

FISH AND FISHERIES OF THE INLE LAKE.

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INTRODUCTION.

The fish of the Shan Plateau and its immediate vicinity have as yet received little attention from ichthyologists. In 1893 Boulenger (*Ann. Mag. Nat. Hist.* (6) xii, pp. 198-203) described a collection of twenty-seven species made by the late Mr. E. W. Oates in the Southern Shan States, while Vinciguerra reported upon the late Signor Fea's collection in 1889 in the *Ann. Mus. Stor. Nat. Genova* (2) ix (xxix), pp. 129-260. The latter collection, though none of it came actually from the plateau, included numerous specimens from Karen-ni, which lies immediately to the south, and from the Upper Salween.

A large part of Mr. Oates's collection was obtained at Fort Stedman on the Inlé Lake, but the fish were probably purchased in the market, several of the species are not lacustrine and the most interesting of the true Inlé forms, most of which are of very small size, were not represented.

The fauna of the Inlé Lake is of a highly peculiar character and it is not surprising that among the smaller fish we obtained there is a large proportion of undescribed forms. It was, however, perhaps hardly

to be expected that we should discover no less than three new genera and even a new family. These belong either to the Cyprinidae or to the eels; it is among the latter that the new family finds a place. Its type is, indeed, perhaps the most primitive form of eel yet known. New species were discovered also in the genera *Nemachilus* and *Barilius* (Cyprinidae) and *Ophiocephalus* (Ophiocephalidae).

The complete list of the species now known to inhabit the lake, all of which are represented in our collection, is as follows. For convenience of reference I have arranged them here according to the order adopted in Day's volumes in the *Fauna of British India*, but I have departed somewhat from this system in the taxonomic part of the paper.

PHYSOSTOMI.

Family Chaudhuriidae, nov.

Chaudhuria caudata, gen. et sp. nov.

Family Symbranchidae.

Amphipnous cuchia (Ham. Buch.).

Monopterus albus (Zuiew).

Family Clariidae.

Clarias batrachus (Linn.).

Family Cyprinidae.

Lepidocephalus berdmorei (Blyth).

Nemachilus brevis, Boulenger.

Nemachilus brunneanus, sp. nov.

Discognathus lamta (Ham. Buch.).

Cirrhina latia (Ham. Buch.).

Barbus sarana caudimarginatus, Blyth.

Barbus schanicus, Boulenger.

Barbus stedmanensis, Boulenger.

Cyprinus carpio intha, subsp. nov.

Sawbwa resplendens, gen. et sp. nov.

Microrasbora rubescens, gen. et sp. nov.

Microrasbora erythromicron, sp. nov.

Barilius auropurpureus, sp. nov.

Family Notopteridae.

Notopterus notopterus (Pallas).

ACANTHOPTERIGII.

Family Mastacembelidae.

Mastacembelus oatesii, Boulenger.

Mastacembelus caudicellatus, Boulenger.

Family Ophiocephalidae.

Ophiocephalus striatus, Bloch.

Ophiocephalus harcourt-butleri, sp. nov.

In addition to these twenty-two species and races the following fish are known to inhabit the Inlé basin, having been recorded from Fort

Stedman by Boulenger (*op. cit.*: 1893) or being represented in our collection:—

Nemachilus botia (Ham. Buch.).
Barbus dukai, Day.
Barbus tor (Ham. Buch.).
Barbus nigrovittatus, Boulenger.
Barbus stoliczkanus, Day.
Barilius ornatus, Sauvage.
Danio aequipinnatus (McC1.).
Ophiocephalus gachua, Ham. Buch.
Ophiocephalus siamensis, Günther.

Most of these species probably live in canals and in streams that run into or out of the lake. We found *Nemachilus botia*, *Barbus dukai* and *Danio aequipinnatus* common in small streams in the surrounding hills, and the Mahseer (*Barbus tor*) is caught both in the river that flows out of the southern end of the lake and on the He-Ho plain.

There are several noteworthy points about the lake species. Most, perhaps all of them also occur in sluggish streams and pools on the He-Ho plain, and it is clear that the fish-fauna of the lake that once occupied that plain and the fish-fauna of the Inlé Lake were practically identical. With this exception, however, no less than 12 species (more than half of the true lacustrine species) and 2 genera are apparently endemic. The geographical relations of the fish of the whole basin will, however, be discussed later in more detail.

The absence of certain families and the scanty representation of others is noteworthy, but is probably correlated with the fact that the lake is situated in an isolated position at a fairly high altitude. The place of the Cyprinodontidae is taken to a large extent by unusually small and highly specialized members of the Cyprinidae.

PHYSICAL AND OTHER CONDITIONS IN THE LAKE AS THEY AFFECT THE FISH.

In the general introduction to this volume I have given an account of the Inlé Lake. Here I need do no more than repeat, with slight omissions and alterations, what I said about the biological aspect of the fisheries in a pamphlet recently published by the Government of Burma.¹

The Inlé Lake is situated in the State of Yawnghwe (Southern Shan States) at an altitude of 3,000 feet above sea-level and is about 14 miles long by 4 miles broad. It is surrounded by marsh-land of a peculiar type, comparable on a small scale to the *sudd* of the Nile and composed of dead and living vegetation matted together and floating on the surface of the water. In the dry season the lake is nowhere more than 12 feet deep. So far as fish are concerned, a very important feature of the water is its clearness, which permits sunlight to penetrate to the bottom and thus encourages the growth of dense submerged thickets of weed.

¹ *A note on the Fisheries of the Inlé Lake, Southern Shan States* (Government Press, Rangoon: 1917).

The bottom is composed of very soft, semi-liquid mud and there are no rocks either at the edge or beneath the surface of the water.

The temperature of the water never sinks as low as freezing point and that of the bottom differs very little from that of the surface, which remains fairly uniform throughout the twenty-four hours. We found at the beginning of March that the surface temperature in the middle of the lake was about 70° Fahrenheit.

The water is heavily charged with lime. The following analysis of a sample taken from the surface near the middle of the lake has been made by Mr. R. V. Briggs, F.C.S., M.S.P.A. :—

						Per litre.
Total solids	...	...	...	...	...	0·1710
Organic matter	...	...	...	...	...	0·0160
Calcium	...	...	...	...	...	0·0222
Magnesium	...	...	...	...	...	0·0279
Chlorine	...	...	...	...	...	0·0017
Sulphate (SO ₄)	...	...	...	...	...	0·0017
Silica	...	...	...	...	...	0·0010
Carbonic acid (CO ₂)	...	...	...	...	...	0·1030
Iron	...	...	...	...	Less than 1 part in 5 million.	

The edible fish of the lake are either rapacious in habits or else live mainly on weed. There is an almost complete absence of species that feed on the surface. This is probably due in large measure to the clearness of the water, which is unfavourable to the growth of minute floating organisms. At first sight the dense weed of the lake would seem to provide an ideal food-supply for vegetarian fishes, but as a matter of fact a great part of the weed belongs to the genus *Ceratophyllum*, the horny nature of which is indicated in its name. It is very doubtful whether this weed is really edible from the fishes' point of view.

An important question in all fisheries is that of cover. Particularly at the breeding season, it is necessary for the fish to hide themselves, and as a rule they avoid bright sunlight. There is no lack of cover in the Inlé Lake and the horny nature of the most abundant weed is doubtless beneficial from this point of view. The eagerness with which the fish seek for cover is illustrated by several of the methods used in capturing them. Another function that the weeds perform is that of providing an abundant supply of oxygen.

As in many well-populated districts, the chief enemy of the Inlé fish is man, but I do not think, as I will explain later, that his enmity should at present be restrained. After man the most active agents of destruction are rapacious fishes such as the snake-heads, which are themselves among the most important species economically. Gulls, cormorants and other piscivorous birds are fairly abundant, but probably never excessively so; the various ducks for which the lake is famous amongst sportsmen cannot do much harm, as they feed chiefly on weed and for the most part desert the lake before the main breeding-season of the fish, in which they might do great damage by devouring the spawn. Internal parasites rarely do appreciable harm to freshwater fish living in natural conditions; we found no trace of any parasitic disease among those of the lake.

According to the Intha fishermen, most if not all of the fish of the lake breed in February, March and April. This view is confirmed by an examination of the roes, which were ripe or nearly ripe in all species examined at the end of February and in March; probably some species breed a little earlier than others, but this is a point on which further investigation is necessary before a definite opinion can be expressed.

GEOGRAPHICAL RELATIONS OF THE FISH OF THE INLE BASIN.

Thirty-one species of fish, belonging to 7 families and 17 genera are known to live in the Inlé basin. Six of these families are widely distributed in the fresh waters of the Oriental and Ethiopian Regions, but one (Chaudhuriidae), which is described for the first time in this paper, is only known from the Inlé Lake, in which it is represented by a small and remarkably primitive species.

Of the 17 genera, 13 are distributed all over the Indian and the Indo-Chinese sections of the Oriental Region, while one (*Monopterus*) first makes its appearance, as we go from west to east, in Burma, but ranges as a monotypic genus over the whole of the eastern part of the Oriental and the south-eastern districts of the Palaearctic Regions. It may therefore be classed as Far Eastern. Another genus (*Microrasbora*), though here described as new, is possibly also Far Eastern, for the small size of its representatives may well have caused them to be overlooked in many places and species probably occur in the Malay Peninsula. The remaining two genera of the 17 are only known at present from the Inlé basin; one (*Chaudhuriia*) is the genotype of the new family to which I have already alluded, while the other (*Sawbwa*) is represented by a peculiar little scaleless fish somewhat remote from any species known elsewhere. It belongs to the family Cyprinidae.

Of the 30 species of fish, no less than 12 (*i.e.*, 2/5ths or 40 per cent.) are known only from the Inlé and He-Ho basins, while a sub-species (*Cyprinus carpio intha*) apparently occurs only in the Southern Shan States. Boulenger¹ has noticed (by implication) the Siamese element in the fish-fauna, but this element is much less strongly marked than the endemic one, being represented by but two species. They are *Ophiocephalus siamensis* and *Barilius ornatus*.² Neither of these is a true lacustrine fish; both were discovered in the Menam and *Barilius ornatus* has also been found in the Upper Salween. Small as the Siamese element is, however, it is but little larger than what we may call the endemic Burmese element, which is also represented by two species (*Barbus stoliczkanus* and *Lepidocephalus berdmorei*), but in addition by a sub-species of the Indian *Barbus sarana*. The one Far Eastern species is *Monopterus albus*.

A more important element than any of these except the endemic Shan element is that of species which occur in the Indian section of the Oriental Region, that is to say west of the Bay of Bengal. This

¹ *Ann. Mag. Nat. Hist.* (6) xii, p. 199 (1893).

² *Sauvage, Bull. Soc. Philom.* (Paris) vii, p. 153 (1883).

element is represented by 10 species, most of which are Oriental in an exact sense in that they are distributed over a large part of the Oriental Region.

Thus we see that the two most important elements in the fish-fauna of the Inlé basin are the endemic Shan element and the Oriental element, while small but distinct groups of Siamese and Burmese species occur. In other words, the fauna is an isolated one. A considerable number of adaptable Oriental species, whose wide range proves their powers of migration, established themselves as members of it at a remote period, but the number of species that have entered the district from neighbouring countries in comparatively recent times is small. How far this isolation is confined to the two connected basins and how far it is of a more comprehensive kind, embracing the whole of the Shan Plateau or even the Salween system generally, we do not yet know precisely, but Boulenger has recorded from the Southern Shan States six species that apparently do not occur in the Inlé basin, and he did not describe any of these as new, the majority being well-known Indo-Burmese fish and one or two characteristically Burmese. Vinciguerra, moreover, has recorded from the Salween and its tributaries a large number of species, only a small proportion of which were new and none of which were closely allied to the peculiar Inlé forms. So far, therefore, as our knowledge extends it would seem that a large proportion of the endemic Shan forms are to be found most commonly if not exclusively in the Inlé and He-Ho basins, which were the longest survivors, though one is now empty, of the old lakes of the country.

INTHA NAMES OF THE INLE FISH.

The fishermen of the Inlé Lake belong to a tribe alien to the Shans and speaking a dialect of Burmese thought to be akin to that spoken in Tavoy. They call themselves *Intha* or Sons of the Lake. In a pamphlet¹ on the Inlé fisheries published recently by the Government of Burma I have given a list of the local names of fish, but at the time of its publication was unable to identify many of the species specifically owing to the fact that the collection had not been completely worked out. The indigenous names were repeatedly checked both among the fishermen and in the bazaar at Fort Stedman. Mr. C. E. Browne, I.S.O., Political Adviser at Yawngghwe, has been kind enough to revise their orthography. *Nga* is the ordinary Burmese for "fish," but it is never omitted in referring to any particular species.

Nga hkon-ma	...	...	<i>Barbus sarana.</i>
Nga hku	...	...	<i>Clarias batrachus.</i>
Nga hpe	...	...	<i>Notopterus notopterus.</i>
Nga hpein...	...	...	<i>Cyprinus carpio.</i>
Nga lu	...	...	<i>Cirrhina latia.</i>
Nga myesok-ma	...	...	<i>Nemachilus brevis.</i>
Nga mywe...	...		{ <i>Mastacembelus oatesii.</i>
			{ <i>Mastacembelus caudicellatus.</i>

¹ A note on the Fisheries of the Inlé Lake, Southern Shan States (Government Press, Rangoon : 1917).

