr. c.* Crescentic process of the tripus.

bladder is concerned it becomes less and less effective with growth. Owing to the competition for space inside the body cavity of forms with a long anal fin, the bladder is pushed from all sides and it seems to me that the modification of the anterior division of the transverse process of the fourth vertebra to form a plate is meant to check the forward growth of the bladder. It is because of this resistance at the anterior end that the bladder finds space for its extension in the muscles of the tail. The so-called " elastic-spring " apparatus is a primitive device, while the condition met with in *P. micronema, Helicophagus waandersi,* and in a majority of the other Siluroid fishes is of a more specialised nature.

From the foregoing considerations it would appear that *Helicophagus,* with long barbels, well-developed dentition, without an " elastic-spring " apparatus, etc., etc., is at a somewhat higher stage of evolution than *Pangasius.* There also seems no justification for separating *Pangasius* from the rest of the Schilbeidae only because of the presence of " elastic-spring " mechanism in a number of its species.