Nga ohn-ma	...	...	<i>Ophiocephalus harcourt-butleri.</i>
Nga pya-tha-ma	...	...	<i>Nemachilus brunneanus.</i>
Nga pya-tha-ywet	...	...	<i>Barilius auropurpureus.</i>
Nga shin	...	...	{ <i>Monopterus albus.</i> <i>Amphipnous cuchia.</i>
Nga taung-nwo	...	...	<i>Barbus stedmanensis.</i>
Nga taung-taing-tet	...	...	<i>Discognathus lamta.</i>
Nga thalido	...	...	<i>Lepidocephalus berdmorei.</i>
Nga thange-kyebya	...	...	{ <i>Microrasbora rubescens.</i> <i>Microrasbora erythromicron.</i> <i>Sawbwa resplendens.</i>
Nga yan	...	...	<i>Ophiocephalus striatus.</i>
Nga yit	...	...	<i>Barbus schanicus.</i>

Most of these names are probably dialectic or local, but Day in the *Fauna of India* gives "Nga yan" as one of the Burmese names of *Ophiocephalus striatus*, "Nga khoo" as that of *Clarias batrachus*, "Nga tha-laydoh" as that of *Lepidocephalus berdmorei*, and "Nga khon-mah-gyee" as that of *Barbus sarana*. Nga mywe ("Nga mwey" in Day) is probably a generic name applied to any kind of *Mastacembelus*; it means, literally, "snake fish." Nga shin ("Nga-sheen" in Day, who applies it to *Amphipnous cuchia*) is probably in the same way a generic name for any kind of eel, while Nga thange-kyebye ("small white fish") is applied to any small silvery fish used in making dried whitebait. Mr. Browne tells me that Nga taing-tet as applied to *Discognathus lamta* is a coined name, meaning "the post-climbing fish" and referring to the peculiar habits of the species (see p. 45); but the name is well understood among the Intha. At He-Ho, where there are no posts for it to climb, it is known as "stone-climbing fish," *Nga kyauk-tet*.

The only name for the true Carp on the Inlé Lake and at He-Ho is Nga hpein or Nga pein, but Mr. G. C. B. Sterling informs me that at Kentung it is called Pa nai, "which is the usual Shan equivalent for Nga Pein."

SYSTEMATIC DESCRIPTION OF THE COLLECTION FROM THE INLE LAKE.

Order **APODES.**

Family CHAUDHURIIDAE, nov.

The family may be defined as consisting of—

Small Apodes with a fan-shaped, practically free caudal fin provided with well-developed rays and supported by a pair of hypural bones; with pectoral fins; with minute scales; with the vent situated a long distance from the head; with teeth arranged in bands on the jaws only; with lateral nostrils; with the gill-openings separate and the integument covering them supported by few branchiostegal rays; with all the pharyngeal slits wide; with four fully developed gill-bearing branchial arches; with the heart close to the branchial arches; with an air bladder with the frontals paired, the ethmoid and vomer distinct and the former separating the maxillaries in front; with well-developed zygapophyses on the vertebrae,

The Chaudhuriidae differ from all other living eels as yet known in the strong development of the true tail. In this respect they resemble the Cretaceous genus *Urenchelys*,¹ Woodward, which has been made the type of a distinct family by Regan,² but the structure of the skull is very different. So far as skull-structure is concerned they seem to be related rather to *Heterenchelys*, Regan (*op. cit.*, p. 383), which he also regards as the type of a family, but the structure of the vertebral column is different.

Only a single genus and species is at present known.

Chaudhuria, gen. nov.

The body is covered with very small scales embedded in the skin ; it is somewhat compressed, especially in the caudal region, which is approximately equal to the head and body in length. The caudal fin is united to the dorsal and anal by a low membrane ; its rays are completely segregated. The dorsal and anal are well-developed but confined to the caudal region. The pectorals are small and lie immediately behind the gill-openings. The snout is not produced ; the anterior tubular nostrils are situated near its tip ; the posterior nostrils are rather large and lie immediately in front of the eyes. The mouth is small and horizontal. The lips are tumid, but the lower lip only so at the sides. The eyes are well-developed. The gill-openings are wide and in the main of lateral position. The teeth are small, sharply pointed and slightly recurved ; they are absent from the vomer and ethmoid ; on the jaws they are arranged in a narrow band. The frontals form a somewhat asymmetrical suture on the roof of the skull. The vomer forms a sharp ridge on the roof of the mouth. The jaws closely resemble those of *Heterenchelys*, Regan. The suspensorium is vertical. The pharyngeal bones seem to be poorly developed ; I have not been able to make out their structure. The otoliths are enclosed at the base of the skull on each side in a thin-walled capsule composed of two bones ; there are two otoliths in each capsule, both flattened and cake-like but one much larger than the other. There are comparatively few vertebrae. The neural arch is produced into an upright flattened plate or spine in front of the true neural spine.³ The ribs are well-developed, and there are strong interspinous bones. The size of the only known species is very small.

Development is probably direct, for the ova are large and well supplied with yolk.

Type-species.—*Chaudhuria caudata*, sp. nov.

I have much pleasure in associating with this remarkable new genus the name of my friend and colleague Dr. B. L. Chaudhuri, to whom I have been indebted for considerable assistance in the preparation of this paper.

¹ *Cat. Foss. Fishes B. M.* iv, p. 337, pl. xviii, figs. 1—3 (1901).

² *Ann. Mag. Nat. Hist.* (8) x, pp. 379, 380 (1912).

³ Mr. R. H. Whitehouse has kindly given me a detailed account of the structure of the tail, which will be published immediately after this paper.

Chaudhuria caudata, sp. nov.

(Plate I, fig. 1 ; pl. IV, fig. 1—10.)

B. V. D. 39-40. P. 6. A. 42-43. C. 7.

The length of the head to the gill-opening is contained about $7\frac{3}{5}$ times in the total length without the caudal fin, the greatest depth of the body 14-16 times, the caudal fin about 22 times. The caudal region is strongly compressed and tapers considerably ; the vent is situated half way between the tip of the tail and that of the snout. The lateral line is complete and extends along the middle of the caudal peduncle. The snout is considerably longer than the eye, which is of moderate size and fairly prominent ; the lower jaw projects slightly beyond the upper. The mouth barely reaches as far back as the level of the anterior border of the eye. The pectorals are situated about half way up the body ;

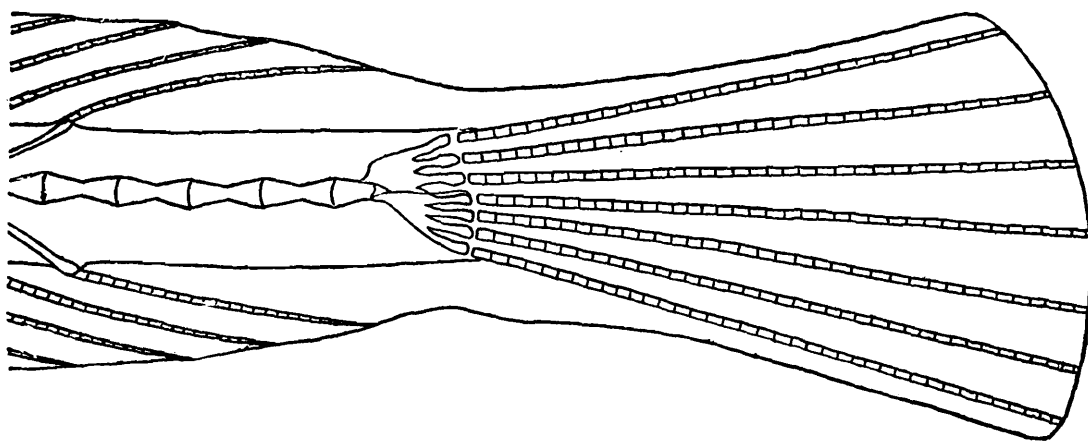


FIG. 1.—Tail of *Chaudhuria caudata*. From a specimen mounted whole in Canada balsam.

The hypural bones are represented diagrammatically and the dorsal and ventral elements of the vertebrae are omitted.

their basies are concealed under the opercula. The branchiostegal rays are long and curved. The internal branchial isthmus is broad. The dorsal and anal are of almost equal length and depth. In the middle of the caudal region they have each less than half the depth of the body, but towards the caudal peduncle they become deeper than the body. The caudal fin is markedly asymmetrical when fully expanded, slightly rounded or subtruncate, and more strongly developed on the ventral than on the dorsal side.

The bones of the skull are extremely delicate and the jaws are feeble. The teeth are arranged biserially in the posterior part of both jaws and triserially near the tip ; in the latter region they are slightly enlarged.

There are about 70 vertebrae.

The back and upper part of the sides of the head, body and caudal region are dark purplish brown, somewhat mottled ; the whole ventral surface and the lower part of the sides are yellowish white. The fins are white with very fine and often interrupted dark lines running along each side of each ray ; minute dark spots are often present at the base of the rays.

The largest specimen examined is 52 mm. long, but individuals of little more than half that length were found to be sexually mature.

Type-specimen.—No. F 9402/1 *Zoological Survey of India (Ind. Mus.)*.

Locality.—Inlé Lake, Southern Shan States (alt. 3000 ft.); February, 1917.

The structure of the vertebrae is peculiar. The centra are elongate, amphicoelous, broader in front than behind and much constricted in the middle. Their ephiphyses sometimes remain distinct and the elements that form the neural and haemal arches, though welded together, are never incorporated with them but remain as a kind of cloak only attached to them at the sides. They have a thin and membranous character. The neural arch (except at the extremity of the tail) bears two spines or a spine and a flattened triangular plate which projects vertically upwards. On the first two vertebrae these structures are incompletely fused together, but on the vertebrae of the trunk and on the caudal vertebrae they are quite distinct. On the trunk and on the anterior part of the caudal region the anterior process has a lamellar form, but on the greater part of the caudal region it is a spine closely resembling the posterior one but directed less backwards. The zygopophyses, both neural and haemal, are well-developed both on the precaudal and the anterior caudal vertebrae.

Two of the four specimens obtained were taken in fishing-baskets filled with peat and weeds and sunk in the open lake, the other two amidst dense vegetation at the edge of floating islands. The stomach of a specimen was full of young crustaceans apparently still in their egg-shells.

In one female, captured at the end of February, the ovaries were ripe. They contained ova in all stages of development. The largest eggs, which were about to be laid, were broadly ovoid or subspherical. They were about 0.68 mm. long by 0.59 mm. broad. At one end there was a depression probably surrounding a minute micropyle. The ovum was contained in a delicate horny shell marked with asymmetrical sinuous concentric striae and raised at either side of the terminal depression into a low ridge.

Order SYMBRANCHOIDEA.

Family SYMBRANCHIDAE.

Monopterus albus (Zuiew).

1889. *Monopterus javanensis*, Day, *Faun. Brit. Ind., Fishes* 1, p. 70, fig. 28.

1889. *Monopterus javanensis*, Vinciguerra, *Ann. Mus. Stor. Nat. Genova* (2) IX (xxix), p. 357.

1916. *Monopterus albus*, Weber, *Fishes Indo-Austr. Arch.* III, p. 413, figs. 210, 211.

This fish is not uncommon at the edge of the Inlé Lake but is perhaps more abundant in pools and rice-fields. It is eaten by the Intha but not by the Shans, who think that its flesh causes leprosy. It is usually captured with a two-pronged spear.

The species is found all over Southern Asia east of the Bay of Bengal. Its range extends to Northern China and Japan.

Amphipnous cuchia (Ham. Buch.)

1889. *Amphipnous cuchia*, Day, *op. cit.*, p. 69, fig. 27.

1899. *Amphipnous cuchia*, Vinciguerra, *op. cit.*, p. 356.

Not uncommon with the last. The Shans and Intha do not distinguish the two species, which they catch in the same way.

A. cuchia is widely distributed in India and Burma.

Order **OSTARIOPHYSI.**Family **CLARIIDAE.****Clarias batrachus** (Linn.).

1889. *Clarias magur*, Day, *op. cit.*, p. 115, figs. 48, 49.

1889. *Clarias magur*, Vinciguerra, *op. cit.*, p. 191.

1913. *Clarias batrachus*, Weber, *Fishes Ind.-Austr. Arch.* II, p. 190, fig. 74 (p. 187).

This species is common in the marginal zone of the Inlé Lake and in slow-running streams and muddy pools of the district. It lives buried in mud.

Specimens from the Shan Plateau are of comparatively small size, apparently never much more than a foot long, and of a dense black colour. Their flesh is considered excellent both by the indigenous peoples and by Europeans, many of whom regard them as the best edible fish of the country. They are caught chiefly in basket-traps near the mouth of streams. The roe was ripe in some females examined at the beginning of March, but not in all.

Clarias batrachus has a very wide range in India, Burma, Ceylon and Malaysia, extending as far east as the Philippines.

Family **CYPRINIDAE.****Lepidocephalus berdmorei** (Blyth).

1889. *Lepidocephalichthys berdmorei*, Day, *op. cit.*, p. 221.

1889. *Lepidocephalichthys berdmorei*, Vinciguerra, *op. cit.*, p. 341.

A very common species in small streams that run into the Inlé Lake or traverse the He-Ho plain. It also occurs in ponds and marshes and occasionally in the marginal zone of the lake. It seems to be equally at home in clear brooks and in muddy still or running water. It is an important element in the dried whitebait manufactured on a large scale by the Intha, and is, therefore, of some economic importance.

The species appears to be common both in Upper Burma and in Tenasserim. It is very closely related to *L. guntea*, the common Indian form, of which Vinciguerra records specimens from various places in the same countries.

Nemachilus brevis, Boulenger.

(Plate II, figs. 1, 1a.)

1893. *Nemachilus brevis*, Boulenger, *Ann. Mag. Nat. Hist.* (6) XII, p. 203.

This is one of the commonest of the smaller bottom fishes in the Inlé Lake, in both the central region and the marginal zone of which it is

found. It does not grow more than 60 mm. in length. The male differs from the female in colouration and also in the shape of the body (see pl. II, figs. 1, 1a); as a rule, instead of being merely spotted or mottled, it has on the sides a number of short black vertical bars, which sometimes fuse together to form an irregular longitudinal bar. The bars are variable both in number and in size. The male has, further, a small cartilaginous pad immediately in front of the lowest quarter of the eye.

This fish also forms an ingredient of dried whitebait. It has only been found in the Inlé basin and on the He-Ho plain but lives both in still and in running water, in ponds and slow streams as well as in the lake, in which it seems to be most abundant in the central region. We did not see it in fast-running water.

Nemachilus brunneanus, sp. nov.

(Plate II, fig. 2.)

B. 111. D. 12-13 (3-4/9-10). P. 10. V. 8. A. 8-9 (2-3/5-6).

A small, slender species related to *N. rupicola* and *N. multifasciatus*¹ but differing from both in proportions, in the number of the fin rays and in its very large eyes.

Depth of body a little greater than the length of the head, a little less than $\frac{1}{6}$ the total length. Eye very large and prominent, a little narrower than the interorbital space, nearly as long as the snout, occupying nearly $\frac{1}{3}$ the length of the head. Head naked, with 6 barbels, 2 rostral and one maxillary on each side; the outer rostral barbel not quite reaching the anterior margin of the eye, about twice as long as the inner; the maxillary barbel the longest, but not much longer than the outer rostral, extending backwards almost to the posterior margin of the eye. Body entirely covered with small scales. Dorsal fin rather high; pectoral fins long, slender and falcate, longer than the head; tail fin deeply notched.

Colouration somewhat variable but not differing with sex; the ground colour of the head and body pale olivaceous; the head mottled and spotted with dark green or black; a variable number of dark horizontal bars on the sides of the body, sometimes narrow, sometimes fairly broad, sometimes alternately complete and reaching half way down the side from the back. Caudal and anal fins reddish in life; all the fins white in preserved specimens; two or three dotted longitudinal lines on the dorsal and the same number of V-shaped dotted lines on the caudal; a small black spot or blotch at the base of the dorsal in front and two rather smaller black spots on each side of the caudal peduncle.

The largest specimen in a large series is only 4.5 cm. long.

Type specimen.—No. F 9406/1, *Zoological Survey of India (Ind. Mus.)*.

Distribution.—This little loach is abundant in the waters of the Yawngwe valley and seems to be equally at home in clear hill-streams,

¹ See Vinciguerra, *Ann. Mus. Civ. Stor. Nat. Genova* 2, IX (XXIX), pp. 336, 337 (1890).

in muddy rivers and among the weed-thickets of the Inlé Lake, in which it occurs both in the central region and in the marginal zone. It is an important ingredient in the dried whitebait sold in the local markets.

The species is named after Mr. C. F. Browne, I.S.O., Political Adviser, Yawnghwe, to whom we are indebted for much assistance on our tour.

***Discognathus lamta* (Ham. Buch.).**

1889. *Discognathus lamta*, Vinciguerra, *op. cit.*, pp. 275, 279 (fig.).

1913. *Discognathus lamta*, Annandale, *Journ. As. Soc. Bengal* (n. s.) IX, p. 36, fig. 1.

Specimens from the Inlé Lake belong to the true *D. lamta*, as do also some from He-Ho. One individual, however, from the latter locality represents a distinct and apparently undescribed species. As great confusion exists in reference to the species and races of the genus, and as most of the specimens belonging to the collection of the Indian Museum are interned at present in Hungary, I refrain from describing the new form.

I have already alluded to the post-climbing propensities of *D. lamta*. To understand them it is necessary to realize that houses are often built by the Intha on posts standing in water as much as ten or twelve feet deep. We lived for some time in a house of the kind more than a mile from shore in the Inlé Lake, and it was possible to watch the ascent of the house-posts by the fish, which was usually seen in the first instance swimming out from a thicket of weeds. It then settled, with its head pointing upwards, low down on one of the house-posts and began to move up it slowly, browsing as it did so on the small algae and polyzoa (*Hislopia lacustris*) with which the posts were covered. The sucker-like structure of the lips enabled it to retain a fairly tight hold on the post while it remained still; its ascent was effected by gentle and almost imperceptible movements of the tail. When it approached the surface of the water it usually moved away either to another post or into the thicket, but sometimes it turned round and went downwards on the original post, and in the course of its ascent it frequently circumvented the post in a spiral course. The Intha are well aware of this habit and have coined a name for the fish accordingly, but the Danu who live on the He-Ho plain, and do not build their houses in water, have apparently noticed the same habit in respect to rocks. They do not distinguish between *D. lamta* and the other species that occurs with it.

D. lamta is extremely difficult to catch. It is very rapid in its movements when disturbed and wary even when engaged in climbing. It, therefore, has no economic importance in the presence of other species of equal and larger size that are less active and cunning.

The species was described originally from northern Bengal and it certainly occurs, alone or with closely allied species, over the greater part of north-eastern and Peninsular India. Vinciguerra records it from several localities in Upper Burma. It is, however, impossible at present to state the precise geographical range of any form of the genus.

Cirrhina latia (Ham. Buch.).

1889. *Cirrhina latia*, Day, *op. cit.*, p. 279.

This fish has probably a number of local races, but the matter cannot be settled without examining good series from many different parts of India and Burma. In the Inlé Lake it does not grow much longer than 6 or 7 inches and is of a very slender form. It is abundant amongst dense thickets of vegetation, but appears to live entirely on the bottom.

Vast numbers are sometimes taken in the great fishing enclosures erected in the lake by the Intha fishermen. As the supply of fresh fish then exceeds the demand, a considerable proportion of a large catch is often dried in the sun, as a rule without being cleaned or salted. The dried fish are sold in the bazaar sorted out into at least two sizes.

Barbus sarana caudimarginatus, Blyth.

(Plate III, fig. 3.)

1860. *Barbus caudimarginatus*, Blyth, *Journ. As. Soc. Bengal* XXIX, p. 157.

1889. *Barbus sarana*, Vinciguerra, *op. cit.*, p. 287.

1893. *Barbus Oatesii*, Boulenger, *op. cit.*, p. 201.

I have examined a co-type of Boulenger's *Barbus oatesii* from Fort Stedman and also a large series of specimens from the Inlé Lake and the He-Ho basin. They do not differ in any respect from specimens from Tenasserim and Upper Burma in the Indian Museum identified by Day and others as *Barbus sarana*. Moreover, the colouration of the living fish agrees very closely with that given by Blyth as typical of his *Barbus caudimarginatus*. In my own field-notes I find the following description :—

“ Bluish green on back ; sides greenish silvery ; belly white. Pectoral fins olivaceous, other fins and lips reddish. Anterior border of dorsal and upper and lower borders of caudal dark bluish green. A vertical dark bar extending down posterior margin of preopercular and another, somewhat curved, immediately behind the opercular border.”

I do not quite understand Boulenger's statement that each scale is edged with black ; but this was probably an artificial condition. It has disappeared in the co-type I have examined.

I take it, for the reasons given, that this form is no more than a Burmese race of the common Indian *B. sarana* (Ham. Buch.), differing only in colouration and in possessing a more variable number of lateral scales. Vinciguerra discusses its relationship to *B. rubripinnis*, Cuv. and Val., *B. pinnauratus* (Day) and *B. chrysopoma*, Cuv. and Val. and seems to be of the opinion that the first at any rate may be identical with Blyth's race, but I have not the material to discuss the question further myself.

The Burmese race of *B. sarana* is common in the Inlé Lake, in which it is not, according to the Intha fishermen, ever longer than a hand. It is found chiefly near villages and among floating islands and is caught in basket-traps and drift-nets. Its small size renders it less valuable than its larger congeners, but its flesh is said to have a good flavour.

***Barbus schanicus*, Boulenger.**

(Plate III, fig. 4.)

1893. *Barbus schanicus*, Boulenger, *op. cit.*, p. 201.

This is perhaps the largest and heaviest Cyprinid fish caught in the lake. It is stated to attain a weight of 7 lbs. Large individuals are commonly 18 inches long and very deep in proportion. The back in living specimens is of a deep blackish green and the fins and tail are tinted with a paler shade of the same colour.

At any rate in February and March, the *Nga yit* is not so abundant in the markets round the lake as its two congeners. It is, however, said by the Intha fishermen to be caught chiefly in canals and at the mouths of the rivers that open into the lake near its southern extremity, and to be much more abundant in these localities at some seasons than others. It is, therefore, in all probability a fluviatile fish that migrates into the lake occasionally in search of food or in order to breed. The species is only known from the Inlé Lake.

The fish is caught with cast-nets in canals and streams and speared in the lake.

***Barbus stedmanensis*, Boulenger.**

(Plate III, fig. 2.)

1893. *Barbus compressus*, Boulenger, *op. cit.*, p. 202 (*nom. preoc.* ¹.)1917. *Barbus stedmanensis*, *id.*, *in litt.*

The name *Barbus stedmanensis* is suggested by Dr. Boulenger in place of *Barbus compressus*, the name he originally gave the species. The fish has no resemblance to the *Barbus compressus* of Day, which probably came from Kashmir. The type of the latter is in the collection of the Indian Museum and I have been able to compare it with a co-type of *Barbus stedmanensis* sent from the British Museum some years ago.

This fish has a very herring-like appearance owing to the shape of its body and head and the direction of the mouth. It is said to attain a weight of 3½ lbs. The back in life is almost black and the dorsal and caudal fins are margined with the same colour, while the tip of the anal and the upper border of the pectoral are also infuscated.

B. stedmanensis, as its shape suggests, is an active and probably to some extent a predacious species, though I found the stomach full of weeds in some specimens. It is usually caught in a dip-net, speared or captured in special traps.

***Cyprinus carpio intha*, subsp. nov.**

(Plate III, fig. 1.)

1893. *Cyprinus carpio*, Boulenger, *op. cit.*, p. 200.1904. *Cyprinus carpio*, Regan, *ibid.* XIII, p. 190 (*in part*).

Tate Regan has pointed out that the Carp of the Southern Shan States is a distinct race, distinguished by the largeness of its scales. This race

¹ *Barbus compressus*, Day, *Proc. Zool. Soc.* 1869, p. 555.

is not peculiar to the lake but is widely distributed in the Southern Shan States. It is common in the streams of the He-Ho basin (3,800 ft.) and I have recently received a specimen from Mr. G. C. B. Sterling, who obtained it from the market at Kentung more than 300 miles east of the lake. Mr. A. G. Gahen has also sent me specimens from Loilem in the Mong Sit State.

I have examined a large series of specimens, in which the number of the lateral scales varies from 25 to 30 $\frac{4-5}{6-7}$. In the Inlé bazaars I saw few individuals more than about a foot in length, and the fishermen told me that the largest they ever caught—and those rarely—weighed about 7 lbs. In life the back and sides of the head are of a greenish bronze colour becoming gradually paler below. The dorsal and caudal fins are greenish, the other fins and the lips reddish.

The Carp is perhaps the most abundant and certainly one of the most esteemed fish in the bazaars at Fort Stedman, Nan-Pan, and Yawnghwe. No attempt seems to have been made to cultivate it artificially and, if the Intha fishermen can be believed, the local race has not the remarkable vitality of the Chinese and European forms. The fish is caught by spearing, in drift nets and in peculiar weed-trawls consisting of a bag-shaped net attached to a large triangular frame of bamboo.

Sawbwa, gen. nov.

The genus consists of small Cyprininae resembling the *Puntius* section of *Barbus* but totally devoid of scales and with a reduced pharyngeal dentition.

The form is compressed but not elevated; the abdomen is not trenchant; the dorsal profile is convex. The head is of moderate size, the eye large, the mouth small, terminal and oblique, the upper jaw protrusible; there are no barbels. The dorsal and anal fins are short, having not more than 7 branched rays each; the dorsal has a toothed bony spine; the anterior part of the dorsal is in front of the anal. The pharyngeal teeth are few in number (4 in the type-species) and arranged uniserially.

Type-species.—*Sawbwa resplendens*, sp. nov.

Sawbwa resplendens, sp. nov.

(Plate II, fig. 3; pl. IV, fig. 15.)

B. 111. D. 9-10 (2-3/7). P. 7. V. 7. A. 7(2/5). C. 18.

The greatest depth of the body is $\frac{1}{5}$ of the total length, that of the caudal peduncle about $\frac{1}{10}$; the length of the head $\frac{1}{4}$, that of the caudal fin slightly less. The eye is at least as long as the snout, its diameter is equal to that of the interorbital space. The lateral line is obscure. The anterior border of the dorsal fin is considerably nearer the base of the caudal fin than the tip of the snout; it is slightly in front of the point midway between the base of the ventral and the anterior border of the anal. The pectoral is rather small and does not extend back to the base of the ventral; the tip of the ventral extends back as far as the vent. The posterior border of the

anal is nearer the vent than the base of the caudal. The caudal is strongly forked, its two points being subangular. The second (or third) spine of the dorsal is stout and bears in its middle region from six to twelve strong spinelets some of which are usually double; its upper part, which is smooth, is curved backwards; the whole spine is shorter than the head. The last branched dorsal ring is divided almost to its base.

The pharyngeal teeth (4 in number) are elongate and narrow, strongly concave on the upper surface; their tips are subtruncate but concave and with a minute terminal projection at either end.

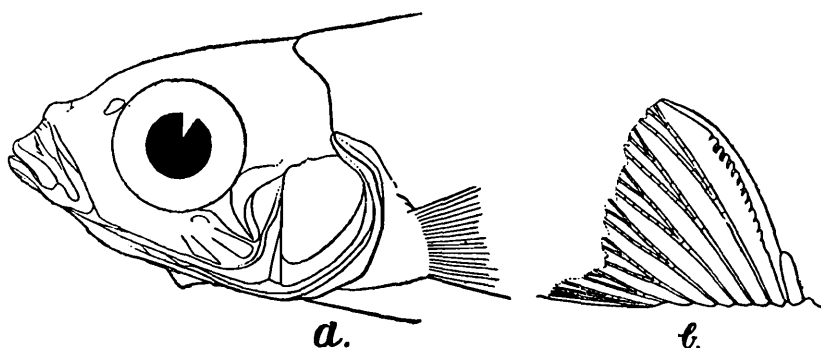


FIG. 1.—*Sawbwa resplendens*, sp. nov. a. Head. b. Dorsal fin.

Preserved specimens are whitish, more or less definitely suffused with green pigment on the back and blackish on the dorsal surface of the head. The sides of male examples are sometimes covered with black chromatophores. The fins are as a rule colourless, except for rows of minute dots running parallel to the rays; in adult males the tips of the dorsal and anal are sometimes blackened. The belly and the sides of the head are silvery. In life the female has much the same colouration as that of preserved specimens, but the silvery appearance of the body is more intense and more universal. The breeding male is much more brilliant, the sides and lower surface of the head, the chest, caudal and anal fins being bright scarlet and the sides of the body bright metallic steely blue.

The length of the adult fish does not exceed 25 mm.

Ova were observed issuing from the vent of a female. They are spherical and enclosed in a delicate, smooth membrane; each is provided with an extremely fine filament of considerable length. The diameter of the egg does not exceed 0.75 mm.

Type-specimen.—No. F 9413/1, *Zoological Survey of India (Ind. Mus.)*.

This little fish is extremely common all over the Inlé Lake and in the swamps that surround it. It lives in large shoals among dense vegetation both in the clear waters of the central region of the lake and in the peaty and often foul water near the edge. Fully coloured males were observed only in the latter situation. Ripe females were taken in February and March.

In spite of its small size, the species is of economic importance to the Intha as it forms an ingredient in the dried whitebait that is one of the chief products of the lake.

Microrasbora, gen. nov.

To this genus I assign two small fish found in the Inlé and He-Ho basins, and possibly also at least two others described from the Malay Peninsula.

The genus *Microrasbora* is closely allied to *Rasbora*, Bleeker and *Brachydanio*, Weber, but is distinguished from the former by the total absence of the lateral line and by the longer anal fin and from the latter by the fact that there is no prominence on the jaw. The mouth is small and almost semicircular and opens obliquely upwards. The species assigned to the genus are very small, strongly compressed, rather deeper in the body than most species of *Rasbora* and as a rule of brilliant or at any rate conspicuous colouration. The general facies is like that of *Danio*, but there are no barbels.

The species I assign to *Microrasbora* are *Microrasbora rubescens*, sp. nov. (type-species), *Microrasbora erythromicron*, sp. nov., and possibly *Rasbora heteromorpha* and *R. maculata*, Duncker.¹ The two former are from the Inlé Lake and the latter from the Malay Peninsula. I have not seen the Malay species, which may be generically distinct.

Microrasbora rubescens, sp. nov.

(Plate II, fig. 3 ; pl. IV, fig. 13.)

B. 111. D.8-9 (2/6-7). P. 11. V. 7. A. 13-15 (3/10-12). C. 26 Ll.29-32-L.t. 7.

The greatest depth of the body is from $\frac{1}{5}$ to $\frac{1}{4}$ the total length, being considerably greater in adult than in sub-adult individuals ; the length of the head is also $\frac{1}{4}$ the total length and the depth of the caudal peduncle a little more than $\frac{1}{3}$ in adults. The eye is longer than the snout and its diameter is greater than that of the interorbital space. The scales are large, thin, transparent and difficult to see ; they are easily removed from the living fish ; each scale bears several radiating striae and the concentric growth lines are well marked. The caudal and anal fins have a distinct sheath of scales at their base. The anterior border of the dorsal fin is slightly in advance of that of the anal and immediately above the vent ; it is much nearer the base of the caudal fin than the tip of the snout. The pectoral extends back further than the base of the ventral, which does not quite reach the vent and does not overlap the anal when pressed back. The anal is rather long, but its posterior border is nearer the vent than the base of the caudal. The caudal is strongly forked. All the fin rays are segmented and none are bony.

The pharyngeal bones have a well marked external prominence. The teeth number about 15 and are arranged triserially. Their form and arrangement is shown in pl. IV, fig. 13.

The colouration of preserved specimens is much like that of similar specimens of *Sawbwa resplendens*. In life the sides and ventral surface of the head, the caudal, anal and sometimes the dorsal fin are orange-scarlet in adults of both sexes. The whole body of the breeding male is suffused with the same colour. A dark mid-lateral streak extending forwards from the base of the tail to the level of the anterior border

¹ *Mitt Naturh. Mus. Hamburg* XXI, p. 182, pl. i, figs. 4, 5 (1203).

of the dorsal fin or further is often conspicuous. Sometimes it expands into a well-defined spot at the base of the caudal.

Our largest specimens are 30 mm. long.

Type-specimen.—No. F 9386/1 *Zoological Survey of India (Ind. Mus.)*

This little fish is very abundant all over the Inlé Lake (3,000 ft.), in ponds and marshes in the same valley and also in streams and pools in the old He-Ho lake-basin 800 feet higher. In habits it resembles *Sawbwa resplendens*, with which it is frequently taken. It is an even more important ingredient in the dried whitebait of the local bazzars.

***Microrasbora erythromicron*, sp. nov.**

(Plate II, fig. 5 ; pl. IV, fig. 14.)

B. 111. D. 9-10 (1-2/8). P. 2. V. 6. A. 9-11 (1-2/8-9). Ll. 21-25. L. t. 7.

The greatest depth of the body is about $\frac{1}{4}$ of the total length, the length of the head the same or slightly more, the depth of the caudal peduncle $\frac{1}{10}$. The eye, which is prominent, is twice as long as the snout and much broader than the interorbital space. The scales are very large but thin and have their sculpture obscure. The anterior border of the dorsal fin is distinctly in advance of the vent and a little nearer the base of the caudal than the tip of the snout. The pectoral when expanded hardly reaches the base of the ventral ; the anal is short, its posterior border lying nearer the vent than the base of the caudal ; the caudal is forked. The scaly sheaths of the dorsal and caudal are very well-developed.

The pharyngeal bones resemble those of *M. rubescens* in form and in the large number of teeth they bear, but are relatively shorter and stouter.

Preserved specimens are of a greyish colour, darker on the back than on the sides and belly, with about 12 obscure blackish vertical stripes on the body and a black spot surrounded by a pale ring on the caudal peduncle. The fins are colourless. In the living fish, however, the whole surface is deeply suffused with scarlet, the vertical stripes are blue and the ocellus on the tail is much more conspicuous.

Our largest specimen is only 20 mm. long and even smaller examples are fully mature.

Type-specimen.—No. F 9385/1 *Zoological Survey of India (Ind. Mus.)*.

This gorgeous little fish was taken only at the edge of the Inlé Lake, among the stems of decaying grass from floating islands. It is markedly gregarious. Numerous specimens have been identified from samples of dried whitebait from the market at Fort Stedman.

***Barilius auropurpureus*, sp. nov.**

(Plate II, fig. 4 ; pl. IV, figs. 11, 12.)

B. 111. D. 9 (2/7). P. 12. V. 7. A. 18 (3/15). Ll. 39-41. L. t. 9 ($7\frac{1}{2}/1\frac{1}{2}$).

The habit is slender and sprat-like. The dorsal profile is higher than the head but not strongly arched, the ventral profile sinuous. The head is long and narrow, the snout sharply pointed. The greatest

depth of the body is about $\frac{1}{5}$ the total length, that of the caudal peduncle $\frac{1}{3}$ to $\frac{1}{4}$; the length of the head slightly less than the greatest depth of the body. The eye is large, a little shorter than the snout and narrower than the interorbital space. There are no barbels. The anterior border of the dorsal fin is immediately above the vent and very slightly in advance of that of the anal; it is much nearer the base of the caudal than the posterior margin of the operculum. The pectoral is long and narrow; adpressed it reaches beyond the base of the ventral, which does not reach the vent. The anal is distinctly longer than the dorsal. The caudal is long and strongly forked. The anal has a well-developed scaly sheath. The scales of the body are large, thin, deciduous and obscurely sculptured.

The pharyngeal bones are short and strongly curved. Each bears about 13 sharp curved teeth arranged triserially.

Preserved specimens are of a dark olivaceous green on the sides and back and the upper surface of the head, white on the belly and silvery on the sides of the head. There about 14 short bluish vertical bars on the middle part of the sides, the series beginning behind the operculum and extending backwards to the level of the posterior margin of the dorsal; on the caudal peduncle it is continued as an irregular horizontal stripe formed by the coalition of further bars. The fins are white and bear rows of minute black dots parallel to the rays. In life this is one of the gorgeous freshwater fishes with which I am acquainted. The back is suffused with deep purple, the vertical bars and caudal stripe are bright ultramarine blue surrounded with a halo of gold, the cheeks are brilliantly iridescent and the whole fish is silvery. The fins of the adult male are pale greenish yellow. Specimens from muddy streams are paler and less brilliant than those from the open lake.

Large specimens from the Inlé Lake are nearly 100 mm. long but in streams in the neighbourhood they do not exceed 70 mm.

Type-specimen.—No. F 9432/1 *Zoological Survey of India (Ind. Mus.)*.

The species is common all over the Inlé Lake and in streams and rivers in the same valley. It is gregarious in habits and is the only fish commonly seen at the surface of the water. The house we lived in near Fort Stedman was built on poles out in the lake a mile from shore. Large shoals of *B. auropurpureus* were attracted by the refuse from our kitchen, beneath and around which they swarmed for the greater part of the day and apparently for the whole night, swimming immediately below the surface. Their natural food in this position consists largely of the small caddis-flies and mayflies that issue from the water every evening and flutter over its surface in enormous numbers. In the heat of the day the fish descend to the bottom, where, through the clear water, we observed them tugging worms or insect-larvæ from the mud. As their mouths are not adapted for this mode of feeding they are obliged to turn over on their sides or on their backs when they have got hold of a worm the greater part of which is embedded. In clear water at any rate, in which alone the fish attains its maximum brilliance of colouration, it is extremely quick and wary in its movements, so much so that the Intha fishermen, who do not despise much smaller fish, make

no serious attempt to catch it. They were able to obtain specimens for us with a dip-net, but only at the expense of great labour. In muddy water such as that of the Yawngwe river it is much easier caught, but I did not see it in any of the markets and have been unable to detect specimens in samples of dried whitebait.

B. auropurpureus breeds rather earlier than most of the fishes of the lake, but the breeding period is evidently prolonged. We found shoals of young post-larval stages and of small fish that had not yet attained the characteristic bright colouration, on the surface near the middle of the lake. In all of these there is a dark mid-lateral band and a row of close-set black dots above the anal fin. I figure two of the younger stages.

Family NOTOPTERIDAE.

Notopterus notopterus (Pall.)

1889. *Notopterus kaporat*, Day, *op. cit.*, p. 406, fig. 129.
 1889. *Notopterus kaporat*, Vinciguerra, *op. cit.*, p. 355.
 1913. *Notopterus notopterus*, Weber, *op. cit.*, p. 9.

This fish is common in the Inlé Lake, but is always small, never exceeding 10 inches in length. Most of the specimens obtained were very dark in colour, the back being black and the sides dark grey. As, however, I have pointed out elsewhere,¹ individuals exposed to a bright light in an aquarium assume this colouration, which in those from the lake is doubtless due to the clearness of the water. *N. notopterus* is also common at He-Ho. It has a wide distribution in India, Burma, Siam, Malaya and the Malay Archipelago. The small size of the fish and its exceeding boniness interferes with its economic value, but large numbers are sold in the Intha bazaars. They are mostly caught with hook and line or taken in weed-trawls. They live as a rule among weeds near the shore of the lake.

Order ACANTHOPTERIGII.

Family MASTACEMBELIDAE.

This family is represented in the Inlé fauna by two species of *Mastacembelus*, both of which are, as far as we know, endemic in the Inlé and He-Ho basins.²

Mastacembelus caudicellatus, Boulenger.

(Plate I, fig. 3.)

1893. *Mastacembelus caudicellatus*, Boulenger, *op. cit.*, p. 199.
 1912. *Mastacembelus caudicellatus*, *id.*, *Journ. Acad. Nat. Sci. Philadelphia* (2) XV, pp. 198, 200.

A photograph of a specimen is reproduced on plate I, fig. 3 to show the characteristic colouration. The ocelli on the sides of the tail are not

¹ Annandale, *Journ. Bom. Nat. Hist. Soc.* XXI, p. 693 (1911-12).

² Dr. Boulenger's statement that they occur in the Irawaddi is due, as he informs me, to a misapprehension. See *Journ. Acad. Nat. Sci. Philadelphia* (2) XV, p. 200 (1912).

always to be clearly distinguished as such, for they are perhaps more often mere pale spaces in a dark reticulation. Young and adults agree in colouration. The species is a small one; no specimens longer than 235 mm. were obtained. It is common in the Inlé Lake, where it occurs both at the edge and in the open parts, always among dense vegetation.

The fish is said to be "sweet" and is eaten by the different tribes that live in the Southern Shan States.

Mastacembelus oatesii, Boulenger.

(Plate I, fig. 2.)

1893. *Mastacembelus oatesii*, Boulenger, *op. cit.*, p. 199.

1912. *Mastacembelus oatesii*, *id.*, *op. cit.*, pp. 198, 200.

This is a larger species, commonly attaining a length of 370 mm. The dorsal spines can be retracted into fleshy sheaths and the praeopercular spines are often completely concealed. Fully adult individuals are of an almost uniform dark greenish colour, but in the young the belly is pale and the sides bear a series of irregular dark, pale-spotted bars (sometimes broken up into spots or blotches), while the sides of the head are ornamented with alternate dark and pale horizontal lines and bars. The caudal fin at this stage is black with a broad white vertical bar; the ventral fins are pale with a dark edge and the pectorals are almost wholly pale. The difference in colouration between the young of this species and *M. caudicellatus* is illustrated in figs. 2 and 3, plate I.

The Intha do not distinguish between the two species of the genus.

Family OPHIOCEPHALIDAE.

Ophiocephalus striatus, Bloch.

1889. *Ophiocephalus striatus*, Day, *op. cit.*, II, p. 363.

1889. *Ophiocephalus striatus*, Vinciguerra, *op. cit.*, p. 184, fig.

This fish is by far the largest in the lake, attaining a weight of 10 lbs. or over. Together with *Clarias batrachus* it has a pre-eminence in favour among the Europeans of the district, but I am not sure that the Intha themselves do not prefer the true Carp. *O. striatus* is caught with hook and line (the bait often being a small live *Notopterus*) and in special traps made of reeds. It is often abundant in the local markets.

The species has a wide distribution in Continental Asia extending as far east as Eastern China and the Philippines.

Ophiocephalus harcourt-butleri, sp. nov.

(Plate II, fig. 7; pl. IV, figs. 16, 17.)

D. 28-38. A. 16-25. L. 1. 40-45. L. t. 14-15.

A small species resembling *O. gachua*, but distinguished by the smaller scales on the head, the longer, narrower, less flattened head, etc.

The total length is from 5 to $5\frac{1}{2}$ times the greatest depth, from $3\frac{1}{2}$ to $3\frac{3}{4}$ the length of the head and from $5\frac{1}{2}$ to 6 times the length of the caudal fin. The length of the orbit is from $\frac{1}{27}$ to $\frac{1}{30}$ the total length

and from $\frac{2}{5}$ to $\frac{2}{3}$ the breadth of the interorbital space. The number of spines in the dorsal fin is usually between 30 and 34 and that in the anal fin between 20 and 25. The number of scales between the orbit and the preopercular angle is 5 or 6; the number between the dorsal and the tip of the snout is 13 to 15. The ventral is less than half the length of the pectoral.

The teeth are for the most part villiform and are arranged in numerous lines on both jaws, but there is an inner row of larger conical teeth both in the upper and in the lower jaw. The arrangement is best shown in a figure (pl. IV, fig. 17).

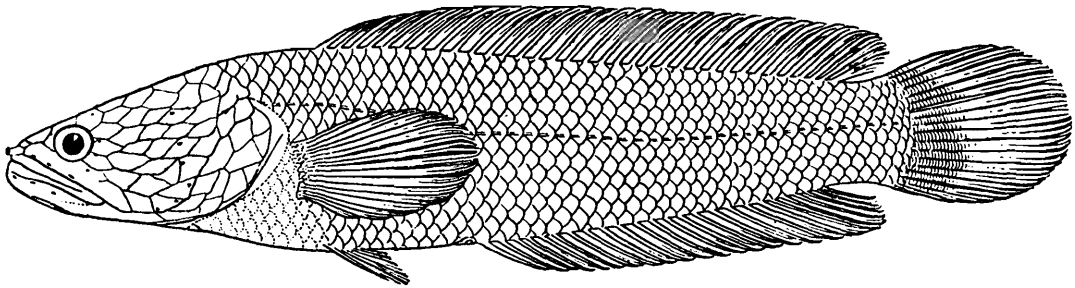


FIG. 2.—*Ophiocephalus harcourt-bulleri*, sp. nov.

Two colour-forms can be distinguished :—

- A. The whole body and head and the greater part of the fins are almost uniformly black, the ventral surface being only slightly paler and a little mottled and the pectoral fins showing slight traces of transverse banding; a narrow margin of red or reddish orange runs round the vertical and the caudal fins.
- B. The head and body are gray or olivaceous, pale on the ventral surface and with incomplete dark < shaped markings on the side (as a rule more or less interrupted), an indistinct dark blotch at the base of the pectoral fin, pale longitudinal lines on the dorsal and vertical lines on the caudal fin.

Form B preserves to a large extent the juvenile colouration (pl. II, fig. 7), in which the markings are more distinct and the blotch at the base of the pectoral is the centre of a well-defined ocellus. There is never an ocellus on the dorsal or the tail.

Our largest specimen (from the Inlé Lake) is 22·6 cm. long, and from all accounts the species does not grow more than 25 cm. long.

Type-specimen.—(Form A) No. F 9439/1 *Zoological Survey of India (Ind. Mus.)* from Fort Stedman.

Distribution.—This species is abundant all over Yawngwe and the neighbouring states. We obtained specimens not only from the Inlé Lake but also from He-Ho (3,800 ft.) and Thamakam (4,200 ft.); it lives on a muddy bottom in sluggish streams and also in all parts of the Inlé Lake, hiding itself as a rule among weeds. Large numbers are sold in the local markets.

The species is named after His Honor Sir Harcourt Butler, K.C.S.I., C.I.E., I.C.S., Lieutenant-Governor of Burma at the time of our visit to Yawngwe, now Lieutenant-Governor of the United Provinces.

FISHERIES OF THE LAKE.

LICENCES.

The fisheries of the Inlé Lake are of the greatest possible importance to the population of its shores, though the revenue that they provide for the state is not large, never rising much above 13000 rupees a year. This revenue is gathered in the form of licences for the use of different kinds of fishing apparatus. The licences are issued monthly to individuals and give the licensee the right to use as many traps, etc., as he can set himself or otherwise utilize without assistance. I have to thank Mr. C. E. Browne, I.S.O., Political Adviser, Yawnghwe, for the following statistics :—

Receipts from Yawnghwe fisheries for the last 8 years.

					Rs.
1908-09	...	...	...	...	11,824
1909-10	...	...	...	...	12,074
1910-11	...	...	...	...	12,759
1911-12	...	...	...	...	11,029
1912-13	...	...	...	...	10,233
1913-14	...	...	...	...	11,005
1914-15	...	...	...	...	13,025
1915-16	...	...	...	...	12,769

Fishing implements used in Yawnghwe State and rate charged for each.

					Monthly charge.
					<i>Rs. a. p.</i>
1. Hmyon-gyi ("Large trap")	...	...	...	...	2 0 0
2. Hmyon-seik	...	...	...	...	0 0 3
3. Hmyon-Paung-Nyat	...	...	...	...	0 0 3
4. Hmyon-Taung-In	...	...	...	...	0 0 3
5. Hmyon-Te	...	...	...	...	0 0 3
6. Hmyon-Nga-Hmwe	...	...	...	...	0 0 3
7. Hmyon-Kwet-Kya	...	...	...	...	0 0 3
8. Hmyon-Kyi-Dauk	...	...	...	...	0 0 3
9. Hmyon-Waing	...	...	...	...	0 0 3
10. Hmyon-Chok	...	...	...	...	0 0 3
11. Hmyon-Hpyu	...	...	...	...	0 0 3
12. Hmya-Tayaw-To (Hmya=Hook)	...	...	...	...	0 4 0
13. Hmya-Tauk	...	...	...	...	0 0 1
14. Hmya-Tan-Kyo	...	...	...	...	0 0 1
15. Hmya-Tan-Let-Kaing	...	...	...	...	0 4 0
16. Ne-Khayin (day-spear)	...	...	...	...	0 4 0
17. Nyat-Khayin (night-spear)	...	...	...	...	1 0 0
18. Po-San (silk net)	...	...	...	...	1 0 0
19. Kyi-San (cotton net)	...	...	...	...	1 0 0
20. Hpyin-San	...	...	...	...	0 8 0
21. Chaung-Ya-Thè	...	...	...	...	2 0 0
22. In-ya-Thè	...	...	...	...	4 0 0
23. Pazunseik-Ngè-Ya-Thè	...	...	...	...	0 8 0
24. Nga-Yan-Paik (Paik=net)	...	...	...	...	0 8 0
25. Nga-Pein-Paik	...	...	...	...	0 8 0
26. Nga-Kon-Ma-Paik	...	...	...	...	0 8 0
27. Hmaw-ehit-Paik	...	...	...	...	1 8 0
28. Paik-Yat-Kyi	...	...	...	...	4 8 0
29. Hsaung	...	...	...	...	0 4 0
30. Hu-Yin	...	...	...	...	0 4 0
31. Kun (casting net)	...	...	...	...	2 0 0
32. Ka-Tat-Htaung-Hnyut	...	...	...	...	0 0 1
33. Pet-Ka	...	...	...	...	0 4 0

Both these tables refer to the whole of the Yawnghwe State and no separate statistics are available for the Inlé Lake; but the lake fisheries are of very much greater importance than those of streams, swamps and rice-fields.

The names of fishing apparatus given in the second table are not in all cases intelligible even to a Burmese scholar, for many of them are strictly local. I have to thank Mr. G. deP. Cotter of the Geological Survey of India for elucidating some of them. They are not in most cases the same as those I obtained myself from the Intha fishermen in reference to specimens collected. It may be remembered, however, that the word *Hmyon* means a basket or basket-work trap of any kind, *Hmya* a hook, *Khayin* a fish-spear and *Paik* a net. *Nga* means fish. The specific Intha names of different species of fish will be found on pp. 24, 25. *Nga-Yan* is *Ophiocephalus striatus*, *Nga-Pein* or *Hpein* the true Carp, *Nga-Kon-Ma* the Burmese Red-finned Barbel (*Barbus sarana caudimarginatus*).

FISHING BOATS.

The Intha ("Sons of the Lake") are great boat-builders and boatmen, very fond of boatracing. All their boats are, however, of one type. They are long and narrow, almost flat-bottomed and with very little freeboard. The two ends of the boat are identical, each is raised and bifurcated at the tip and a little widened so that a rope passed over it does not slip. The bottom of the boat is built of the outer sections of several tree-trunks laid end to end, and its size is measured by the number of logs thus used. Planks are built up above the logs and the whole is covered with a thick layer of *thitsi* varnish composed of wood-oil from the tree *Melanorrhoea usitata* mixed with damar resin. Broken shells of Gastropod molluscs from the lake are sometimes mixed with the varnish and applied on the raised ends of the boat to give the boatmen foot-hold.

The boats are rowed by means of paddles with fairly long blades. The Intha as a rule row standing and use their legs as well as their arms in rowing. The leg is hooked round the outside of the paddle in such a way that the two first toes touch and sometimes grasp the shaft from behind above the top of the blade. The position is shown very well in the photograph on pl. V, fig. 1. It is not uncommon to see a man rowing with his right arm and right leg, standing on his left leg and wielding a fish-spear with his left arm (pl. VI, fig. 2). Women also row in the same fashion. The right and left arms and legs are used indiscriminately. When a man is fishing in a boat by himself he often uses a simple contrivance to keep it steady while he is spearing fish or otherwise employed. The contrivance of two flat, more or less paddle-shaped pieces of wood tied together by a piece of string, which is laid across the boat near one end and is sufficiently long to allow the two boards to hang into the water one on each side (pl. VI, fig. 2).

Sails are not very often employed and the Intha are not skilled in their use. A single mast is, however, sometimes fixed in a block fastened to a cross-bar near one end of the boat and a narrow oblong sail of cloth hoisted on it. A much commoner practice is the use of a large

silk umbrella as an accessory sail. When there is a slight breeze behind the boat it is a common sight to see a man or woman kneeling in front and holding up a large umbrella of oiled silk for this purpose. The umbrella is the same as that used for protection against sun or rain.

FISH-TRAPS AND BASKETS.

The fish-traps used in the Inlé Lake are not different in general principle or structure from those used in most parts of the East. They depend for their efficacy largely on the fact that many fish have a habit of thrusting themselves into any hole that seems likely to lead to a sheltered retreat. It is always easier, owing to the direction of the fins, for a fish to go forwards through a small aperture than for it to retreat backwards, and apparently fish have not the sense to turn round and go by the way they came. Consequently the traps used in the Inlé Lake, with the exception of certain baskets with which I will deal later, have one or more entrances fitted with a funnel-shaped passage-way that has the narrower end innermost.

Perhaps the most characteristic trap of the kind known to the Intha is that used in catching the Inlé Herring Barbel (*Barbus stedmanensis*) and called by them *pwanhnwet*: see pl. VII, fig. 3. It is of stout barrel-shaped form and is neatly constructed of very fine strips of cane crossing diagonally in two directions, and of some twenty rather stouter strips of the same material bent in circles. The diagonal strips pass alternately above and under the circular ones. The trap is made in two longitudinal halves, each of which has several circular strips twisted round its open end. The two halves are roughly tied together with coarse twine and can be separated in order to remove the fish. There is an entrance at either end of the complete trap. Its funnel-shaped passage-way is formed of inwardly projecting strips of bamboo which converge considerably. They are strengthened by other strips wound round them in a spiral. The trap is never baited, but is either laid amongst weeds with a stone inside to keep it from floating or else suspended in the lake under a small floating island, which is anchored by means of a rope and stone. The floating island may be a mass of peat with vegetation growing on it or simply a mass of floating weed. A plant frequently used for the purpose is *Ammania rotundifolia*.

A coarser type of trap (pl. VII, fig. 4), used chiefly for catching *Ophiocephalus striatus*, is often set in the lake. It is made of slender but very strong reed-stems peeled and coated with *thitsi* varnish. They are fastened parallel to one another by means of bands of some tough bark twisted round and between them in a double spiral. At the two ends and in the middle there is a twig or strip of bamboo bent in a circle and fixed inside the reeds to strengthen the whole. The strips of bark and the internal supports are manipulated in such a way that the trap is somewhat compressed at one end; otherwise it has an almost cylindrical shape. It is about 82 cm. long and 44 cm. deep. There are two compartments and both the round end of the trap and the partition between the compartments are provided with a passage-way of converging reeds. The compressed end is provided with a moveable

door of reed-stems. This trap, which is called *pwanhnwet-nga-yan* is very like one from Bengal figured by Day in his hand-book of "Indian Fish and Fishing" compiled for the Fisheries Exhibition in London of 1883. The reference is to pl. 1, fig. 4 of the book. The chief difference is that the Intha trap is truncated at the compressed end instead of being produced.

The other traps recognized for revenue purposes by the Yawnghwe State are probably used for the most part in rice-fields, canals, etc., rather than in the lake itself; the only other type which I know to be set in the lake is the one used in connection with the large fishing enclosures which I will discuss later. In general structure it resembles the conical frames (pl. V, fig. 1) used in connection with fish-spears, but is not more than 4 feet long and relatively narrow. A funnel-shaped passageway is fitted in the broad end and a hole at the narrow end is filled with weeds when the trap is set. The fish are extracted from this hole.

The traps used in rice-fields differ only in small details from those used all over India and Burma. Two types are common. One is conical and has a funnel-shaped entrance. It resembles the large traps used in the enclosures but is only about a foot long and is made of very narrow strips of reed-stem. The other, which stands upright, has a flat bottom of bamboo-matting. The upright sides are made of very narrow strips of bamboo arranged closely parallel to one another in a vertical direction. In cross-section the trap is shaped like a figure of 8 with the double curve of one side smoothed out into a single convexity. In the depression on the other side there is a series of narrow slits, through which the little fish and prawns enter. As the top is open and the whole trap not more than eighteen inches high, it can only be used in very shallow water.

Two kinds of baskets are used in catching small fish and prawns. One (pl. VII, fig. 2) of these (*hmyonkwet*) is broadly cylindrical, and is formed of a very coarse network of rough bamboo strips, with a number of similar strips twisted round the top. A specimen is 42 cm. high and 1.3 m. in circumference. Baskets of this kind are filled with peat, fresh weeds and stones, and sunk in the open parts of the lake. They are left at the bottom for 24 hours or more, and then fished up with a fishing spear. Several hundreds are often laid down by a single boat or a pair of boats, on which they are piled to a great height. Fish of various kinds, especially the small Cyprinidae and the species of *Mastacembelus* and *Notopterus*, go into them, apparently to look for food among the peat as well as to take shelter, for the peat is considered necessary. They remain in hiding amongst the weeds when the basket is drawn up. The monthly licence for using baskets of this kind is only three annas.

The other kind of fishing basket (pl. VII, fig. 1) is also made of bamboo strips, but the strips are much narrower and more carefully prepared, and the workmanship is neat and close. The structure is that of a more normal basket with upright strips radiating from the bottom, and with finer strips passing horizontally alternately in and out, below and above them. A large specimen is 26 cm. deep, and

1.47 m. in diameter. Small Cyprinidae, and especially small prawns, are caught by dipping baskets of the kind into the water under duckweed or other floating plants among the floating islands in the marginal zone of the lake and in canals and water-channels in the surrounding country. The water runs out through the interstices of the basket when it is lifted, leaving the little fish and prawns in a mass of weeds.

NETS.

At least six different types of nets are recognised by the revenue officers of the Yawngwe State. Some of these nets are distinguished by the name of the fish which they are used in catching. There is the *nga-yan-paik* (i.e., the net for catching *Ophiocephalus striatus*), the *nga-pein-paik* (i.e., the Carp net), and the *nga-kon-ma-paik* (i.e., the net for catching *Barbus sarana*). There are also the *hmaw-chit-paik*, the *paik-yat-kyi*—names I cannot explain—and the *kun* or cast-net.

The prices of monthly licenses for these different nets are as follows :—

Kind of Net.				Monthly Licence.		
				₹	a.	p.
Nga-yan-paik	...	...	...	0	8	0
Nga-kon-ma-paik	...	...	...	0	8	0
Hmaw-chit-paik	...	...	...	1	8	0
Paik-yat-kyi	...	...	...	4	8	0
Kun	...	...	...	2	0	0

The relative efficacy of the different nets can be gauged to some extent by the licence paid for their use. I am not sure that all of them are used actually in the lake, for the revenue statistics from which my information is drawn apply to the whole of the State of Yawngwe and the names given me by the fishermen do not agree with those in the official list.

The Carp net and the barbel net are drift-nets of very ordinary structure. That used for the Carp is made of fine silk (imported overland from China) of considerable length but only about 1½ feet deep; the mesh is 24 mm. across. There are small floats of some very light wood fastened to a double string that runs along the top. They are flattened cylinders about 8 mm. long, and are fastened at intervals of about 15 cm. Along the bottom of the net there are small leaden weights consisting of thin plates about 7 cm. long bent round another double string and hammered tight. When not in use the net is festooned on a bamboo. The net for barbel is precisely similar in construction, but is made of cotton and has a slightly smaller mesh, about 20 mm. across. I am told that the *Ophiocephalus* net has a considerably larger mesh. All these are used most commonly in connection with floating islands, which are towed out into the middle of the lake and there anchored. The fish take shelter under them, and the nets are drawn round them, or along one side.

The weed-trawl (pl. V, fig. 2) is a much more characteristic net. It has a triangular or almost triangular frame of variable size, but at least 5 feet long. The frame is made of two bamboos bent into an

arch above and tied together with twine. A third bamboo passes transversely through holes in their free ends. The net itself is bag-shaped, and has a small mesh of about 12 mm. It is made of cotton. A long rope is fastened to each of the lower angles of the framework. Two boats have to be used in fishing with this net. A man stands upright in one of these boats holding the top of the framework in his hands, he plunges it downwards and throws the two ropes across to two men in the other boat. They haul in the ropes until the net is horizontal and the two boats are close together. The bag is then emptied out into the second boat. The contents consist of a mass of weeds, with Carp, *Notopterus*, *Barbus sarana*, *Ophiocephalus striatus* and any other fish that may have taken shelter among the weeds.

The *Sin* or dip-net is of various sizes, and may be either square or oblong. It is used mainly for catching the herring-like *Barbus stedmanensis*, and the sprat-like *Barilius*, both open-water fish. The mesh is naturally smaller for the latter than for the former. The net is fastened at its four corners to two stout bent pieces of bamboo which are crossed above and temporarily tied together with string. A longer straight bamboo is tied above them as a handle. The net is allowed to sink into the water where a shoal of fish is seen, and rice-chaff is sprinkled on the surface above it. The fish come to this, thinking it to be some kind of food, and the net is drawn up from below them. The large dip-nets worked with a windlass that are often seen in Travancore, on the Talé Sap in Peninsular Siam and in many parts of China are not used on the Inlé Lake.

The cast-net is used rather in canals and flooded rice-fields than in the lake itself. It does not differ in construction or method of use from nets employed in other parts of the East.

FISHING ENCLOSURES.

I did not see real stake-nets of any kind in use on the lake, but driftnets are sometimes used in connection with large enclosures (pl. V, fig. 3). These are made in the following manner:—Masses of living weed (*Ceratophyllum*) are collected in boats and allowed to dry. They form a felted substance of some strength. With this walls are built in the lake round areas often of large size. They reach from the bottom to well above the surface of the water and are fixed in position by long bamboo poles driven through them into the mud of the bottom. Small holes are made in the walls at intervals a short distance below the surface and the mouths of conical fish traps made of bamboo (see above) are fixed in the holes. The bottom of the enclosed area is then systematically stirred up by means of bamboos and the fish are driven out into the traps. The nets are suspended in the air on bamboos above the walls of the enclosures to catch those fish that may attempt to leap out.

HOOKS AND LINES.

The revenue department of Yawnghwe recognize several different kinds of methods of using fish-hooks, but I have little information as to the methods except that both fishing-rods made of long reeds and

long lines with many hooks are used. A common bait for large fish such as *Ophiocephalus striatus* is a small living *Notopterus*. The cost of the monthly licence for the use of different kinds of fishing lines varies from one to four annas.

FISH-SPEARING.

The most profitable and one of the most heavily taxed methods of fishing is that of spearing (pl. VI, figs. 1, 2, 3). The spears are of two kinds, one (pl. VI, fig. 4) with two prongs and one with five (pl. VI, fig. 5). The former is used for spearing Carp and all other fish except eels, it is called *kyin* or *khyin*. The monthly license for its use costs four annas if it is used by day, but one rupee if it is used by night with a small fire in the front portion of the boat. An accessory frequently employed with this type of spear is a large conical frame made of strips of bamboo bound together with ratan and sufficiently long to reach the bottom of the lake. It has a small hole at the top and is without a bottom. This contrivance is let down over fish in the water and they are then speared through the hole at the top.

The spear with two prongs is only used in catching the eels *Amphipnous cuchia* and *Monopterus albus*. It is of much less importance than the one with five prongs. It is named *shin-su*.

The construction of the two kinds of spears is essentially the same but that of the *shin-su* is somewhat simpler than that of the kind with five prongs. Its shaft is made of a slender bamboo about 5 feet long. The two prongs, each of which has a single barb on the inner surface, are apparently cast in one piece with a spike at the base, which is inserted into the tip of the shaft. They are fixed in position by means of some kind of resin and the tip of the shaft is strengthened by a copper band hammered tight round it. The prongs are of course of iron.

The shaft of the five-pronged spear is longer and more slender and is formed of the stem of a stout reed covered with *thitsi* varnish. The five prongs are all in one piece and each has a single barb; they are bound to the shaft by thin twine or cotton thread covered with resin or *thitsi* varnish. The shaft is sometimes as much as 12 feet long.

CHIEF EDIBLE FISH OF THE LAKE.

In the systematic part of this paper I have stated briefly, in discussing each species, its economic status. It may be convenient here to summarize what has been said on the subject: at the same time I wish to say a little more about the dried whitebait that is so characteristic a product of the Yawnghwe State.

All the species commonly sold in the market are abundant, a fact probably correlated with the comparatively small number of species represented in the lake. There are no really large fish in the Inlé Lake and several of the species certainly do not attain the size they attain in the lowland waters of Burma. This may be due to the lack of a sufficiently abundant supply of nitrogenous food or to other causes of like nature. Some of the fish of the lake are always very small, not growing more than an inch long. The great majority of the

fish are eaten commonly by the people, but several species are of little economic importance because they are of relatively small size and are at the same time difficult to catch. To this category belong the species of *Barilius*, a sprat-like fish which as a rule swims near the surface, and *Discognathus*, which is provided with an adhesive apparatus connected with the mouth and feeds by crawling up house-posts and the like and grazing on the minute vegetation attached thereto.

The chief food fishes among the larger species that are eaten fresh are the following :—

Clarias batrachus, *Cirrhina latia*, *Barbus sarana caudimarginatus*, *Barbus stedmanensis*, *Cyprinus carpio intha*, *Notopterus notopterus*, *Ophiocephalus striatus* and *O. harcourt-butleri*. Of these, Europeans prefer *Clarias batrachus* and *Ophiocephalus striatus*, but the favourite fish of the Intha seems to be the local race of the true Carp.

The larger fish are seldom preserved by salting or drying, but half-grown Murrel are occasionally split, cleaned and salted, while a surplus catch of *Cirrhina latia* is frequently dried without even being cleaned. Small dried fish of the latter species are sold separately from larger ones.

The dried whitebait consists of small fish of diverse species, which are captured mostly in rice-fields at the time when they are being drained in autumn. A comparatively small number are, however, taken among the floating islands near the edge of the lake. The fish are caught in the baskets described above and also in small traps of types widely distributed in India and the surrounding countries. The fish identified from samples of whitebait purchased in the Intha bazaars are :—

Lepidocephalus berdmorei, *Nemachilus botia*, *N. brevis*, *N. brunneanus*, *Cirrhina latia*, *Danio aequipinnatus*, *Cyprinus carpio intha*, *Sawbwa resplendens*, *Microrasbora rubescens*, *M. erythromicron*, *Mastacembelus oatesii* and *M. caudicellatus*. Of the larger species only a small number of young individuals were found to be present. The great bulk of all the samples examined consisted of the species of *Lepidocephalus*, *Nemachilus*, *Sawbwa*, *Danio* and *Microrasbora*.

Several different qualities of whitebait are recognized in the local markets, the difference depending chiefly on the species present or predominant. The selection is, however, perhaps to some extent different in different villages. In Fort Stedman bazaar I found two qualities commonly on sale in February: A sample of the first quality (called *Poktha*) consisted of 74 per cent. of small loaches and 26 per cent. of Cyprininae of species that never grow more than 2 inches long. The second quality was called *Nga tha-hpwe-gyauk* and only differed from the first in having a very much smaller proportion of loaches. In the Nan-Pan bazaar at the same season three qualities were distinguished. The first quality was called (*Nga Me*="black fish"). It consisted of loaches and of small Cyprininae in about equal proportion. The second quality (*Nga Mi*="red fish") consisted mainly of *Danio*, with some loaches and a few (not more than 5 per cent.) of young *Cyprini* and *Cirrhinae*. The third quality (*Nga Hpyn*="white fish") consisted mainly of *Sawbwa* and *Microrasbora* with a small admixture of young loaches and a few young *Cirrhinae*.

No salt is used in preserving these small fish, which are dried in the sun on bamboo mats. The product is exported to other parts of the Southern Shan States and possibly even further afield.

Small prawns of the genus *Caridina* are captured and utilized precisely in the same manner as the small fish, and they form an even more important article of local export. They will, however, be discussed more appropriately when the Crustacea of the lake are described.

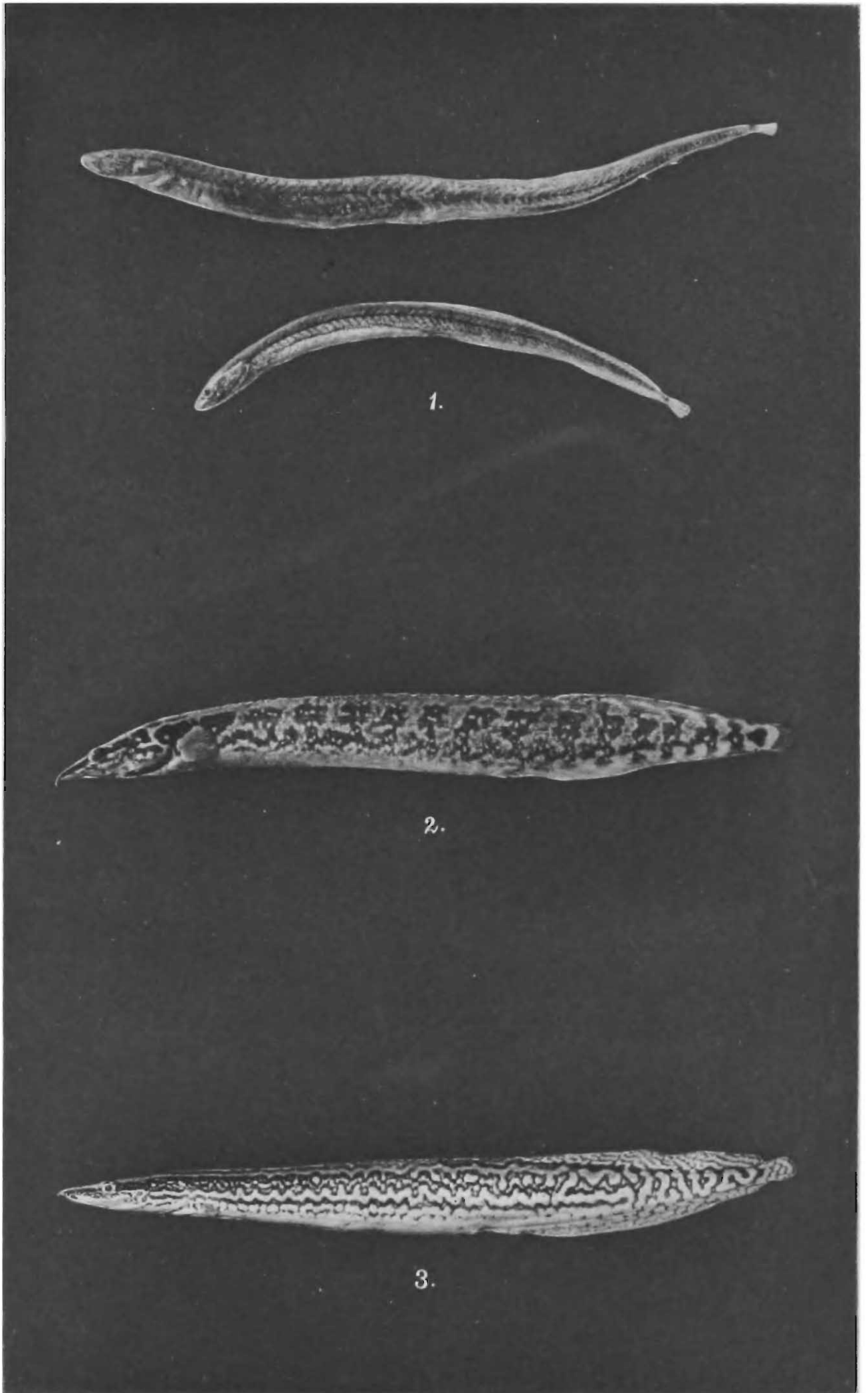
Except for the licencing of different kinds of apparatus there is no restriction¹ placed on the fisheries of the Inlé Lake, and I could discover no facts that would justify any such restriction at present. The lake, however, is bound to become gradually smaller and shallower, and the fish to become scarcer as the area available for them is restricted. When this occurs the only course will be to experiment in the intensive culture of the Carp and of the small fish used in making dried whitebait. There is every reason to hope that experiments of the kind would be successful.

¹ Some of the Intha think it wrong to fish in the "Buddhist Lent," in summer and autumn, but this is not the breeding-season of the fish and no legal restriction or strong religious influence is exerted in the matter.

EXPLANATION OF PLATE I.

PHOTOGRAPHS OF PRESERVED SPECIMENS OF INLE FISH.

- FIG. 1.—Type-specimens of *Chaudhuria caudata*, gen. et sp. nov., $\times 2$.
,, 2.—Young specimen of *Mastacembelus oatesi*, Boulg., nat. size.
,, 3.—Adult specimen of *M. caudicellatus*, Boulg., $\times \frac{1}{2}$.



S. C. Mondul photo.

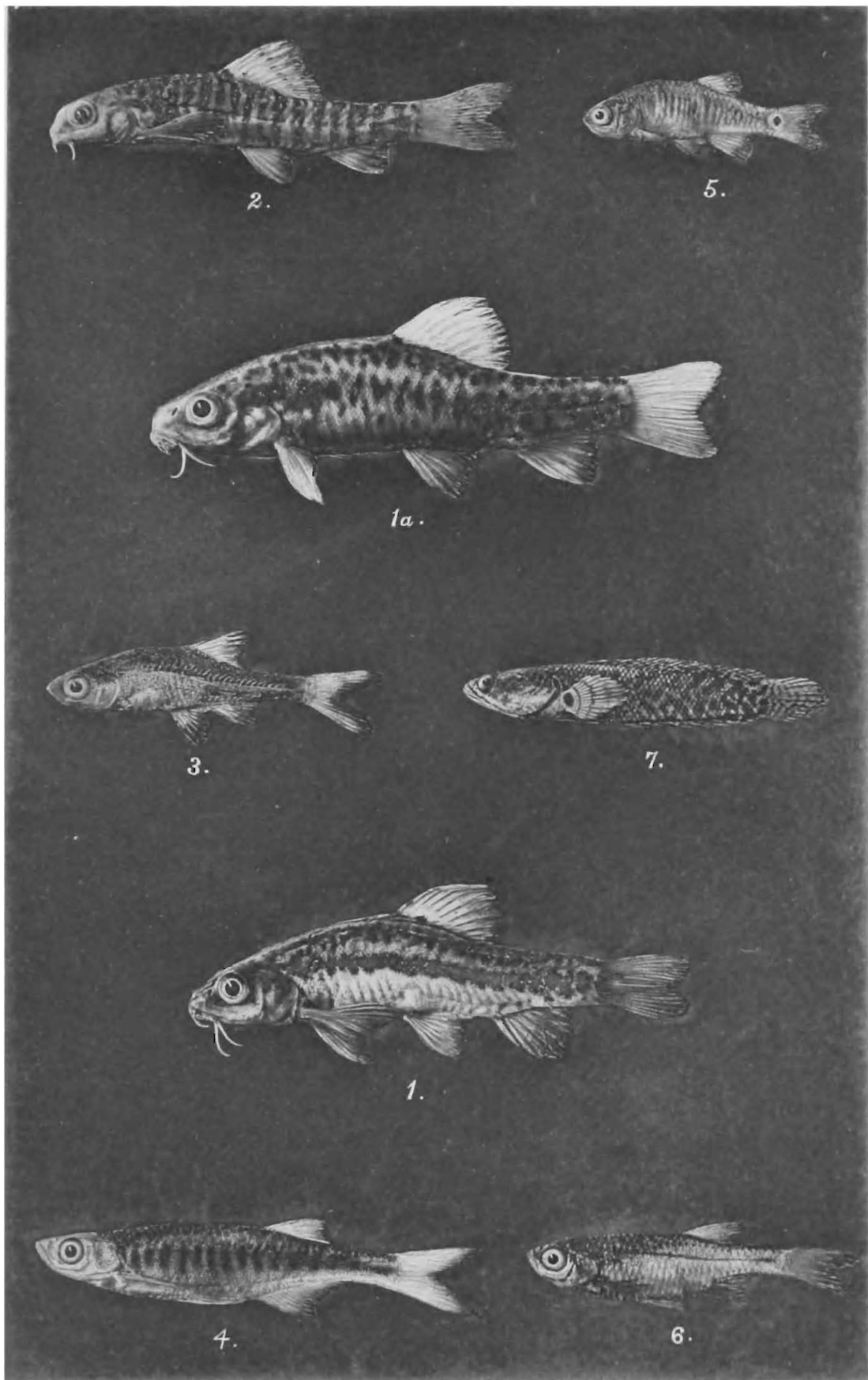
Photogravure. Survey of India Offices, Calcutta, 1918

FISH OF THE INLE LAKE

EXPLANATION OF PLATE II.

PHOTOGRAPHS OF PRESERVED SPECIMENS OF INLE FISH.

- FIG. 1.—Male specimen of *Nemachilus brevis*, Boulg., × 2.
,, 1a.—Female specimen of the same species, × 2.
,, 2.—Type-specimen of *Nemachilus brunneanus*, sp. nov., × 2.
,, 3.—Type-specimen (male) of *Sawbwa resplendens*, gen. et sp. nov.,
× 2.
,, 4.—Co-type of *Barilius auropurpureus*, sp. nov.; somewhat re-
duced.
,, 5.—Type-specimen of *Microrasbora erythromicron*, gen. et sp. nov.,
× 2.
,, 6.—Type-specimen of *Microrasbora rubescens*, sp. nov., × 2.
,, 7.—A young specimen of *Ophiocephalus harcourt-butleri*, sp. nov.,
nat. size.



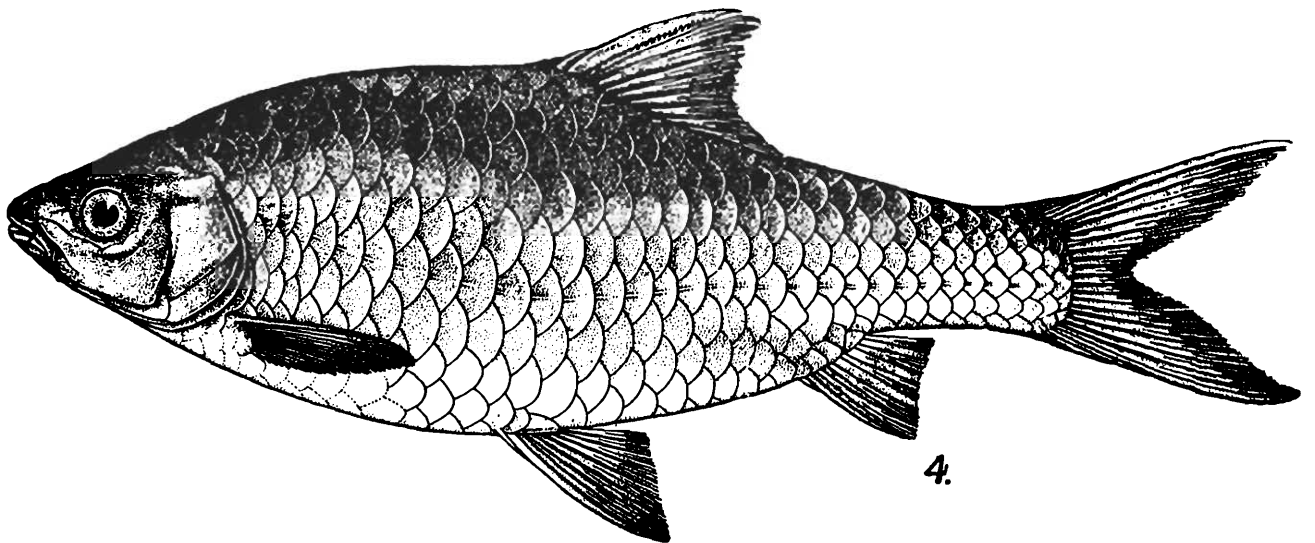
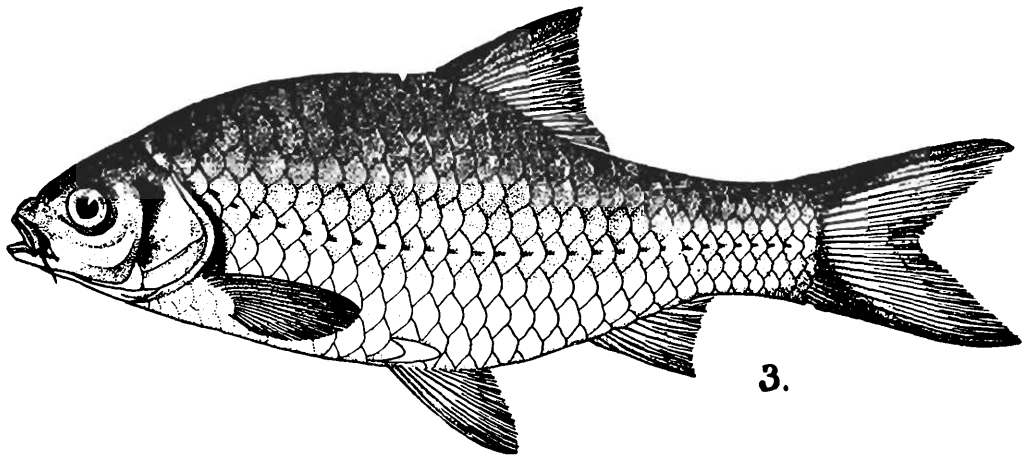
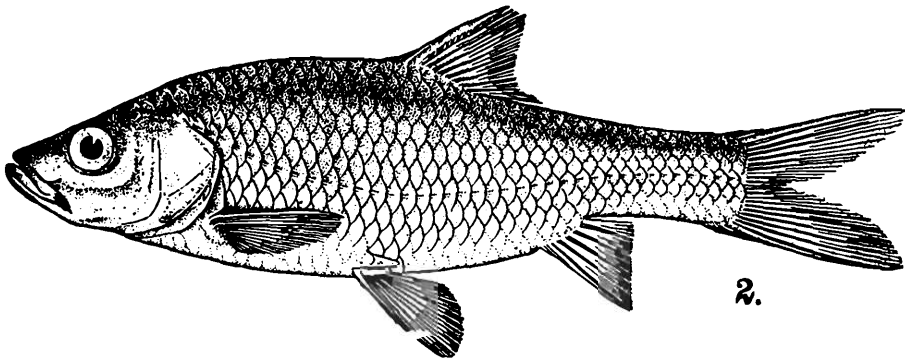
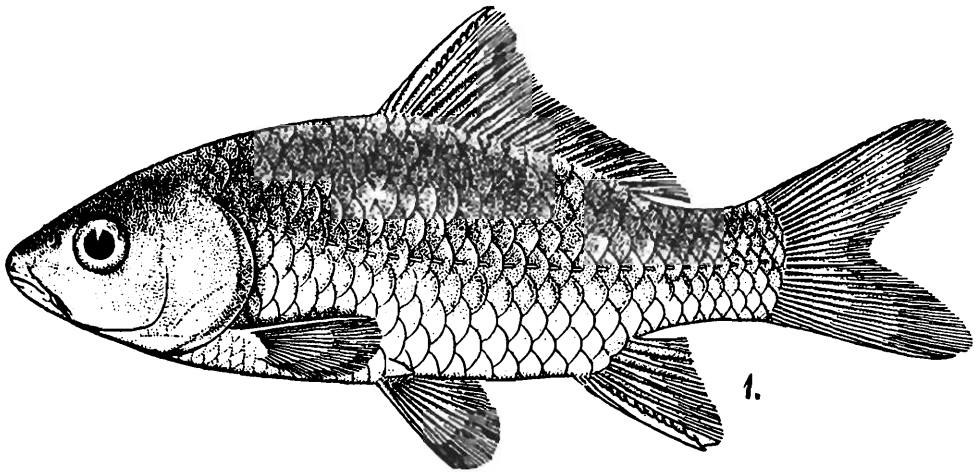
S. C. Mondul photo.

Photogravure. Survey of India Office, Calcutta, 1918

FISH OF THE INLE LAKE

EXPLANATION OF PLATE III.

- FIG. 1.—*Cyprinus carpio intha*, subsp. nov.
,, 2.—*Barbus stedmanensis*, Boulenger.
,, 3.—*Barbus sarana caudimarginatus*, Blyth.
,, 4.—*Barbus schanicus*, Boulenger.



A, C. Chowdhary del.

FISH OF THE INLE LAKE.

EXPLANATION OF PLATE IV

Chaudhuria caudata, gen. et sp. nov.

- FIG. 1.—Head and forequarters of type-specimen as seen from the left side, $\times 9$.
- „ 2.—The same from below. The right operculum has been raised slightly to show the base of the pectoral fin.
- „ 3.—Upper jaw from below, $\times 15$. *e*=ethmoid : *m*=maxillary : *v*=vomer.
- „ 4.—Lower jaw from above, $\times 15$.
- „ 5.—Slightly oblique anterior view of the atlas vertebra, $\times 25$.
- „ 6.—Oblique lateral view (from the right side) of the second vertebra, $\times 25$.
- „ 7.—Lateral view of a trunk vertebra, $\times 22.5$.
- „ 8.—Lateral view of a caudal vertebra, $\times 44$.
- „ 9.—Ripe egg viewed as a solid object, $\times 10$.
- „ 10.—The same viewed by transmitted light after staining with borax carmine, clearing with oil of cloves and mounting in Canada balsam.

Barilius auropurpureus, sp. nov.

- FIG. 11.—Early post-larval stage in which the tail is not yet forked and the dorsal fin undifferentiated, $\times 6$.
- „ 12.—A later stage, $\times 5$.

Microrasbora rubescens, gen. et sp. nov.

- FIG. 13.—Right pharyngeal bone, $\times 15$.

Microrasbora erythromicron, sp. nov.

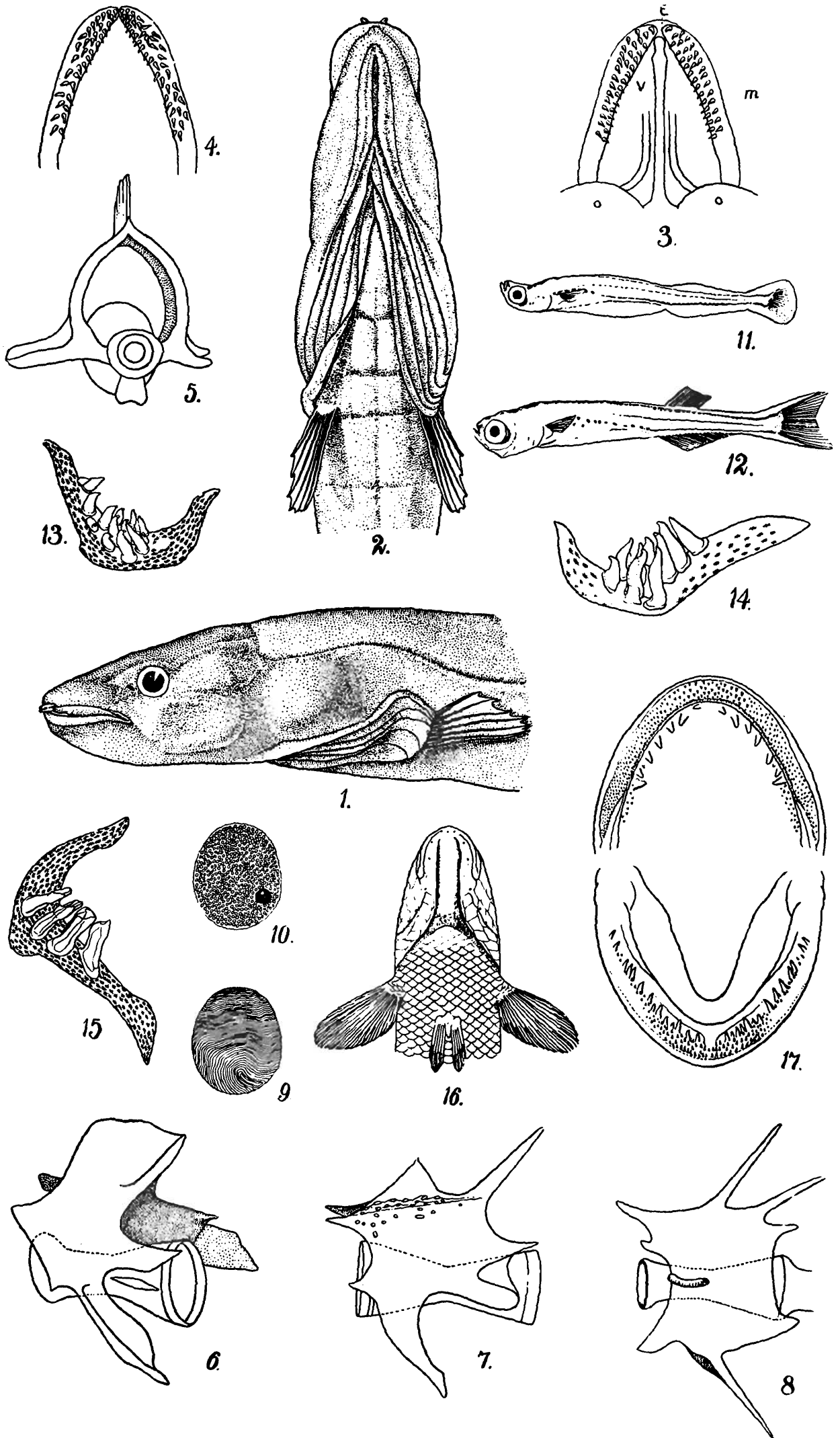
- FIG. 14.—Left pharyngeal bone, $\times 25$.

Sawbwa resplendens, gen. et sp. nov.

- FIG. 15.—Right pharyngeal bone, $\times 15$.

Ophiocephalus harcourt-butleri, sp. nov.

- FIG. 16.—Head and forequarters from below, $\times \frac{1}{2}$.
- „ 17.—Jaws and teeth, $\times 2$.

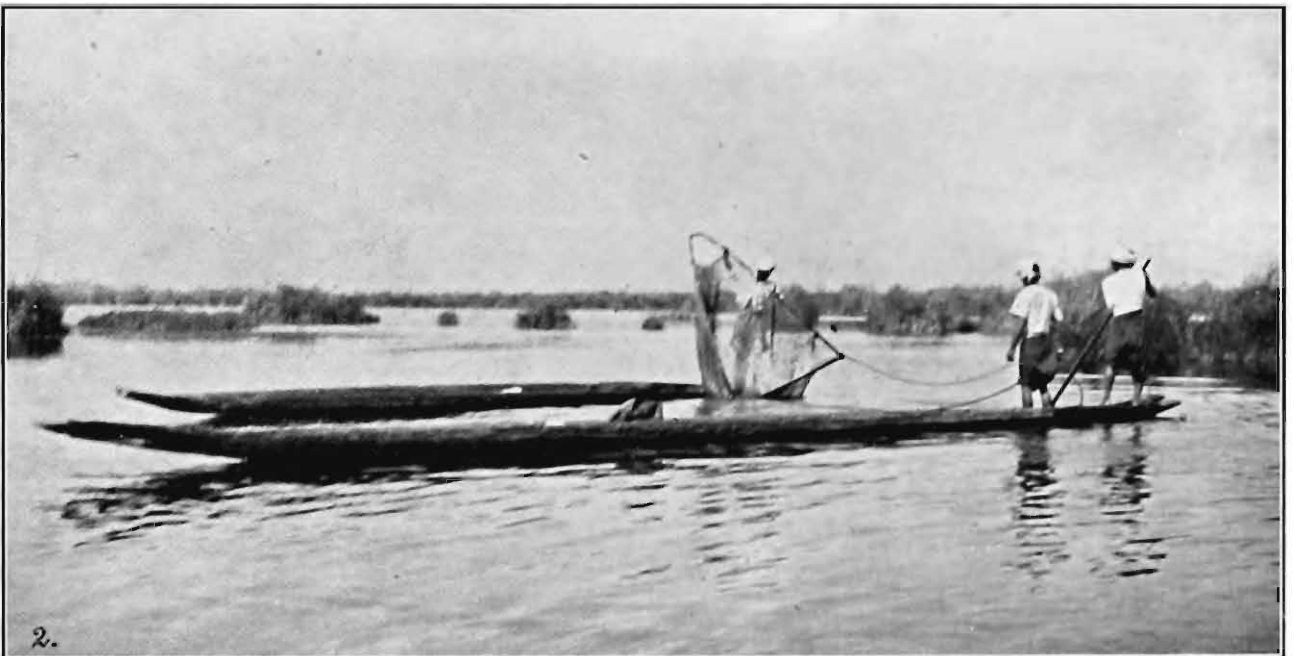
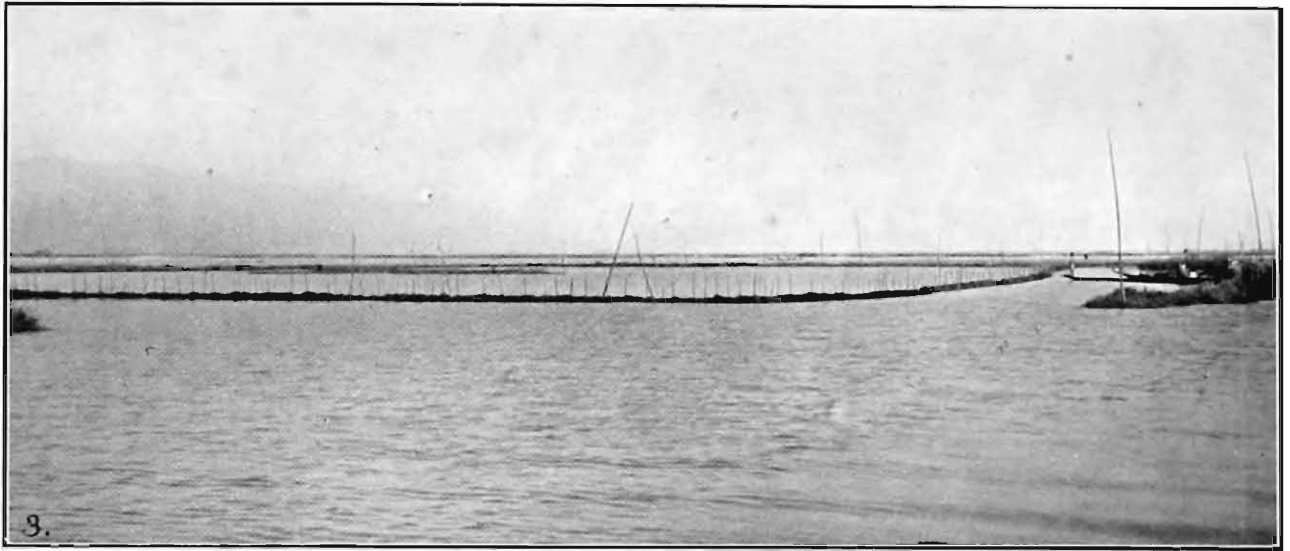


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EXPLANATION OF PLATE V.

FISHING AND ROWING ON THE INLE LAKE.

- FIG. 1.—Boatman rowing in the Intha style with arm and leg. The white marks on the sides of the boat represent lines of broken Gastropod shells incorporated with the varnish to give foot-hold.
- „ 2.—Use of the weed-trawl among the floating islands near Nan-Pan at the south end of the lake.
- „ 3.—Large fishing enclosure made of dried *Ceratophyllum* off Fort Stedman.

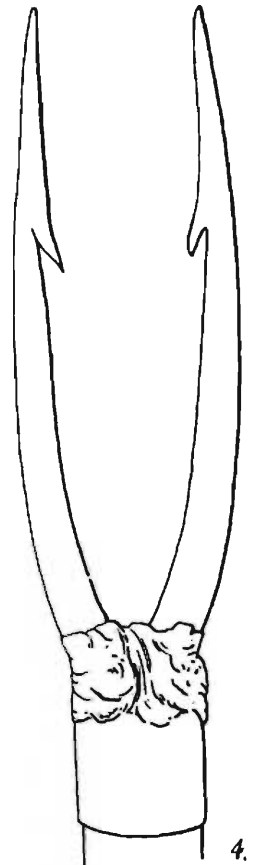
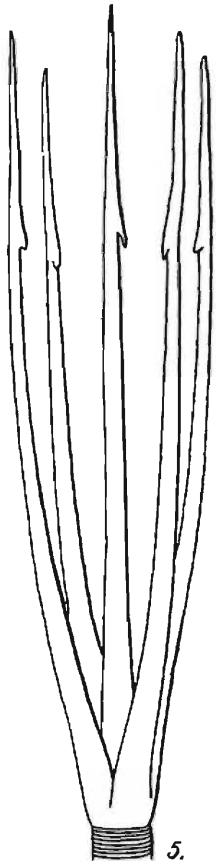


F. H. Gravely photo.

EXPLANATION OF PLATE VI.

FISH-SPEARING ON THE INLE LAKE.

- FIG. 1.—Boats with spears and bamboo frames to be let down over fish in the water.
- „ 2.—A single boatman spearing fish and rowing at the same time. Note the plank hanging into the water from the hind part of the boat to keep it steady while the boatman is otherwise engaged.
- „ 3.—Stirring up the mud at the bottom of the lake with bamboo poles as a preliminary to fish-spearing.
- „ 4.—Prongs of eel-spear, actual size.
- „ 5.—Prongs of ordinary fish-spear, $\times \frac{4}{7}$.



F. H. Gravely photo.

EXPLANATION OF PLATE VII.

INTHA FISH-TRAPS AND BASKETS.

- FIG. 1.—Shallow bamboo basket used in catching small fish and prawns among floating plants at the edge of the Inlé Lake and elsewhere in the district, $\times \frac{1}{8}$.
- „ 2.—Rough bamboo basket filled with peat, weeds and stones and sunk in the central part of the lake to catch various kinds of fish, $\times \frac{1}{8}$.
- „ 3.—Trap for *Barbus stedmanensis*. The two halves can be separated to take out the fish, $\times \frac{1}{6}$.
- „ 4.—Trap with two compartments to catch *Ophiocephalus striatus*, $\times \frac{1}{8}$.

